



FedEx Procedures for Testing Packaged Products Weighing Up to 150 lbs.

At FedEx, we believe that smart packaging strategies can help your goods arrive at their destination on time; they can also save you money. To eliminate the guesswork about proper packaging, our testing lab recommends a series of shipping-integrity tests for your FedEx® shipments. We can perform the tests for you, or you can follow our instructions to simulate air and ground shipping environments.



Overview of General Testing Procedures

FedEx package-testing procedures are based on industry data, as well as international testing procedures and standards, to provide reliable packaging tests. Here we outline the general simulation procedures for testing packaged products weighing up to 150 lbs. We use drop, impact, compression and vibration tests to evaluate the integrity and protective performance of the packaging.

We consider package-closure performance an important test criterion. We routinely open packaging and inspect the contents after completion of all test procedures, unless obvious damage is noted during or after an individual test.

When we conduct vibration testing, we test packaging for liquids, dangerous goods, hazardous materials, and other items with directional sensitivity upside down, with bottle caps and directional up arrows facing downward. Never send actual dangerous goods or hazardous materials to our testing labs. Instead, send sample package components containing nonhazardous substitutes such as water or sand in a weight equal to your proposed packaging.

We follow a strict sequence of testing procedures, performing tests on each sample in the sequence indicated in the following table.

Tests for Packaged Products Weighing Up to 150 lbs.

Product/Service	U.S. Shipments						International Shipments		
	Electronic, Powered, Medical Items			All Other Items			All Items		
	Regular	Flat	Elongated	Regular	Flat	Elongated	Regular	Flat	Elongated
Free-Fall Drop Test*	X	X	X	X	X	X	X	X	X
Concentrated Impact Test		X			X			X	
Bridge Impact Test			X			X			X
Compression Test	X	X	X	X	X	X	X	X	X
Rotary Vibration Test				X	X	X			
Random Vibration Test – U.S.**	X	X	X						
Random Vibration Test – International**							X	X	X
Second Free-Fall Drop Test*							X	X	X

* Computer-aided data acquisition and analysis are available upon request.

** Currently the random vibration system can test samples up to 200 lbs., and the rotary vibration table can test samples up to 1,250 lbs. Contact FedEx Packaging Design and Development before sending test samples weighing more than 200 lbs.

The FedEx Packaging Design and Development department reserves the right to alter the test sequence or equipment used to accommodate special package characteristics, commodities or testing equipment limitations to provide the most representative test possible. When package or content conditions are uncertain, or conditional on customer input, a "Post-Test Inspection Notice" will be sent with the report after the test is completed.

For packaged products over 150 lbs., please refer to the *FedEx Procedures for Testing Packaged Products Weighing More Than 150 lbs.* brochure.

Packaging Definitions

For testing purposes, we classify packaging into three categories. Use these simple definitions to determine if your packaging configuration is flat, elongated or regular.

Flat Package

We classify a package as flat if the shortest dimension is less than or equal to 8", 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 800 cubic inches.

Elongated Package

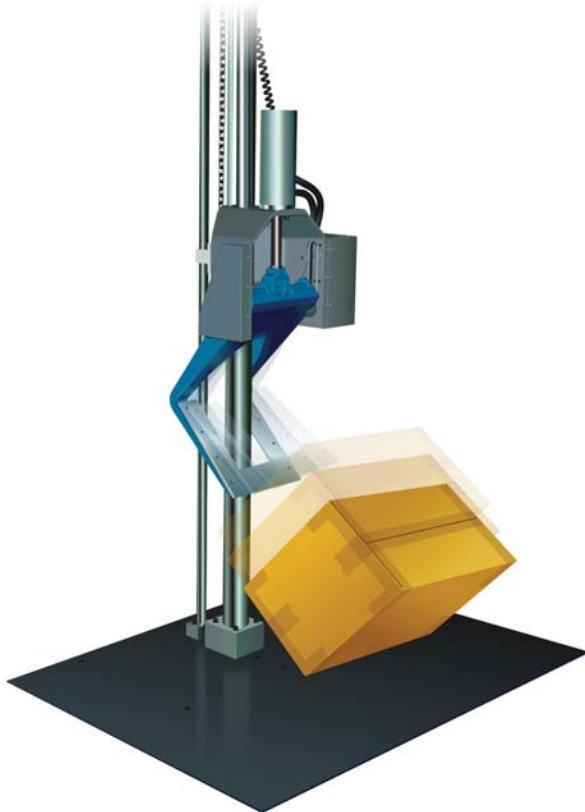
We classify a package as elongated if the longest dimension is at least 36" and the other two dimensions measure 20% or less than the longest dimension.

Regular Package

We classify any package that is not defined as flat or elongated as a regular package.

Impact Tests

Free-Fall Drop Tester



Package Weight	Drop Height	Drops per Sequence
Equal to or less than 75 lbs.	30"	10
Greater than 75 lbs. but equal to or less than 100 lbs.	24"	10
Greater than 100 lbs. but equal to or less than 150 lbs.	18"	10

Free-Fall Drop Test Procedures

We employ a free-fall drop tester* to drop packages onto a flat, firm, nonyielding steel base. We vary the drop height based on the package weight shown in the chart. For international products, we conduct a second sequence of free-fall drop tests following the vibration test. We conduct ten drop tests, one for each of the following orientations.

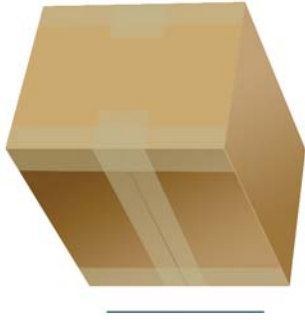


1. Most fragile corner.



2. Shortest edge radiating from the drop corner.

*Computer-aided data acquisition and analysis are available upon request.



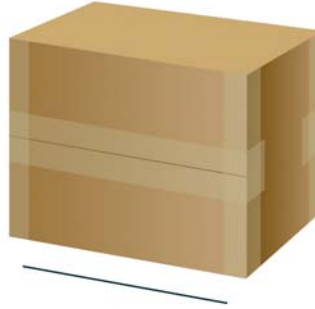
3. Medium edge radiating from the drop corner.



7. Flat on one of the medium faces.



4. Longest edge radiating from the drop corner.



8. Flat on the opposite medium face.



5. Flat on one of the smallest faces.



9. Flat on one of the largest faces.



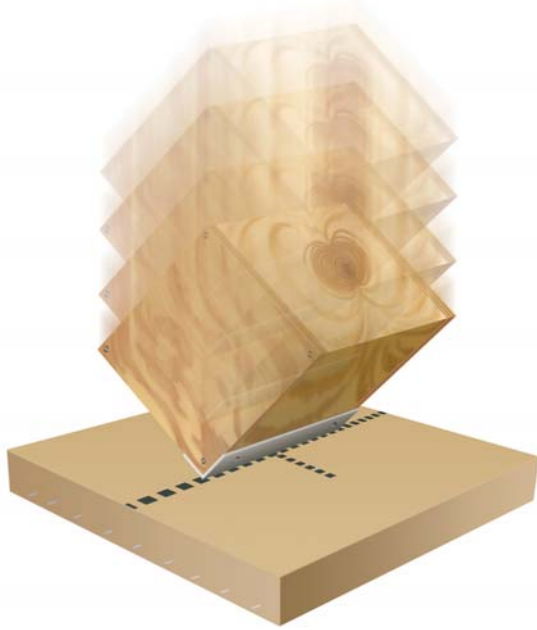
6. Flat on the opposite small face.



10. Flat on the opposite large face.

NOTE: When it comes to irregularly shaped items, we follow special drop orientation procedures.

Concentrated Impact Test for Flat Packages



Concentrated Impact Test Procedures

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.

1. Place the package with its largest surface area on a nonyielding steel or concrete base.
2. Measure and mark the center of the test package in both directions. Raise the drop tester platen to 30".
3. 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.
4. 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.

Bridge Impact Test for Elongated Packages



Bridge Impact Test Procedures

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.

1. Place the test package on two 4"-high blocks at opposite ends of the longest package dimension and parallel to each other at the shortest package edge.
2. Measure and mark the center of the test package in both directions. Raise the drop tester platen to 30".
3. 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 marked test-package midpoint.
4. 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.

Compression Test

Compression Tester



Compression Test Procedures

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

1. Calculate the compression load using this formula:

Compression

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

- 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.

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

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

4. Bring platens together at 0.5" per minute.

5. 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.

Shipping Unit Construction	F-Factors Assurance Level		
	I	II	III
Corrugated, fiberboard or plastic container that may or may not have stress-bearing interior packaging using these materials, and where the product does not support any of the load.	10.0	7.0	5.0
Corrugated, fiberboard or plastic container that has stress-bearing interior packaging with rigid inserts such as wood.	6.0	4.5	3.0
Containers constructed of materials other than corrugate, fiberboard or plastic that are not temperature- or humidity-sensitive, or when the product supports the load directly.	4.0	3.0	2.0

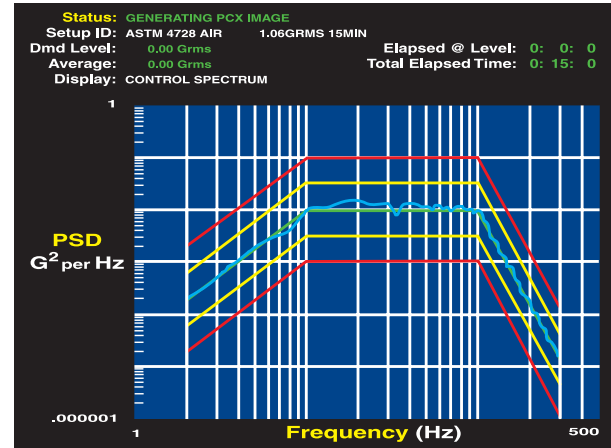
The F-Factor is normally set to Assurance Level III and may vary as shown.

Vibration Tests

Random Vibration Tester



Aircraft Random Vibration Profile



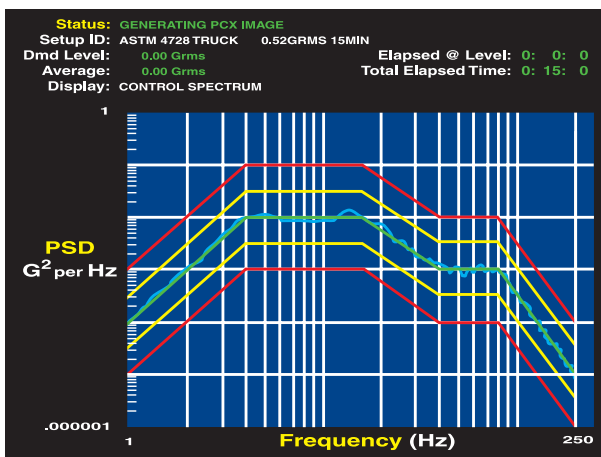
Random Vibration Test Procedures

We perform the random vibration test on a vertical electrohydraulic vibration machine equipped with computerized controls. To perform this test, we use the following procedures.

1. Program the vibration system to reproduce three consecutive sequences of random vibration profiles representing the FedEx distribution environment as indicated in the spectra profiles.
 - Truck vibration at 0.52 Grms (profile one).
 - Air vibration at 1.06 Grms (profile two).
 - Repeat truck vibration at 0.52 Grms (profile one).
2. Set the duration of each sequence at 15 minutes for U.S. shipments, 30 minutes for international shipments.
3. Place the test package on the vibration table. Fixtures may be used during testing to prevent the package from moving off the table, to prevent unsafe conditions or to maintain test orientation without restricting the vertical movement.
4. Load the appropriate automatic sequences of random vibration profiles and perform tests.

Truck and Aircraft Random Vibration Profiles

Truck Random Vibration Profile



Rotary Vibration Tester



Rotary Vibration Test Procedures

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 of 14,200 vibratory impacts. Fixtures or restraints may be used during testing. To perform this test, we use the following procedures.

1. Place the package on the vibration table and begin the vibration cycle at a running speed of approximately 237 cycles per minute.
2. Stop the vibration test after 30 minutes (7,100 impacts). Maintain the orientation and turn the package 90 degrees on its face.
3. If package size or shape does not permit 90 degree horizontal rotation, rotate the package 180 degrees horizontally.
4. Start the vibration machine for the remaining 30 minutes.

Flat and elongated packages will be vibrated on their smallest and largest surfaces respectively.

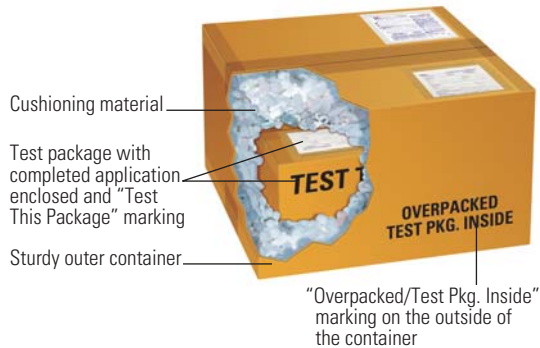
Testing Request Guidelines

Follow these steps for submitting your packaging for testing. An active FedEx account number is required. You and your FedEx account executive should expect testing results in approximately 5 to 7 business days from receipt of your packaging.

1. Obtain a *Packaging Services Application* at fedex.com by searching "packaging application" or by contacting FedEx Packaging Design and Development at packagingservices@fedex.com or 1.800.633.7019.
2. Complete and sign your application, referencing the name of your FedEx account executive on the form.
3. Prepare a sample test package including all the packaging components and contents in the exact configuration you intend to send to your customer. (Substitute water or sand for any hazardous materials.)
4. Place your completed application, your sample test package labeled "Test This Package" and any necessary cushioning material in a sturdy outer container marked "Overpacked/Test Pkg. Inside."
5. Send your shipment to:
FedEx Packaging Design and Development
2828 Business Park Drive
Bldg. H, Suite 500
Memphis, TN 38118

Shipping Instructions

You may send up to three package samples for testing and analysis per submission. We recommend that you overpack or overbox the product to be tested and its packaging.



NOTE: Do not send actual dangerous goods or hazardous materials to our testing labs. Instead, send sample package components containing nonhazardous substitutes such as water or sand in a weight equal to your proposed packaging. Please mark "Nonhazardous Content" on the outer box and on the test samples. Hazardous-materials testing is performed for FedEx Ground shipments only. When shipping hazardous materials, all Department of Transportation (DOT) and all other applicable regulations and requirements must be met.

Shipping Charges

FedEx will pay for shipments to and from our facility if you ship them using one of the following FedEx Express® services: FedEx 2Day® or FedEx 2Day® Freight service (except perishable shipments, which can be shipped via FedEx Standard Overnight® or FedEx 1Day® Freight service). Be sure to indicate *Bill Recipient* in the *Billing* field.

When requested, we will return packages free of charge via FedEx Ground® or FedEx 2Day service. Of course, you may ship or request return of your packaging via other FedEx services at your own expense.

Contacts and Resources

- *How to Pack* guidelines at fedex.com/us/services/packageshipment/.
- FedEx Packaging Design and Development lab, packagingservices@fedex.com or 1.800.633.7019.
- FedEx field packaging engineers, pkgfield@mail.fedex.com. Or contact your FedEx account executive for a referral.

NOTICE: This packaging brochure is provided free to FedEx customers to help reduce loss or damage due to improper packaging. It is NOT intended to be a comprehensive guide for packaging items we accept for transit. We make no warranties, expressed or implied, regarding this information. Proper packaging is the sole responsibility of the shipper. For more information and additional guidelines, go to the packaging tips page on fedex.com/us/services/packageshipment/, e-mail packagingservices@fedex.com or contact FedEx Packaging Design and Development at 1.800.633.7019. Refer to the current FedEx Service Guide for terms, conditions and limitations applicable to FedEx® delivery services.