

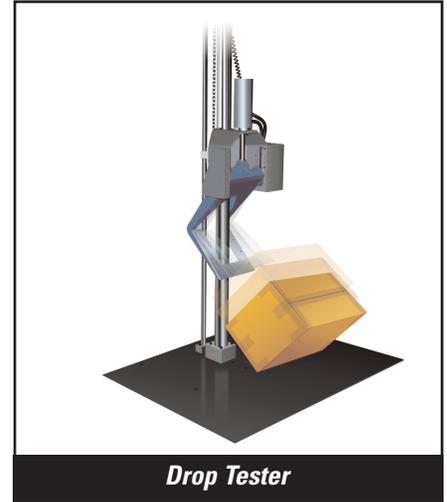
FedEx Package Testing Procedures



Procedure for Testing Packaged Products 150 lb (68 kg) or Less

1. DROP TEST

- a. Performed on a free fall drop tester.* Package is dropped onto a flat, firm, non-yielding steel base.
- b. The drop height varies with weight and drop orientation, and shall be as follows:
 1. the drop height for packages weighing between 1-75 pounds is 30 inches on all drop orientations.
 2. the drop height for packages weighing between 76-100 pounds is 24 inches, except the bottom drop; the drop height for the bottom drop is 30 inches.
 3. the drop height for packages weighing between 101-150 pounds is 12 inches, except the bottom drop; the drop height for the bottom drop is 24 inches.
- c. Total of ten drops are conducted as follows:
 1. bottom corner diagonally opposite the manufacturer's joint
 2. shortest edge radiating from that corner
 3. medium edge radiating from that corner
 4. longest edge radiating from that 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.
- d. The package and its contents are inspected. Any damage and deterioration are recorded after the test. If there appears to be no damage to the product, the **Compression and/or Vibration Test** is proceeded.



* Computer-aided data acquisition and analysis are available when requested.

2. COMPRESSION TEST

- a. Performed on a dynamic compression tester equipped with computerized control system.
- b. Calculate the compression load using the following formula:

$$\text{Compression Load (lbf)} = 0.007(\text{lb/in}^3) \times [108(\text{in}) - H(\text{in})] \times L(\text{in}) \times W(\text{in}) \times F$$

where:

- 0.007 = average density of freight (pounds/cubic inch), or 12 lb/ft³,
- 108 in = maximum height of stack in transit vehicle inches,
- 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.



Procedure for Testing Packaged Products 150 lb (68 kg) or Less-con't.

The F - Factor is normally set to Assurance Level II, and may vary as follows:

Shipping Unit Construction	F - Factors		
	Assurance Level		
	I	II	III
1. 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
2. Corrugated, fiberboard, or plastic container that has stress-bearing interior packaging with rigid inserts such as wood	6.0	4.5	3.0
3. Containers constructed of materials other than corrugated, fiberboard, or plastic that are not temperature or humidity sensitive or when the product supports the load directly	4.0	3.0	2.0

- c. Setup the compression tester.
- d. Center the packaged-product on the lower platen of the compression tester.
- e. Bring the platens together at the rate of 0.5 inch per minute.
- f. Immediately release the load when the recorded force equals the *Compression Load* determined in step b.
- g. The package and its contents are inspected. Any damage and deterioration are recorded after the test. If there appears to be no damage to the product, the **Vibration Test** is proceeded.

3. VIBRATION TEST**

- a. Performed on a vertical electrohydraulic vibration machine equipped with computerized control.
- b. The vibration system is programmed to reproduce three consecutive sequences of random vibration profiles (spectra) representing the FedEx express distribution environment: (1) Truck vibration @ 0.52 Grms; (2) Air vibration @ 1.06 G rms; (3) Truck Vibration @ 0.52 G rms.
- c. The duration of each sequence is 15 minutes for domestic shipments and 30 minutes for international shipments.
- d. The package is placed on the vibration table. Fixtures may be used during testing to prevent the package from moving off the table, or to maintain test orientation, without restricting the vertical movement.
- e. Appropriate automatic sequences of random vibration profiles are loaded and testing performed.
- f. The package and its contents are inspected. Any damage and deterioration are recorded after the test.

** Current vibration system can test packages up to max. 200 lb. Contact FedEx Packaging Design and Development before sending test packages over 200 lb.



NOTE: FOR INTERNATIONAL SHIPMENTS, A SECOND SERIES OF DROP TESTS WILL BE PERFORMED FOLLOWING THE VIBRATION TEST.

Procedure for Testing Packaged Products Over 150 lb (68 kg)*

1. IMPACT TEST

a. **Incline Impact Test** – Performed on an inclined impact tester equipped with velocity meter**

1. The package is positioned on the center of the dolly with the face receiving the impact placed 2 inches beyond the front edge of the dolly.
2. The dolly is extended to the proper distance necessary to achieve a minimum impact velocity of 5.75 feet per second.
3. Each of the six faces of the package is subjected to a single impact.
4. If the top and bottom impact is impractical, the **Flat Free Fall Drop Test**, or **Raised Edge Free Fall Drop Test**, or **Raised Corner Free Fall Drop Test**, or **all** should be performed.



b. **Free Fall Drop Test Option** – Performed on a free fall drop tester**
The package is dropped onto a flat, firm, non-yielding steel base.

1. Raise the package above the impact surface a minimum of 8 inches.
2. Position load while in the air for flat bottom drop, edge drop, or corner drop as desired. The angle of drop is at the user's option but must be recorded.
3. Release the load and allow to fall freely.
4. Where packages are tall or top heavy, provision must be made to prevent the package from tipping over after the drop is made.
5. If the stability of the load is in question, the **Tip Test** or **Tipover Test**, or **both** should be performed.



c. **Tip Test** – Performed manually with mechanical assistance on a flat, firm, non-yielding concrete floor.

1. Tip the package to a predetermined angle from vertical in the most critical direction and release it. Unless otherwise specified, it is recommended that an angle of 22° be used.
2. The package should right itself and not tip over in either the tipped direction nor the opposite direction.
3. The test should be repeated in all potentially unstable directions.
4. If the package tips over in any direction, the center of gravity must be lowered or the dimensions of the base must be increased before the test can be completed, or the package and product must be able to pass the **Tipover Test** procedure.

d. **Tipover Test** – Performed manually with mechanical assistance on a flat, firm, non-yielding concrete floor.

1. Place the test package in the predetermined attitude on the impact surface (such as standing on its base or one of its smaller faces).
2. The package shall be slowly tipped until it falls freely, without thrust, onto the face opposite that of load application.
3. Repeat the test with the package standing on, or impacting onto other appropriate faces.
4. In the case of tall packages, the repeat tests shall be carried out with the package standing on its normal base and toppling onto each side face in turn.

Procedure for Testing Packaged Products Over 150 lb (68 kg)-con't.

5. In the case of flat packages (or tall packages where the normal base is not defined), the tests shall be carried out with the package standing on each smaller face in turn and impacting onto each of the larger faces.
 6. If the structure strength of the load base such as the pallet is in question, the **Raise Edge Free Fall Drop Test** or **Raised Corner Free Fall Drop Test**, or **both** should be performed.
- e. Raised Edge Free Fall Drop Test** – Performed manually with mechanical assistance on a flat, firm, non-yielding concrete floor.
1. With one edge of the load supported by the floor, raise the other end to 10 inches high and release to fall flat on the impact surface.
 2. Where the loads are tall or top heavy, provision must be made to prevent the load from tipping over after the drop is made.
 3. If the stability of the load is in question, the **Tip Test** or **Tipover Test**, or **both** should be performed.
- f. Raised Corner Free Fall Drop Test** – Performed manually with mechanical assistance on a firm, non-yielding concrete floor.
1. With one corner of the load supported by the floor, raise the diagonal corner of the other end to 10 inches high and release to fall flat on the impact surface.
 2. Where loads are tall or top heavy, provision must be made to prevent the load from tipping over after the drop is made.
 3. If the stability of the load is in question, the **Tip Test** or **Tipover Test**, or **both** should be performed.
- g.** The package and its contents are inspected. Any damage and deterioration are recorded after the test. If there appears to be no damage to the product, the **Compression and/or Vibration Test** is proceeded.

* Any shipping package weighing more than 150 lb must contain a base which permits movement with a forklift or standard freight pallet jack.

** Computer-aided data acquisition and analysis are available when requested.

2. COMPRESSION TEST

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Procedure for Testing Packaged Products Over 150 lb (68 kg)-con't.

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3. Containers constructed of materials other than corrugated, fiberboard, or plastic that are not temperature or humidity sensitive or when the product supports the load directly	4.0	3.0	2.0

- c. Setup the compression tester.
- d. Center the packaged-product on the lower platen of the compression tester.
- e. Bring the platens together at the rate of 0.5 inch per minute.
- f. Immediately release the load when the recorded force equals the *Compression Load* determined in step b.
- g. The package and its contents are inspected. Any damage and deterioration are recorded after the test. If there appears to be no damage to the product, the **Vibration Test** is proceeded.

3. VIBRATION TEST***

- a. Performed on a vertical electrohydraulic vibration machine equipped with computerized control.
- b. The vibration system is programmed to reproduce three consecutive sequences of random vibration profiles (spectra) representing the FedEx air express distribution environment: (1)Truck vibration @ 0.52 G rms; (2)Air vibration @ 1.06 G rms; (3)Truck Vibration @ 0.52 G rms.
- c. The duration of each sequence is 15 minutes for domestic shipments and 30 minutes for international shipments.
- d. The package is placed on the vibration table. Fixtures may be used during testing to prevent the package from moving off the table, or to maintain test orientation, without restricting the vertical movement.
- e. Appropriate automatic sequences of random vibration profiles are loaded and testing performed.
- f. The package and its contents are inspected. Any damage and deterioration are recorded after the test.

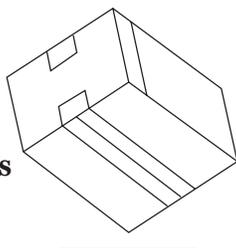


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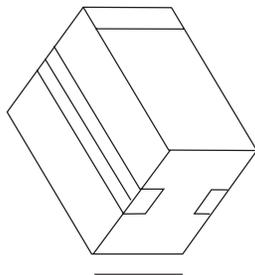
NOTE: FOR INTERNATIONAL SHIPMENTS, A SECOND SERIES OF IMPACT TESTS WILL BE PERFORMED FOLLOWING THE VIBRATION TEST.

Drop Test Package Orientation Guide*

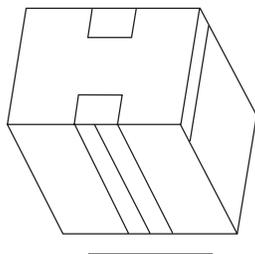
DROP 1.
Bottom Corner
diagonally opposite
to the manufacturer's
joint



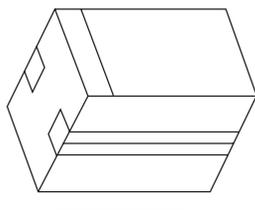
DROP 2.
Short Edge
radiating from the
bottom corner



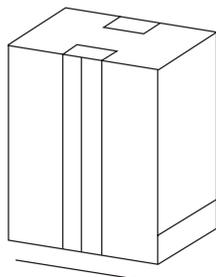
DROP 3.
Medium Edge
radiating from the
bottom corner



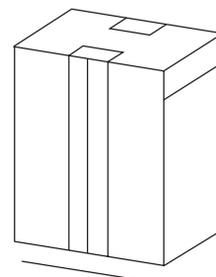
DROP 4.
Long Edge
radiating from the
bottom corner



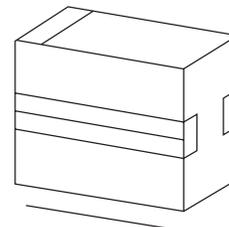
DROP 5.
Smallest Flat Face



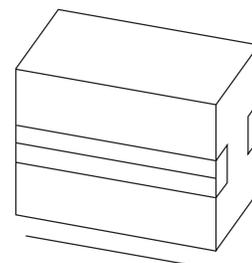
DROP 6.
Opposite Smallest
Flat Face



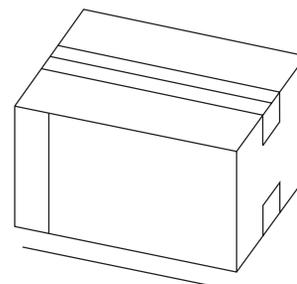
DROP 7.
Medium Flat Face



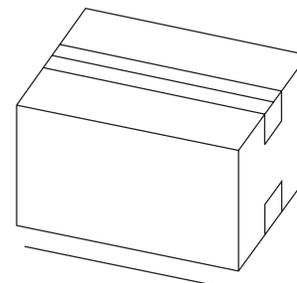
DROP 8.
Opposite Medium
Flat Face



DROP 9.
Largest Flat Face



DROP 10.
Opposite Largest
Flat Face



* **NOTE:** Contact FedEx Packaging Design and Development on how to determine the bottom of any other package types for testing.

Truck and Air Random Vibration Profiles

Figure 1. Random Vibration Profile 1 - Truck

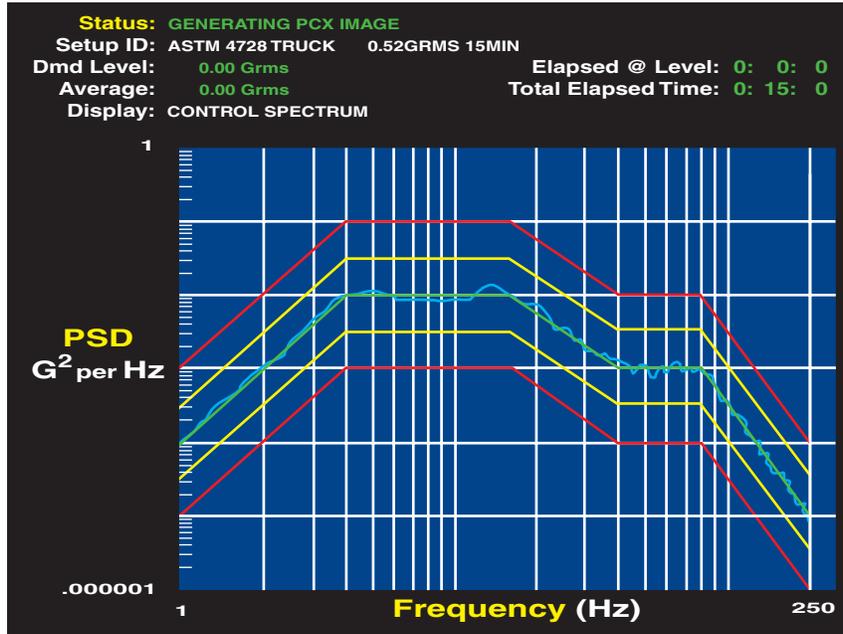
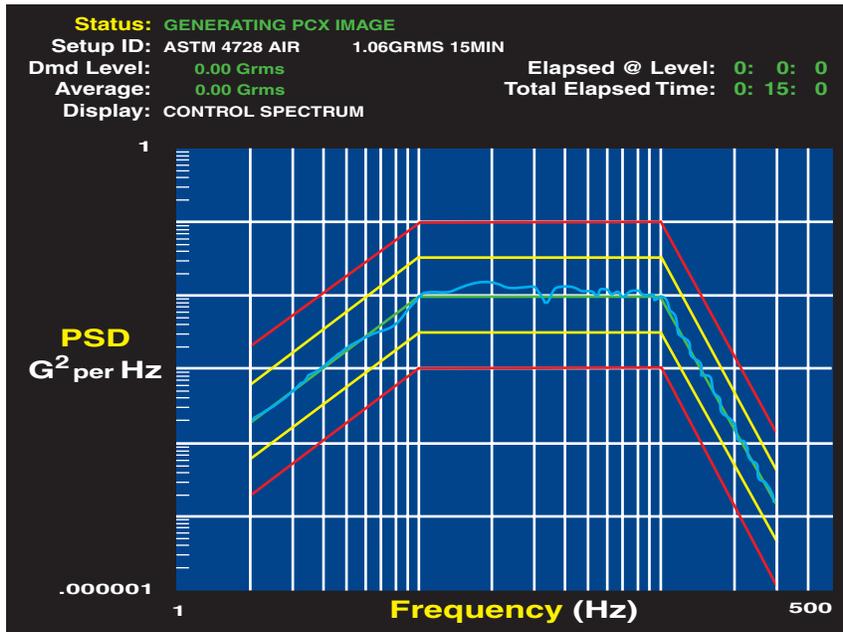


Figure 2. Random Vibration Profile 2 - Air



Overpack Instructions for Submission of Test Samples to the Packaging Design and Development Lab

Place original packaging with product inside an outer box that allows approximately 2" - 4" of space. Fill void areas with polystyrene peanuts or comparable dunnage.

2" - 4" Fill Space (All Sides)



Please mark overpack

The FedEx Packaging Design and Development Department does not test hazardous materials.

NOTICE

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