



# Performance Testing of Shipping Containers and Systems - Q&A

## ASTM D4169-22 Revision

### Package Distribution Testing at WESTPAK:

- ✓ Amazon Package
- ✓ Drop
- ✓ Incline Impact
- ✓ Vibration
- ✓ Compression
- ✓ Environmental Conditioning
- ✓ Low Pressure (Altitude)
- ✓ Repetitive Free-Fall
- ✓ Horizontal Impact



### What is the background of the ASTM D4169 standard?

The ASTM D4169 standard provides the basis for testing in a controlled laboratory environment, simulating the typical distribution channel, and is widely used across industries. Using a combination of different hazards, referred to as Schedules, various Distribution Cycles (DC) allow the user to design a testing plan that closely simulate a specific distribution environment.

Schedules can be added or omitted based on the in-use distribution environment. The most common Distribution Cycle employs a mix of free-fall impacts, vehicle vibration (both truck and air), loose load vibration, vehicle stacking (compression), low pressure (altitude), and concentrated impacts.

Following a recent data collection and field study analysis conducted by ASTM, the 2022 revision incorporates changes that align the laboratory testing inputs more closely to hazards observed in the normal distribution environment.

### What are the general changes to the ASTM D4169-22 revision?

The latest revision, ASTM D4169-22 (2022), updates the vibration profile for the air spectrum. Significant changes were made to the duration, intensity, frequency band, and overall profile shape. The frequency band decreased from 300Hz to 200Hz, and the shape of the air profile shifted. The new power spectral density (PSD) plot is more intense in the sub-10Hz frequency range and therefore has higher displacement. However, this is likely to be offset by a decrease in overall intensity by approximately 5x.

Another significant change is that units under test (UUT) are subjected to a low, medium, and high-intensity input for a total of 40 minutes per axis.

All other test inputs remain the same.

## Performance Testing Standards

ASTM D4169

ASTM D4332

ASTM D7386

ISTA 1A-3A

ISTA 1B-3B



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# Performance Testing: ASTM D4169-22 Q&A

### Current Air Spectrum Intensities and Duration per ASTM D4169-22

Intensity		Duration (Minutes)	Typical Shipper Box (3 Axes)
Low	0.16 Grms	27	40 minutes/axis
Medium	0.22 Grms	10	
High	0.29 Grms	3	

### Previous Air Spectrum Intensities and Duration per ASTM D4169-16

Intensity		Typical Shipper Box (3 Axes)
Assurance Level III	0.74 Grms	40 minutes/axis
Assurance Level II	1.05 Grms	
Assurance Level I	1.49 Grms	

## What vibration input should I use?

Before testing, the user should determine which hazards are present in the distribution environment. If a justification can be made that packages will never be transported by air, a Distribution Cycle (DC) that omits air vibration is reasonable. If a less than truckload (LTL) shipment is likely, using the truck and air vibration inputs (DC 13) is recommended.

The -22 revision, along with a similar revision to the truck vibration profile in -16 (2016), eliminates the need for the user to choose an Assurance Level.

## What other inputs should be considered for testing?

Recalling that the purpose of laboratory testing is to simulate the distribution environment of the UUT, it is essential to understand the likely hazards of the 'real world.' Typically, temperature and humidity inputs simulating frozen, tropical, and desert climates are conducted before distribution testing.

## What actions should I take with the new ASTM D4169 revision?

As with any change, a documentation review should be conducted to understand how the differences may affect testing. Then, internal protocols should be reviewed and revised as necessary.

If testing is conducted in-house, verification of equipment capabilities should be conducted. For example, many electro-dynamic shakers have a 1" zero-to-peak displacement limit; the new air profile exceeds this. If you outsource your testing, ensure the lab's equipment has been validated to handle the new requirements.

With any remaining questions, WESTPAK is here to assist.