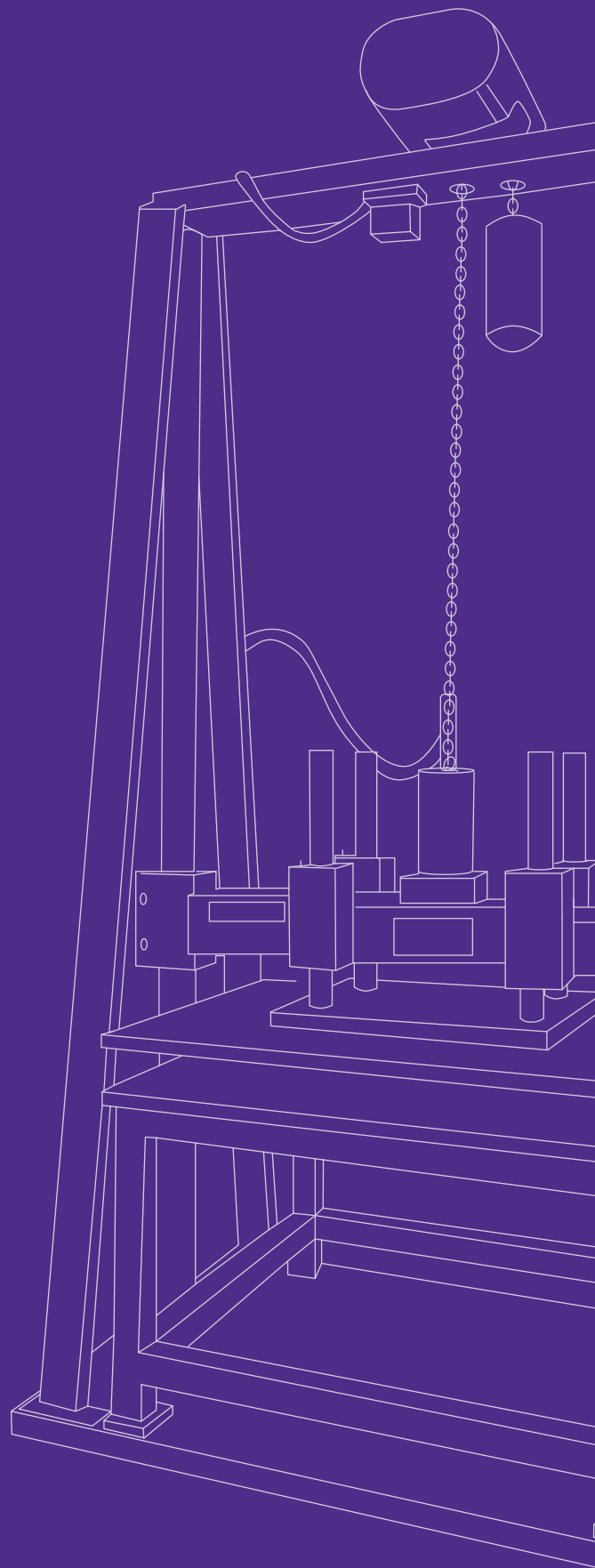


Testing Packages for FedEx Small Parcel Networks



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What We Do

The History of Our Testing

FedEx package testing procedures are based on data from shipping studies within our networks, industry procedures, international testing standards, and development methodology and practice to provide reliable packaging tests. These tests are provided to our customers with an active FedEx account number. Here we outline the general simulation procedures for testing packaged products moving through our FedEx Express® and FedEx Ground® small parcel shipping networks.

These tests are intended to help ensure the packaging will adequately protect and contain its contents when in transit to the recipient.

Our Networks

Both FedEx Ground® and FedEx Express® handle packages up to 150 lbs and no more than 165 inches in combined length plus girth. Packages larger than these requirements must be shipped through a freight handling network such as FedEx Express Air Freight or FedEx Freight® Less-Than-Truckload services. Please review the FedEx Service Guide online at [fedex.com](https://www.fedex.com) for further information regarding these networks and their shipping policies.

Pass/Fail Criteria

- 1 **Product damage.** If the product is damaged during testing, then it is a failure.
- 2 **Packaging failure.** If the outer packaging or the closure method fails and exposes the product, then it fails to keep the product contained.
- 3 **The package must remain safe to handle** (free from protrusions, broken glass, product leakage, etc.) in an effort to protect our team members and associated packages.
- 4 **Customer specific criteria.** We will take into account the specific criteria for a failure determined by the customer if we do not see #1 and #2 (e.g. dented cans, scuffs, torn labels).

After the testing protocol has been completed, our technicians will open the packaging and inspect the contents unless obvious damage is noted during or after an individual test. If at any point during the testing sequences damage is noted, further testing may not be completed.

Customer Post Test Inspection. In some instances, we will return the product and packaging to the customer for further inspection or functional testing (e.g. medical devices, sensitive electronic equipment, etc.). We will provide a link to the Post Test Inspection Notice to complete and return in a timely manner with their findings. We will then prepare the finalized test report.

A formal report of the completed testing along with our findings, recommendations, and pictures of the inspection will be provided to the customer. Test Results include Pass, Fail, Pending Inspection, and See Comments Only. Reference Appendix for more information.

Testing Procedures

Domestic vs International

We recommend choosing domestic if your shipment stays within the country from which it ships. Our data indicates most domestic shipments will travel through up to (2) two major sortations. For this reason, we follow a standard 10 point drop cycle to replicate potential forces applied to your package.

We recommend choosing international if your shipment originates in one country and travels to another country. Our data indicates most international shipments will travel through up to (4) four major sortations. For this reason we follow an enhanced 20-point drop cycle to replicate potential forces applied to your package.

FedEx Ground® vs FedEx Express®

The FedEx Ground® and FedEx Express® sortation networks are different in certain aspects. We recommend selecting the most common shipping method for your package to evaluate the performance of the packaging.

Standard vs Flat vs Elongated

We classify a package as flat if the shortest dimension is less than or equal to 10 inches, the next shortest dimension is at least four times the length of the shortest dimension, and the volume of the total package is at least 400 cubic inches.

We classify a package as elongated if the longest dimension is at least 24 inches and the other two dimensions measure 20 percent or less than the longest dimension.

We classify any package that is not defined as flat or elongated as a standard package. Flat or elongated packages will not receive the compression test.

Disclaimer

Actual package classification, testing elements, settings, sequence may vary based upon the characteristics of the test package and how it's most likely to be handled, sorted, and transported through particular system(s) of FedEx Express® and FedEx Ground® distributions networks.

We reserve the right to stop further testing if, at any time, employee safety is at risk or obvious signs of damage have occurred (e.g. broken glass, leaking liquids, etc.).

Tests Performed Overview

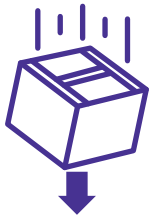


Preconditioning Room or Chambers

Temperature: 73F (23C) +/- 3 degrees

Humidity: 50% RH +/- 3%

Equipment Used: Temperature & Humidity Chamber or similar

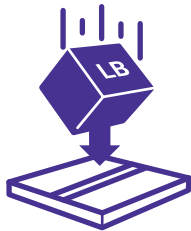


Impact Tests Using Free Fall Drop Tester

Drop Heights: 18-30"

Drop Count: 10-20 individual drops

Equipment Used: Lansmont PDT-80 Drop tester or Lansmont PDT-300 or similar

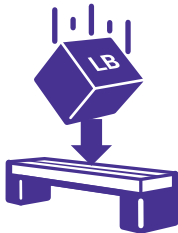


Hazard Impact for Flat Packages

Drop Height: 30" to package surface

Drop Count: 1 on the largest face

Equipment Used: Wooden Hazard Box

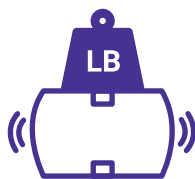


Bridge Impact for Elongated Packages

Drop Heights: 30" to package surface

Drop Count: 1 drop in center of package

Equipment Used: Wooden Hazard Box



Compression Test Using a Compression Table

Up to 30,000 lbs can be applied

Compress the vertical shipping orientation of the package

Equipment Used: Lansmont 122-15K or Lansmont 152-30K or similar

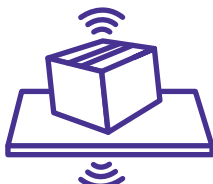


Vibration Test Using Rotary Table

200 CPM (cycles per minute)

Length of time: 60 mins

Equipment Used: Gaines Mechanical Vibration Table or similar



Vibration Test Using Random Vertical Table

Frequency varies by profile used

Length of time: 45-90 min

Equipment Used: Lansmont 1800 TTV4 or Lansmont Model 10000 or similar

Before Testing

Restrictions. We cannot complete testing on the following packages:

- Dangerous Goods (for air shipment)
- Hazardous Materials (for ground shipment. Exception: must be substituted with like weight or water)
- Clinical substances
- Military applications or standards
- Firearms and ammunition

Shipper Use

- 1 If the package contains perishable products and coolants, such as gel packs or dry ice, mark the package and the test application indicating this as Perishable so it will be tested immediately upon arrival. We recommend sending the package to our facility by using FedEx Express Priority Overnight delivery.
- 2 The package must remain safe to handle (free from protrusions, broken glass, product leakage, etc.) in an effort to protect our team members and other packages.

Lab Use

- 3 Mark any pre-existing damage to the package to determine if that led to any product damage or packaging failure before the test began. Please note, only 'See Comments' status will be given on the test report for product and/or package with damages prior testing.
- 4 Mark the bottom drop corner (diagonally opposite the manufacturer's joint to indicate the impact corner).
- 5 If the box design does not have a manufacturer's joint, select a bottom corner that is most prone to packaging failure (i.e. near a flap or closure).
- 6 If the package is not cubic, mark in a way to establish a cubic setup (i.e. cylinders, soft packs, triangle tubes, etc.).
- 7 Determine orientation for compression in the vertical position. This is based on the package's most stable orientation which may or may not be similar to the engineered orientation.
- 8 Mark the top drop corner, diagonally opposite the bottom impact corner, if conducting international sequence.

Testing Sequence

1

All packages should be preconditioned for a minimum of 12 hours to a temperature of 73 degrees Fahrenheit with a relative humidity of 50%. Tolerance includes +/- 3 degrees and +/- 5% R.H.. If the package is a perishable package that must be tested immediately, preconditioning can be skipped.

2

Next, we perform shock testing on the bottom orientation of the package by utilizing a free-fall drop tester. Ten (10) drops are conducted in order of the box orientation chart shown in Appendix (Pg. 9). The package is held on the platen by hand or mechanical means in the correct orientation and released by the controller. For packages under 75lbs, we use a 30 inch drop height. For packages between 76-100lbs, we use a 24 inch drop height. For packages between 101-150lbs we use an 18 inch drop height.

3a

If the package classifies as a flat package, we use a free-fall drop tester to drop a dense wooden box measuring 12" x 12" x 12", with one bottom edge covered by an angle iron, onto the test package. The box should have a total weight of 21 lbs, filled with a sandbag to achieve the weight and void fill to hold the bag in place. To perform this test, we use the following procedures.

Place the package with its largest surface area on a nonyielding steel or concrete base.

Measure and mark the center of the test package in both directions. Raise the drop tester platen to 30" above the package surface.

Position the wooden box on the drop platen so that the angle-iron edge is pointed toward the package and is parallel to the shortest dimension of the largest package face. Mark the midpoint of the wooden box impact edge and ensure that it is lined up with the marked test-package midpoint.

Allow the box to fall freely and impact the package at the marked midpoints evenly, without attempting to catch any rebound of the wooden box.

3b

If the package classifies as an elongated package, we use a free-fall drop tester to drop a dense wooden box measuring 12" x 12" x 12", with one bottom edge covered by an angle iron, onto the test package. The box should have a total weight of 21 lbs, filled with a sandbag to achieve the weight and void fill to hold the bag in place. To perform this test, we use the following procedures.

Place the test package on two 3.5"-4" high blocks at opposite ends of the length of the package.

Measure and mark the center of the test package in both directions. Raise the drop tester platen to 30" above the package surface.

Position the wooden box on the drop platen so that the angle-iron edge is pointed toward the package and is parallel to the shortest dimension of the largest package face. Mark the midpoint of the wooden box impact edge and ensure that it is lined up with the marked test-package midpoint.

Allow the box to fall freely and impact the package at the marked midpoints evenly, without attempting to catch any rebound of the wooden box.

Testing Sequence (continued)

4

Next, we perform a compression test on a dynamic compression tester equipped with a computerized control system. To perform this test, we use the following procedures:

Calculate the compression load using this formula:

$$\text{Compression Load (pounds)} = 0.007 \times (108 - H) \times L \times W \times F$$

0.007 = Average density of freight in pounds per cubic inch (12 lbs. per cubic foot).

108 = Maximum height (inches) of package stack in transit.

H = Height of shipping unit (inches).

L = Length of shipping unit (inches).

W = Width of shipping unit (inches).

F = A factor to account for humidity, time and stacking pattern. **We use a Factor of 3.**

Set up the compression tester for the stop force, equivalent to the compression load calculated in step 1, the yield detection percentage (15 percent) and stop deflection (1").

Center the packaged product on the lower platen of the compression tester.

Bring platens together at 0.5" per minute.

Conclude the test when one of these conditions is first detected by the compression tester:

The stop force.

The yield detection percentage.

The stop deflection

5

For packages that contain electronics, medical/pharmaceutical devices, or are shipped Internationally via aircraft, we perform the random vibration test. To perform this test, we use the following procedures (see Appendix):

Express packages-Domestic- 45 minute combination of a 15 min truck profile, 15 min air profile, and 15 min truck profile

Ground packages-Domestic- 45 minute truck profile

Express packages-International- 90 minute combination of a 30 min truck profile, 30 min air profile, and 30 min truck profile

6

For all other domestically shipped commodities, we perform the rotary vibration test on a mechanical rotary vibration machine. The machine will vibrate at 1.0" total displacement. Packages will be subjected to a total vibration time of 60 minutes. To perform this test, we use the following procedures:

Place the package on the vibration table in its most stable position. Loosely applied strapping may be used during testing to prevent the test sample from moving off the table, to prevent unsafe conditions or to maintain test orientation without restricting the vertical movement.

Set the table to 200 cycles per minute (CPMs) and run for 60 minutes

Stop the vibration table after 30 minutes and rotate 90 degrees perpendicular to a different orientation. If this orientation is not stable, fixtures or straps may be used to maintain the package in the correct orientation.

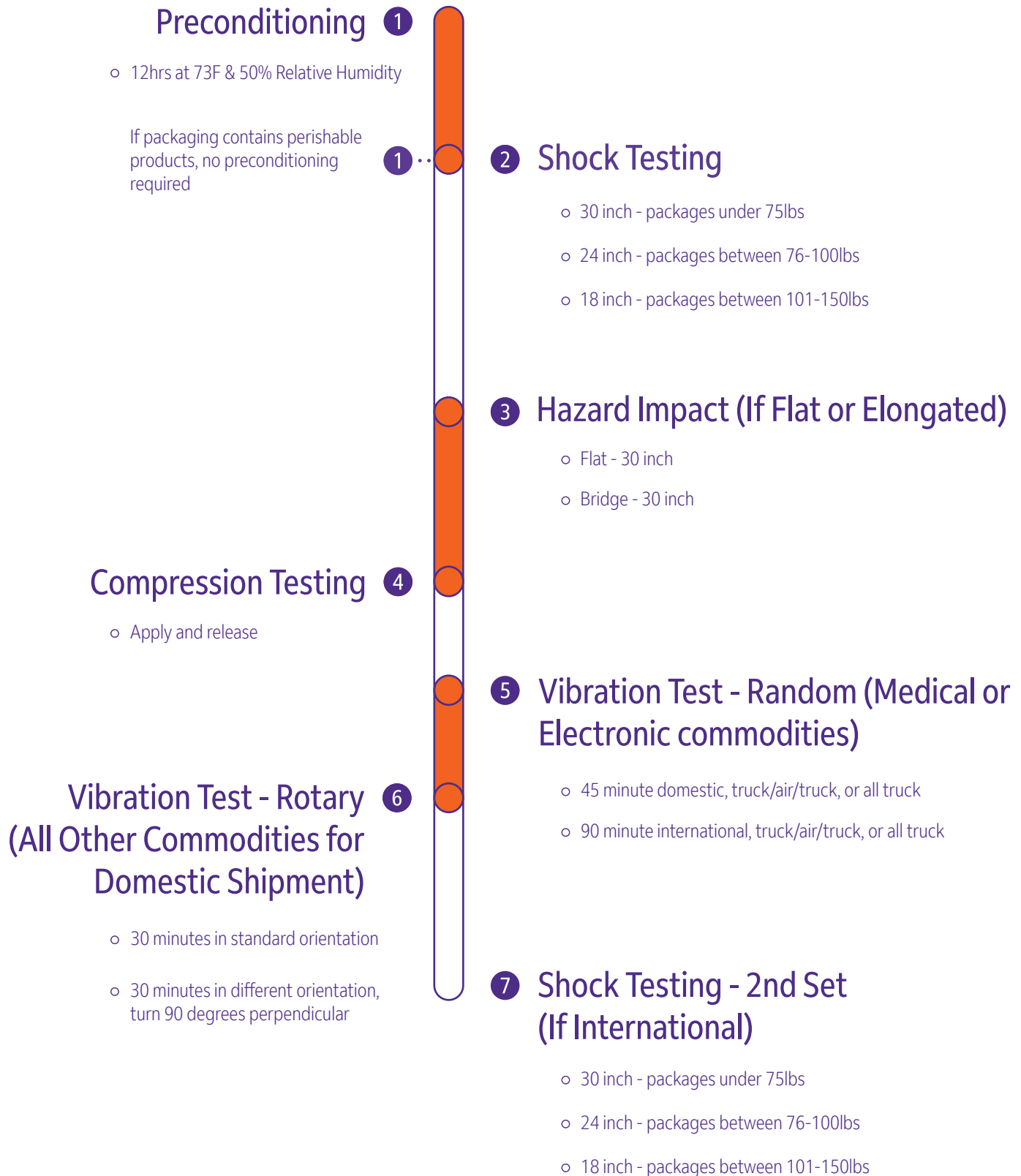
Resume testing for another 30 minutes.

7

If the package is identified as an international shipment, a second set of drops are performed beginning in the top orientation of the package. Ten (10) drops are conducted in order of the box orientation chart shown in Appendix (Pg. 11). The package is held on the platen by hand or mechanical means in the correct orientation and released by the controller. For packages under 75lbs, we use a 30 inch drop height. For packages between 76-100lbs, we use a 24 inch drop height. For packages between 101-150lbs we use an 18 inch drop height.

7

Test Sequence Overview



Test procedures

Customers with an active FedEx account can request complimentary package testing that simulates conditions experienced when shipping through our network. We offer ISTA-6-FEDEX-A for FedEx Express® and FedEx Ground® shipments; ISTA-6-FEDEX-B for FedEx Express® Freight shipments; and ISTA 3B for FedEx Freight® LTL shipments.



Submission guidelines

- **Send no more than four packages.**
- Include all packaging components and products in the exact configuration you'd send to a customer.
- Be sure that the information you provide on the application is accurate.
- We don't test packages that contain dangerous goods or hazardous materials, except for dry ice. While we can test packages with simulated hazardous materials (sand, water or dummy products), testing does not meet regulatory compliance or offer certification for shipping hazardous materials.
- After completing the application form, attach a copy to the exterior package via pouch or packing list, email the application to packagingservices@fedex.com and send your package to:
Attn: Testing
FedEx Packaging Lab
789 Progress Road
Collierville, TN 38017
- We'll contact you with results via email within 4–6 business days after we receive your package. Only one contact will receive the report for your company.

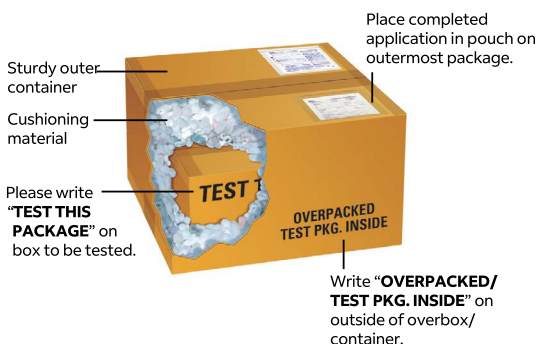


Preparing the test package

Get the most accurate test results by following the instructions below to ensure your small-parcel and freight shipments arrive to us undamaged. For all shipments, be sure to indicate which packaging components should be removed before testing.

Small-parcel testing

- Place your test package in an outer container as shown in the diagram below.
- For cushioning material, use foam, air-cellular cushioning, packing peanuts or other materials.



Freight testing

- To protect palletized freight shipments, band test packages onto an extra pallet and then overwrap with corrugated pads, angle boards or stretchwrap as shown in the diagram below.
- To protect non-palletized test shipments, send in an overbox or on a single pallet. (No diagram shown.)



Shipping costs

- Testing is complimentary*, but you'll cover the cost of shipping to us.
- If requested, we'll return your package free of charge* via FedEx Ground or FedEx Freight in North America, or for international customers, FedEx Express. Or we'll ship via the FedEx service of your choice at your expense.
- Return shipping for freight packages outside North America must be covered by the customer.
- Packages will be shipped back to a commercial address, not to a residential address.
- We reserve the right to consolidate small packages into one palletized return freight shipment.

*Some conditions apply for certain packages.



FedEx Package Test Application

Please note these services are available in English only

Contact information

Company name	FedEx account no. (9 digits)	Country	
<input type="text"/>	<input type="text"/>	<input type="text"/>	
Address	City	State/Province	ZIP/Postal Code
<input type="text"/>	<input type="text"/>	<input type="text"/>	<input type="text"/>
Contact name	Contact phone	Contact email	
<input type="text"/>	<input type="text"/>	<input type="text"/>	
Vendor approval program (if yes, provide name)		Special instructions	
<input type="text"/>		<input type="text"/>	
What constitutes a failure for your company?		Alternate return address	
<input type="text"/>		<input type="text"/>	
<input type="radio"/> Initial package test		<input type="radio"/> Retest (previous test number)	
<input type="text"/>		Describe previous damages to your product.	
<input type="text"/>		<input type="text"/>	

Complimentary testing

Service: (test procedure)

<input type="checkbox"/> FedEx Ground (ISTA 6-FedEx-A)	<input type="checkbox"/> Air Freight (ISTA 6-FedEx-B)
<input type="checkbox"/> FedEx Express (ISTA 6-FedEx-A)	<input type="checkbox"/> LTL Freight (ISTA 3B)

This packaging is:

<input type="checkbox"/> Current packaging	<input type="checkbox"/> Prototype packaging
--	--

Do you ship this product domestically or internationally?

<input type="checkbox"/> Domestically (within own country)	<input type="checkbox"/> Internationally (multiple countries)
---	--

Product name or description

Model no.

Approx. value (USD)

The package contains: (check all that apply)

<input type="checkbox"/> Dry ice	<input type="checkbox"/> Gel packs or ice	<input type="checkbox"/> Electronics
<input type="checkbox"/> Pharmaceuticals/medical devices		
<input type="checkbox"/> Simulated hazardous materials*		

*Note: If you send hazardous materials, we will return or dispose of the packaging and contents at your expense.

I have placed my test package in an overbox/overpack for safe shipment. (see page 1 for info)

<input type="radio"/> Yes (see below)	<input type="radio"/> No (test as received)
---------------------------------------	---

If yes, what outer packaging needs to be removed prior to testing?

<input type="checkbox"/> Pallet	<input type="checkbox"/> Stretchwrap/banding
<input type="checkbox"/> Wooden crate	<input type="checkbox"/> Corrugated box/pad

I would like my sample(s) returned after test completion.

<input type="radio"/> Yes	<input type="radio"/> No
---------------------------	--------------------------

Release & authorization

I release the product and packaging to FedEx for testing. I also release and agree to hold FedEx harmless for any damages or liability for loss of product or packaging submitted to the FedEx Packaging Lab. Federal, legal and regulatory requirements may prevent FedEx from returning certain commodities. For safety reasons, FedEx cannot return packaging that contains leaking products or broken glass.

<input type="checkbox"/> I agree to the terms stated above.

Name

Date

☐ Fast forward your next step

Identifying your packaging issues is step one. Addressing the issues comes next. If you'd like, we can help speed up that process by connecting you with a third-party packaging supplier. Simply check this box, and we'll send the supplier your test package and results. They'll contact you with a packaging solution, no obligation required.*

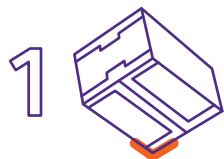
To submit this form, print and sign it, save it to your desktop and attach it to an email addressed to **packagingservices@fedex.com** with your company name and inbound tracking number in the subject line.

* FedEx is an independent company; has no ownership interest or other control over any third-party package supplier; and doesn't make any warranty or assume any liability relating to any work, services, or products of any such supplier. Third-party package supplier referrals are not intended to represent or convey any endorsement by FedEx of the services or products provided by such suppliers.

Appendix

Drop Testing Sequence

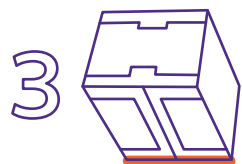
NOTE: When it comes to irregularly shaped items, we follow special drop orientation procedures to identify and mark the package as a cube. The first set of ten drops begin in the bottom orientation of the package. The second set of ten drops begin in the top orientation of the package.



1 Most fragile corner. Reference step 4 of Before Testing (page 5).



2 Shortest edge radiating from the drop corner.



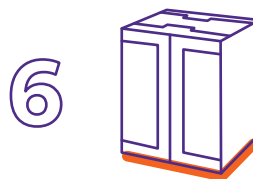
3 Medium edge radiating from the drop corner.



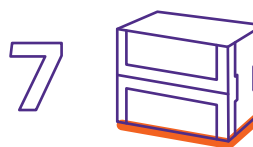
4 Longest edge radiating from the drop corner.



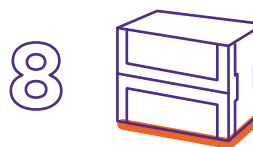
5 Flat on one of the smallest faces.



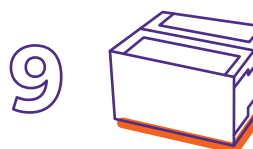
6 Flat on the opposite small face.



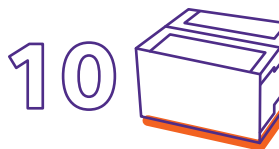
7 Flat on one of the medium faces.



8 Flat on the opposite medium face.



9 Flat on one of the largest faces.



10 Flat on the opposite large face.

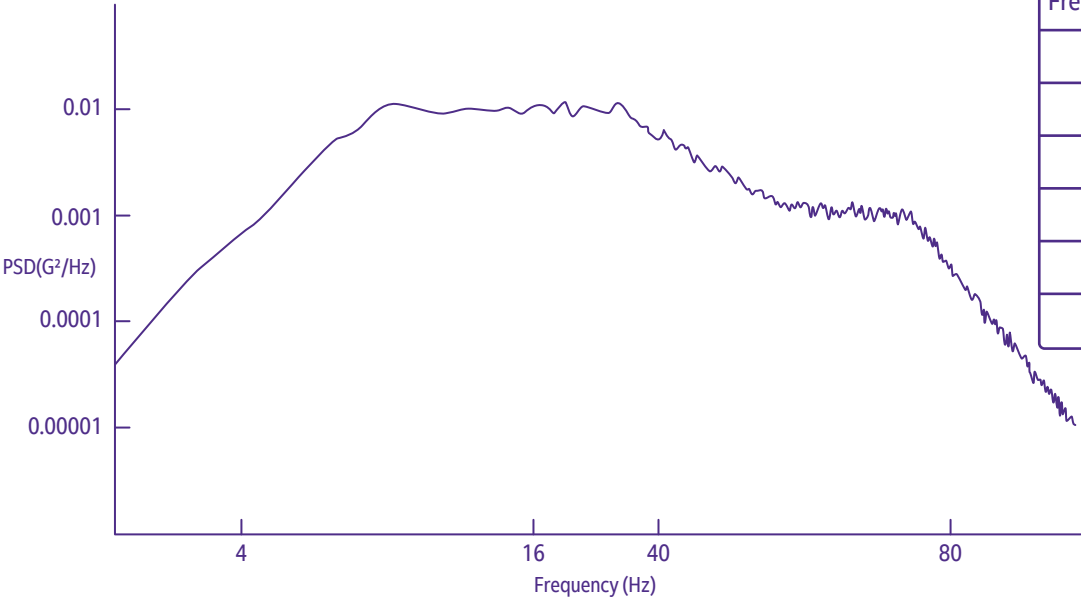
Appendix

Vibration Charts for Random Table

Truck Random Vibration Profile

Truck Random Vibration
Profile Breakpoints

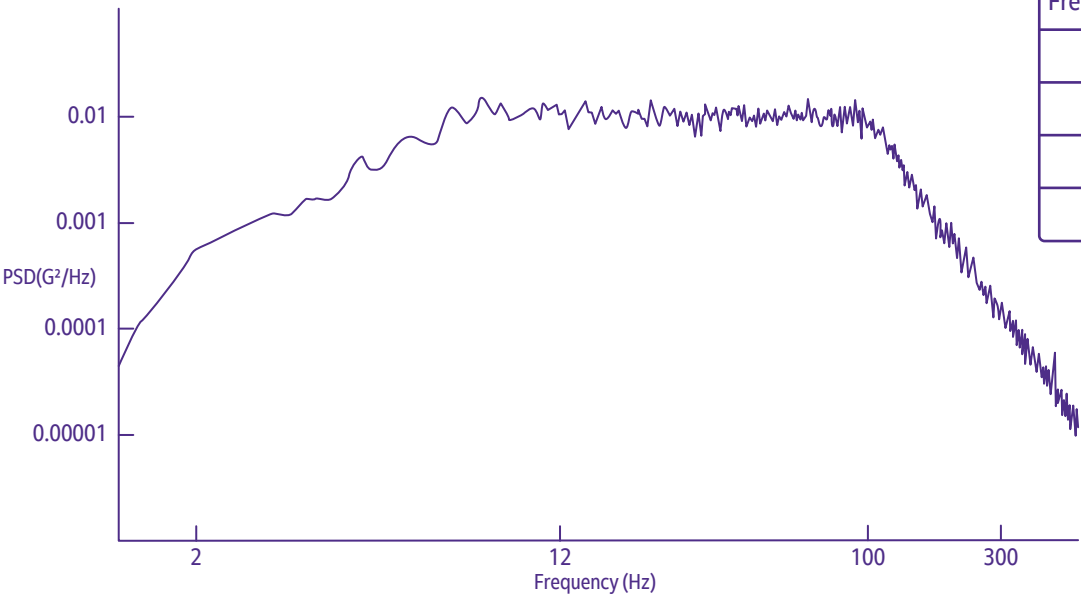
Frequency (Hz)	PSD(G^2/Hz)
1	0.00005
4	0.01
16	0.01
40	0.001
80	0.001
200	0.00001



Aircraft Random Vibration Profile

Aircraft Random Vibration
Profile Breakpoints

Frequency (Hz)	PSD(G^2/Hz)
2	0.0002
12	0.01
100	0.01
300	0.00001



Appendix

Testing Pass/Fail Criteria - Definition of Results

Pass

A package, with article, that has passed all the FedEx Standard Testing Procedures. For commodities restricted under Liabilities Not Assumed in the FedEx Service Guide, the Service Guide Terms and Conditions will take precedence over testing results.

Fail

A package, with article, that has failed all or some FedEx Standard Testing Procedures.

Pending Customer Review

A package, with article, that has been tested to all FedEx Standard Test Procedures. Confirmation of results is subject to customer inspection.

See Comments

A package, with article, that has been partially tested to a FedEx Standard Test Procedure or tested to a specific customer request such as Do Not Open. This status is treated similarly to a Failed package.