



FedEx Procedure for Testing Packaged Products Over 150 lbs.





As the industry leader, FedEx sets the highest standard for the development of testing procedures to help ensure your packages reach their destination safely. FedEx package testing procedures are based on factual industry data, as well as international testing procedures and standards to provide the most reliable package test possible. Should you have any questions concerning any of the information in this brochure, contact the FedEx Packaging Design and Development department at 1.800.633.7019.



Procedure for Testing Packaged Products Over 150 lbs.

PROCEDURE OVERVIEW

This procedure is a general simulation test for packaged products weighing more than 150 lbs.* It is used to evaluate:

- the protective performance of the packaging.
- the strength of the shipping unit base for mechanical handling.
- the load integrity and stability in the shipping and handling environment.

The tests should be performed on each test sample in the sequence indicated in the following table:

Product/Service	U.S. Shipments		International Shipments**
	Electronic, Powered, Medical Items	All Other Items	All Items
Side Impact Test***	X	X	X
Bottom Impact Test***	X	X	X
Tip Test	X	X	X
Raised Edge Impact Test	X	X	X
Raised Corner Impact Test	X	X	X
Compression Test	X	X	X
Rotary Vibration Test****		X	
Random Vibration Test – U.S.****	X		
Random Vibration Test – International****			X

* FedEx requires that any shipment weighing more than 150 lbs. must contain a base which permits movement with a forklift or standard freight pallet jack (refer to Packaging Your Freight Shipment in the current FedEx Service Guide for details).

** For international shipments, a second series of impact tests will be performed following the vibration test.

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

**** Currently the random vibration system can test samples up to a maximum of 200 lbs., and the rotary vibration table can test samples up to a maximum of 1,250 lbs. Contact the FedEx Packaging Design and Development department before sending test samples over 200 lbs.

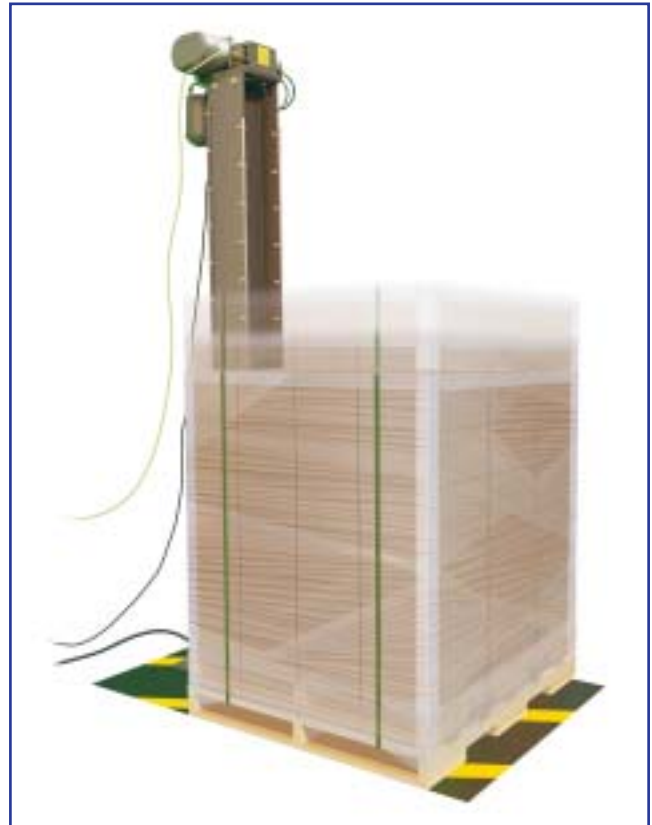
The FedEx Packaging Design and Development department reserves the right to alter the test sequence or equipment used to accommodate special package characteristics, commodities and/or testing equipment limitations to provide the most representative test possible. When package and/or content conditions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

For packaged products under 150 lbs., please refer to FedEx Procedure for Testing Packaged Products 150 lbs. or Less.

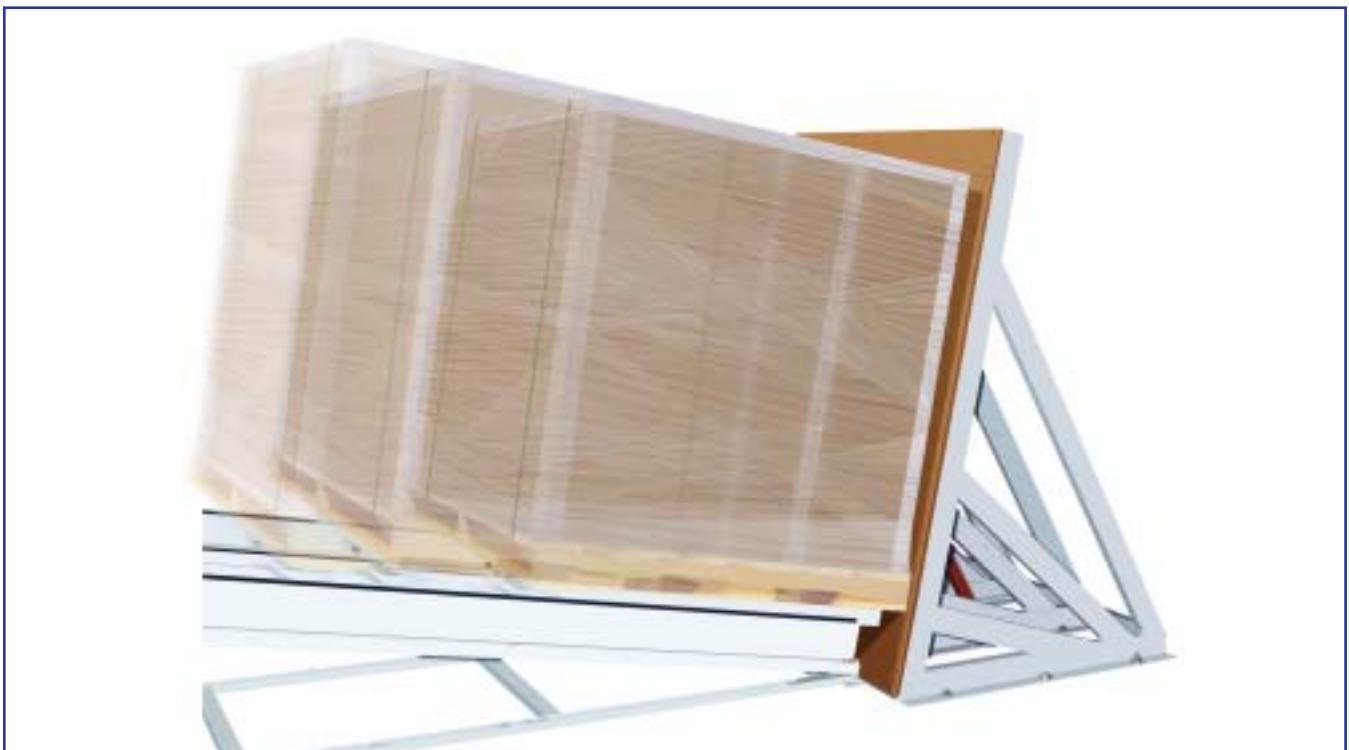
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1. IMPACT TEST

- a. **Bottom Impact Test** – Performed on a free fall drop tester. The test sample is dropped onto a flat, non-yielding surface.
 - 1. Raise the base of the test sample 8 inches above the impact surface.
 - 2. Release the test sample and allow to fall freely.
- b. **Side Impact Test** – Performed on an inclined impact tester equipped with velocity meter.
 - 1. Position the test sample on the center of the carriage with the face receiving the impact placed 2 inches beyond the front edge of the carriage.
 - 2. Position the carriage a distance necessary to achieve a minimum impact velocity of 5.75 feet per second at impact.
 - 3. Subject each side of the test sample to a single impact.



1a. Bottom Impact Test



1b. Side Impact Test

1. IMPACT TEST continued



1c. Tip Test

- c. **Tip Test** – Performed with mechanical assistance on a flat, non-yielding surface.
 1. Tip the test sample to a 22° angle between the impact surface and the bottom of the test sample and release.
 2. The test sample should return to its initial orientation.
 3. Perform the test for all four sides.
- d. **Raised Edge Impact Test** – Performed with mechanical assistance on a flat, non-yielding surface.
 1. With one bottom edge of the test sample supported by the impact surface, raise the opposite bottom edge 10 inches above the impact surface and release.
 2. The test sample should return to its initial orientation.
 3. Perform the test for all four bottom edges.
- e. **Raised Corner Impact Test** – Performed with mechanical assistance on a flat, non-yielding surface.
 1. With one bottom corner of the test sample supported by the impact surface, raise the diagonal bottom corner 10 inches above the impact surface and release.
 2. The test sample should return to its initial orientation.
 3. Perform the test on all four bottom corners.
- f. **Test Evaluation** – Inspect and report the condition of the test sample and its contents after the test. If the contents appear undamaged, proceed to the Compression Test and/or Vibration Test.



1d. Raised Edge Impact Test



1e. Raised Corner Impact Test

2. COMPRESSION TEST

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

a. Performed on a dynamic compression tester equipped with a computerized control system.

Testing procedure:

1. Calculate the compression load in pound-force (lbf) using the **formula** shown above:

Where:

- 0.007 = Average density of freight (lb./in.³), or 12 (lb./ft.³)
- 108 = Maximum height of stack in transit vehicle (in.)
- H = Height of shipping unit (in.)
- L = Length of shipping unit (in.)
- W = Width of shipping unit (in.)
- F = A factor to account for humidity, time and stacking pattern

2. Set up the compression tester for the Stop Force – the Compression Load calculated in step (1), the Yield Detection Percentage (15%), and Stop Deflection (1 in.).
3. Center the test sample on the lower platen of the compression tester.
4. Place the top load pallet hazard device (see Figure 1 on page 6 for detailed specifications) on the top of the test sample.
5. Compress the test sample at the rate of 0.5 in./min.
6. The test is completed when one of three conditions is first detected by the compression tester:
 - the Stop Force
 - the Yield Detection Percentage
 - the Stop Deflection

b. Test Evaluation –

1. If the compression tester stops when it first detects the Yield Detection Percentage or the Stop Deflection, record the compression load and the deflection from the test.
2. Inspect and report the condition of the test sample and its contents after the test. If the contents appear undamaged, proceed to the Vibration Test.

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

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 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



3. VIBRATION TEST

- a. **Random Vibration Option** – Performed on a vertical electrohydraulic vibration machine equipped with a computerized control.
1. Program the vibration system to produce three consecutive sequences of random vibration profiles (spectra) representing the FedEx Express distribution environment (see figures 2 and 3 on page 7 for detailed specifications):
 - Truck vibration @ 0.52 G rms;
 - Air vibration @ 1.06 G rms;
 - Truck Vibration @ 0.52 G rms.
 2. The duration of each sequence is 15 minutes for U.S. shipments and 30 minutes for international shipments.
 3. Place the test sample on the vibration table. Fixtures may be used during the 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.
 4. Load the appropriate automatic sequences of random vibration profiles and perform the tests.

Note: For FedEx Freight® shipments, the test sample will be subjected to the truck vibration @0.52 G rms for 60 minutes.

- b. **Rotary Vibration Option** – Performed on a mechanical, rotary vibration machine. The machine will vibrate at 1 inch total vertical displacement. Test samples will be subjected to a total of 14,200 vibratory impacts.
1. Place the test sample on the vibration table. Fixtures may be used during the 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.
 2. Start the vibration table to vibrate at its lowest speed or frequency. Maintain the 1 inch fixed displacement and slowly increase the speed (frequency) of the vibration table until the test sample begins to momentarily leave the surface of the vibration table. Record this speed – Cycles Per Minute (CPM) or frequency – Cycles Per Second (Hz) and stop the vibration table.
 3. Determine the vibration test duration in minutes, based on the speed (CPM) or frequency (Hz) identified in Step (2), using the following formula:

$$\text{Test Duration (minutes)} = \frac{14,200 \text{ Vibratory Impacts}}{\text{Speed (CPM) or} \\ \text{[Frequency (Hz) x 60]}}$$

4. Start the vibration table to vibrate at the speed (CPM) or frequency (Hz) identified in Step (2). Stop the vibration test half way through the vibration test duration determined in Step (3).
5. Rotate the test sample 90° horizontally. Start the vibration system to vibrate at the same speed (CPM) or frequency (Hz) identified in Step (2). Complete remaining vibration test duration as determined in Step (3).

Note: For relationship between vibration acceleration and speed of vibration table, see Figure 2 on page 6.

- c. **Test Evaluation** – Inspect and report the condition of the test sample and its contents after the test.



3a. Random Vibration Test



3b. Rotary Vibration Test

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Figure 1. Top Load Pallet Hazard Device

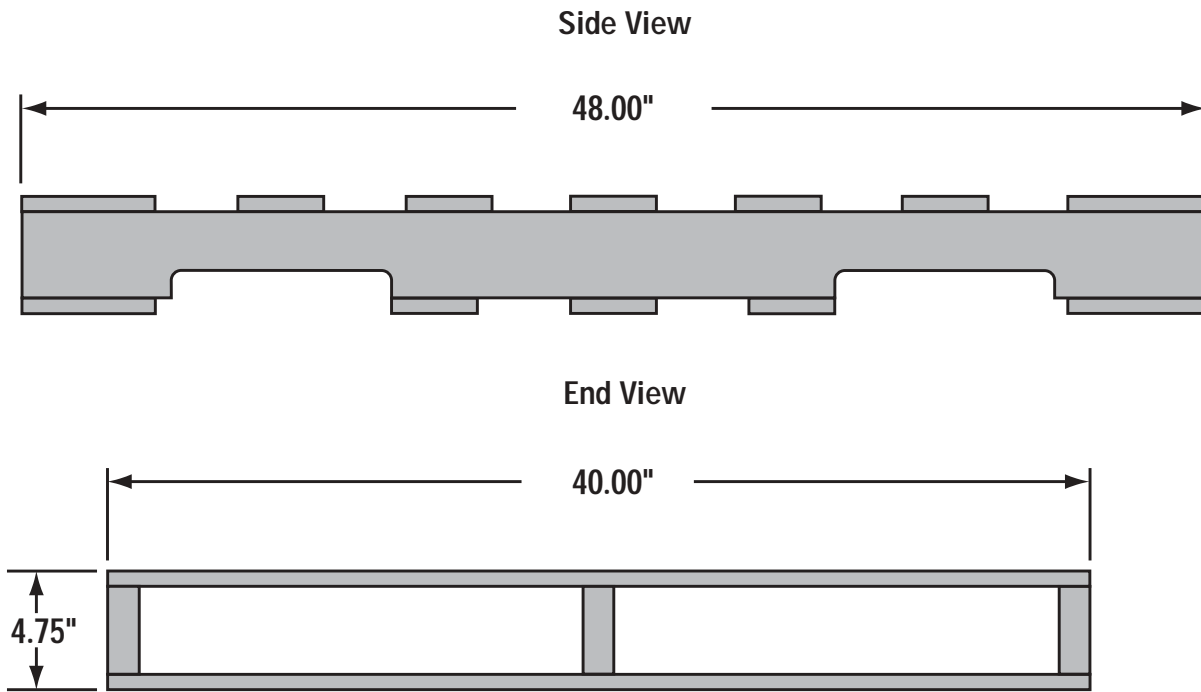
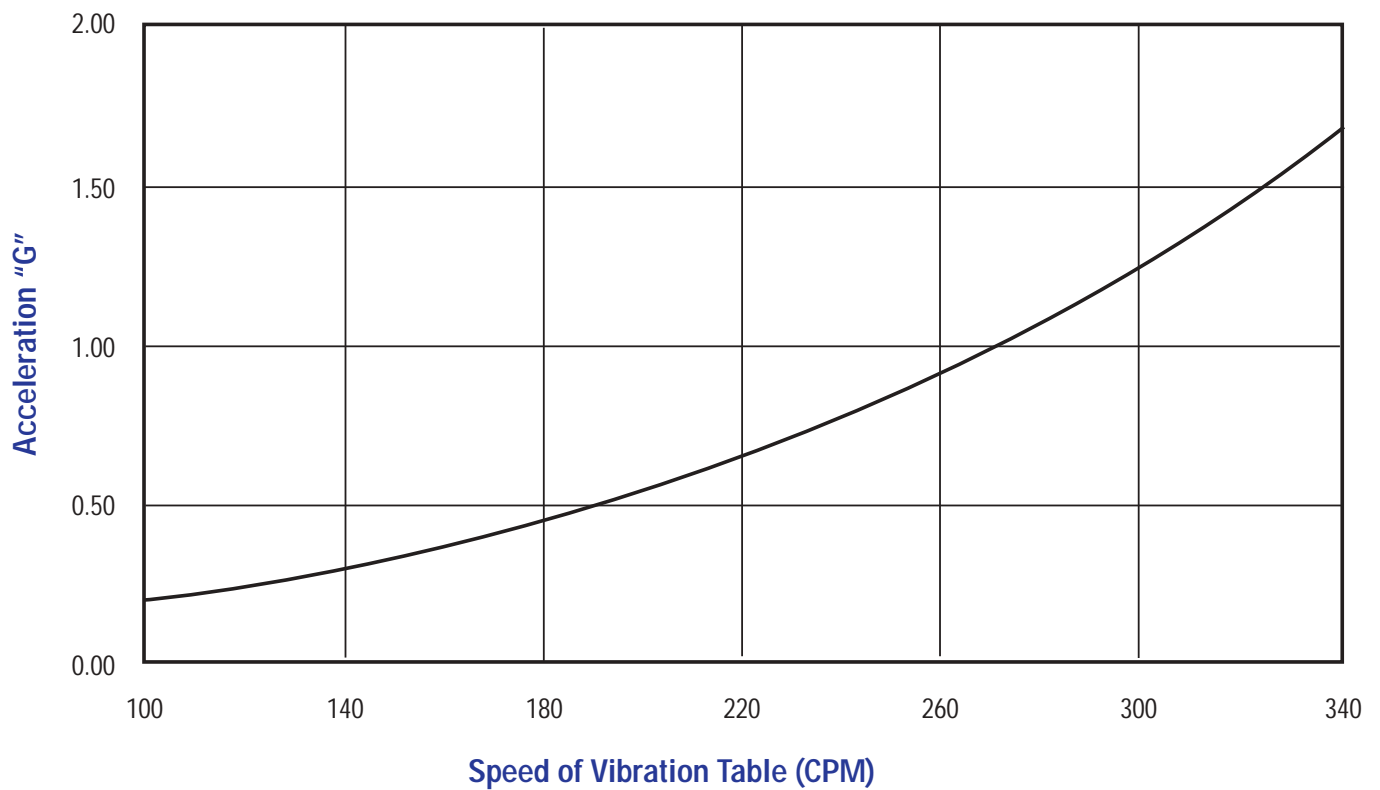


Figure 2. Rotary Vibration Acceleration vs. Speed of Vibration Table



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Figure 3. Random Vibration Profile 1 – Truck

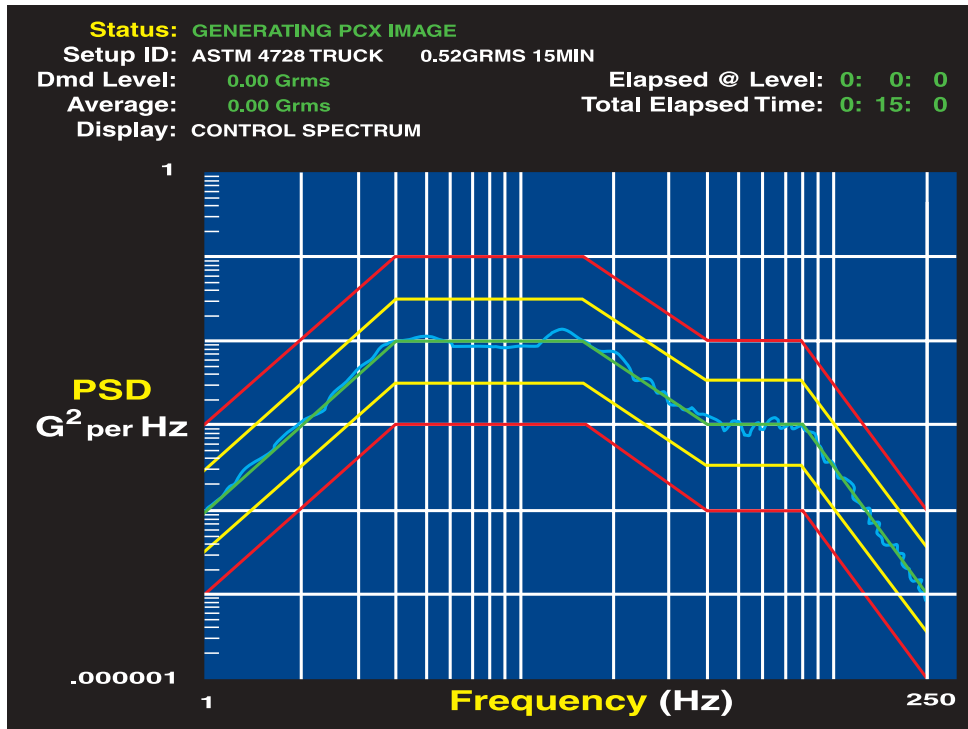
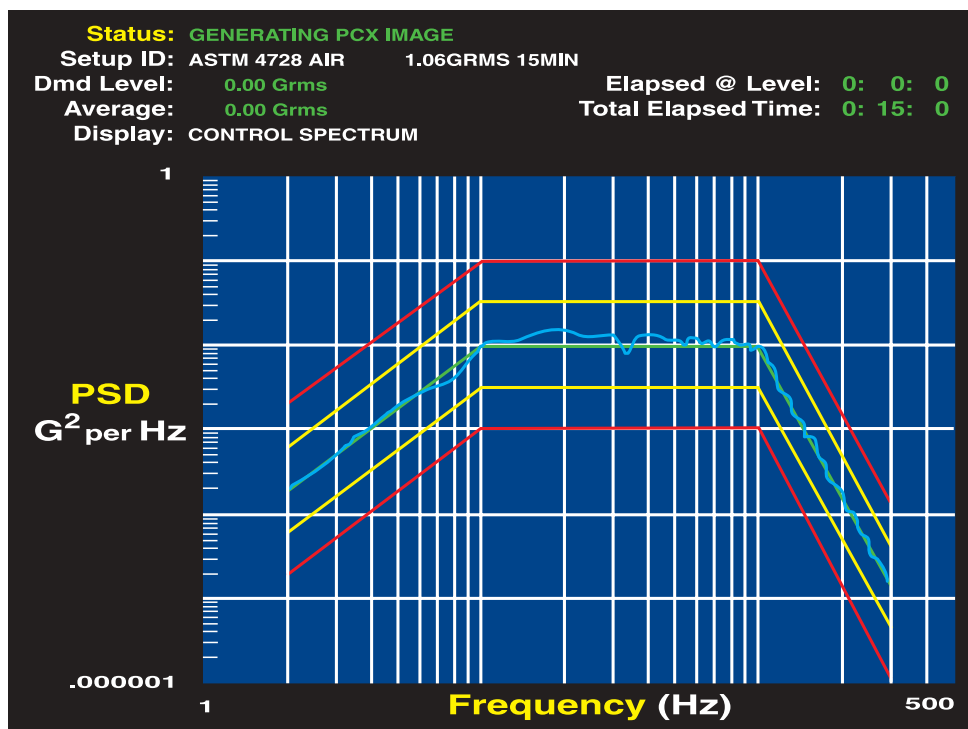


Figure 4. Random Vibration Profile 2 – Air



NOTICE

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