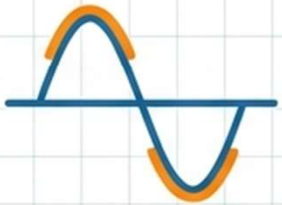
PACKAGING VIBRATION TESTING

Standards, Methods, and Protocols: From Fixed Displacement to Random Simulation

QUALITY PRODUCT BY QUALITY SERVICE

THE INTERNATIONAL TESTING LANDSCAPE



ASTM D 999. Standard Test Method for Vibration Testing of Shipping Containers.

ISTA 6-AMAZON.COM. Ships in Own Container (SIOC) Protocols

ASTM D 4728. Standard Test Method for Random Vibration Testing

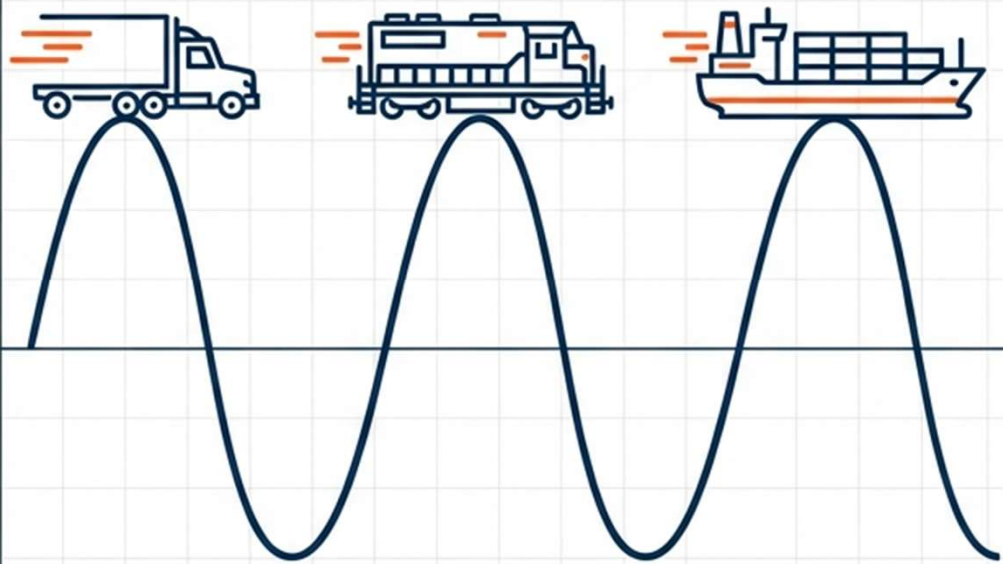
ISO 13355. Packaging – Complete, filled transportation packages – Vertical random vibration test

ASTM D 999

The Fixed Displacement Standard

Utilizes Sinusoidal (Fixed Displacement) vibration to simulate repetitive stress.

- Simulates truck, rail, and ship transport.
- Ideal for R&D and Resonance Search.
- Identifies fatigue points in limited equipment scenarios.

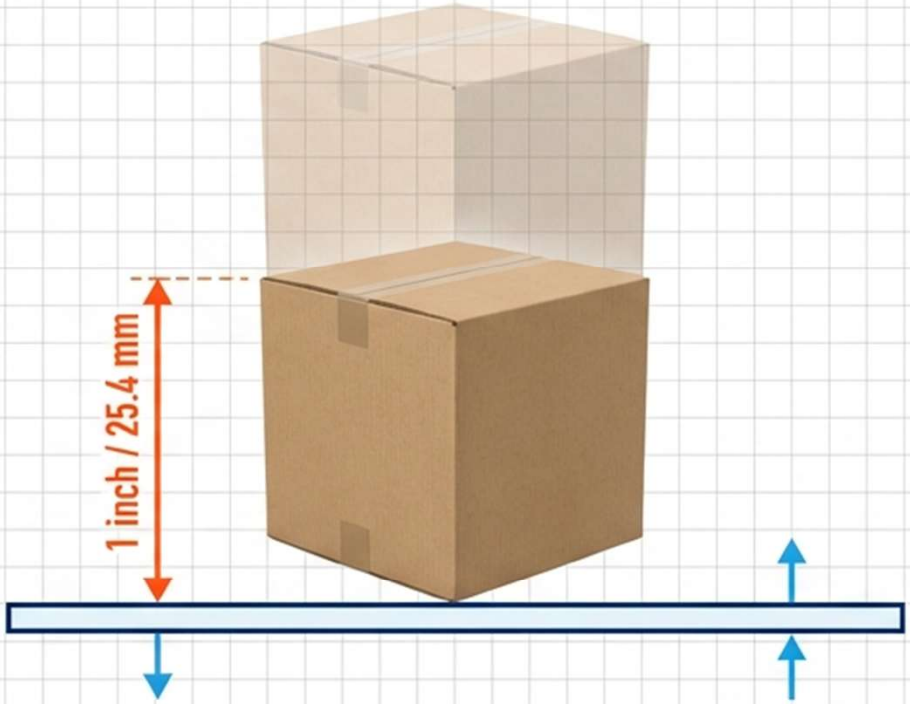


Siam Intercorp (Thailand) Co.,Ltd.

METHOD A: REPETITIVE SHOCK

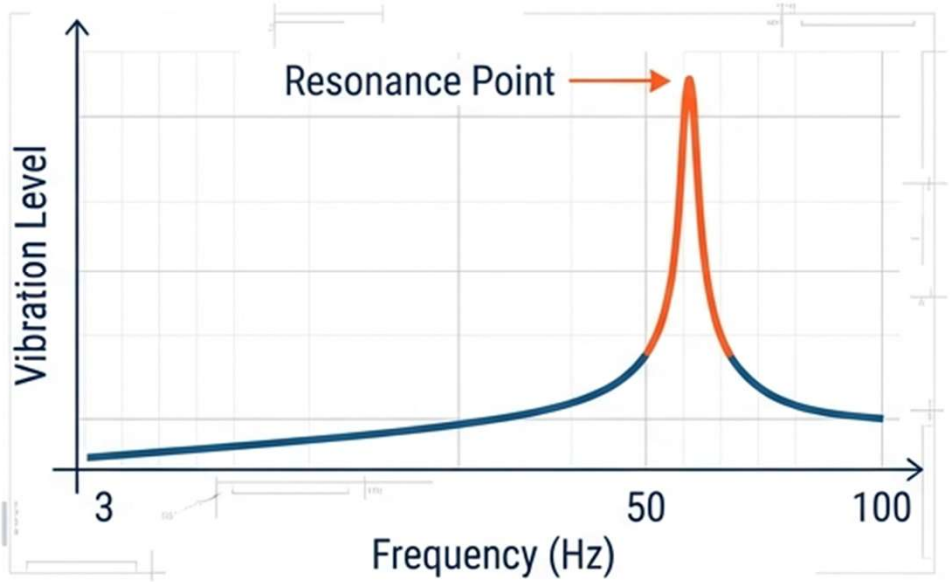
The vibration table operates at a Fixed Amplitude (typically 1 inch / 25.4 mm). The package physically lifts off the table and impacts back down, creating a ‘bouncing’ effect.

Insight: **Simulates loose cargo bouncing on a truck bed over rough terrain.**



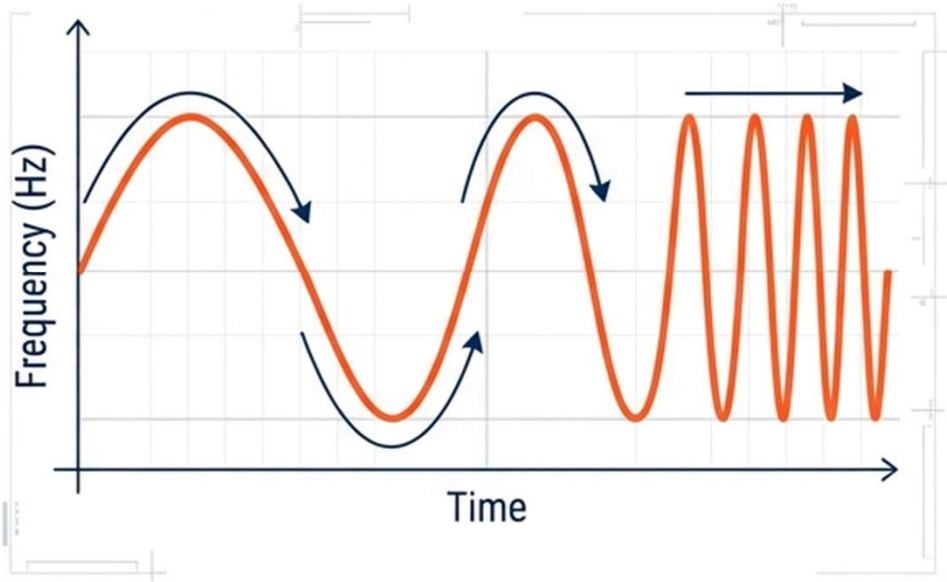
METHODS B & C: ADVANCED ANALYSIS

Method B - Resonance Search



Scans 3–100 Hz to find where the product is most vulnerable. The test "Dwells" at this frequency to induce fatigue.

Method C - Variable Frequency

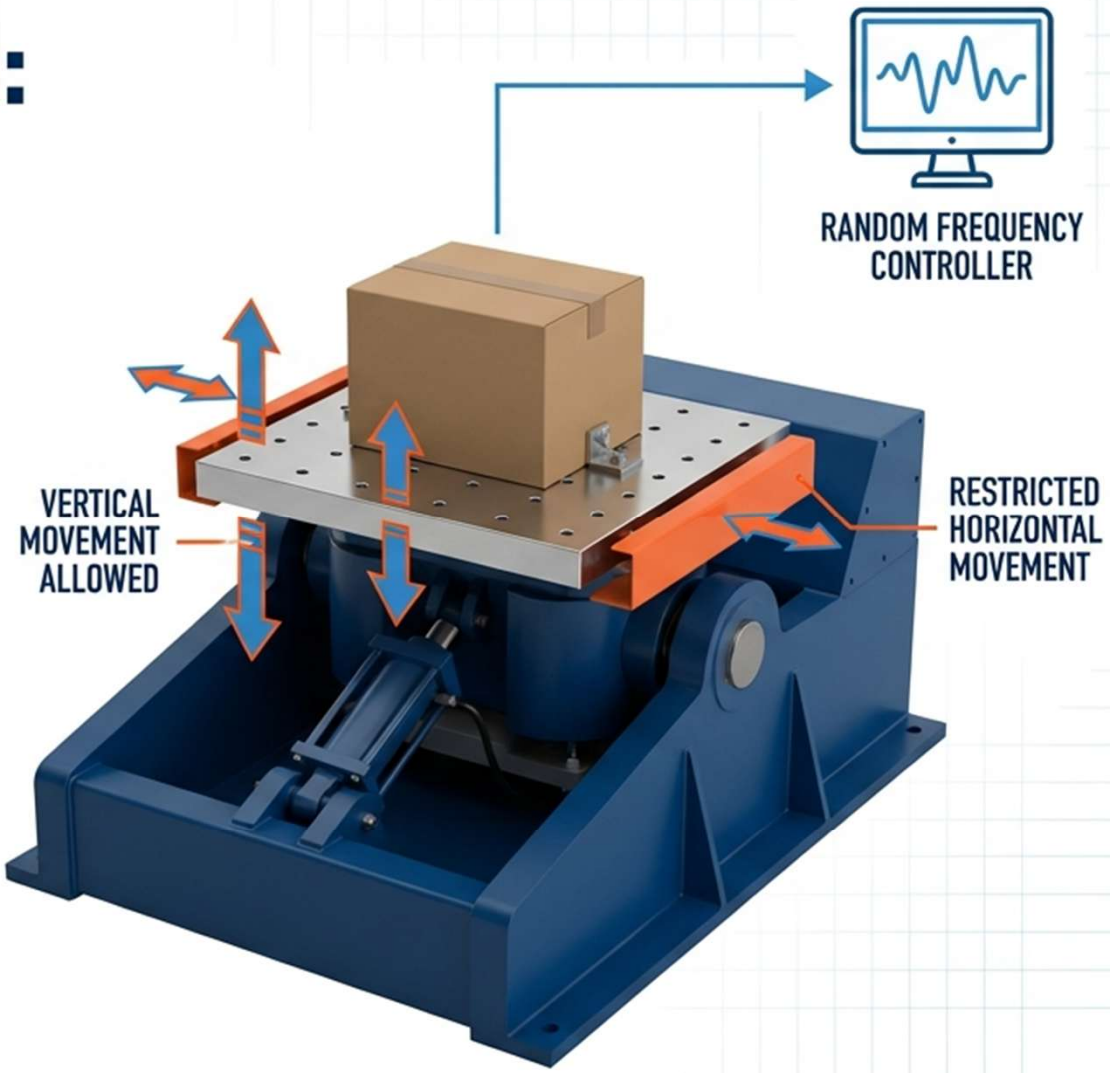


Continuously adjusts frequency across a range. Often paired with Top Loads to simulate compressive stress during transport.

MOVING TO REALISM: RANDOM VIBRATION

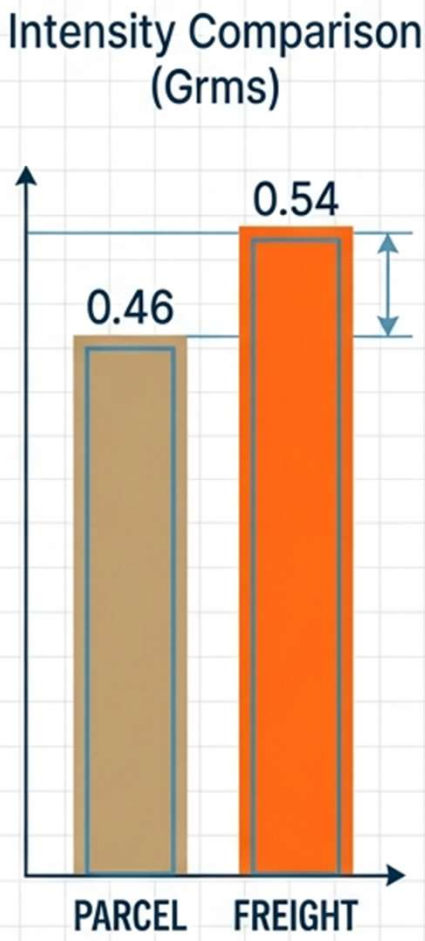
ASTM D 4728 / ISO 13355

Unlike fixed sine waves, Random Vibration simulates the chaos of the real world. This requires advanced hydraulic or electro-dynamic systems.



RANDOM VIBRATION INTENSITY PROFILES

Package Type	Test Condition	Intensity (Grms)
Type A, B, C, G (Parcel)	With / Without Top Load	**0.53 & 0.46**
Type D, F (LTL)	With Top Load Only	0.54
Type F (LTL Palletized)	With Top Load Only	0.54
Type H (LTL TV/Monitor)	With Top Load Only	0.54



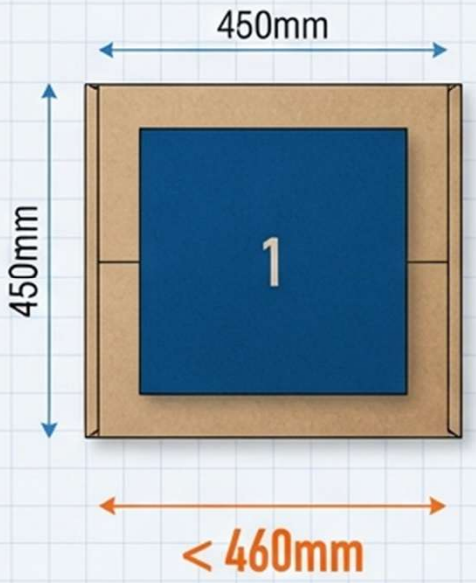
TOP LOAD APPARATUS: LTL / FREIGHT

Siam Intercorp (Thailand) Co.,Ltd.

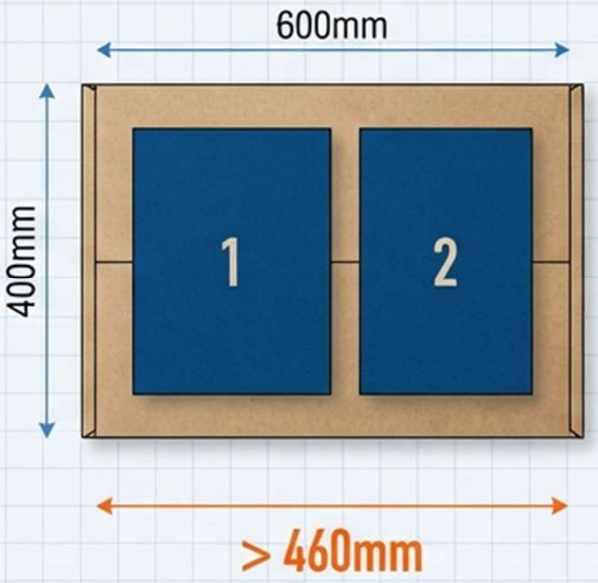
Apparatus:
9 inch (230 mm) box
+ Plywood Base

SIZING THE LOAD: THE 460mm RULE

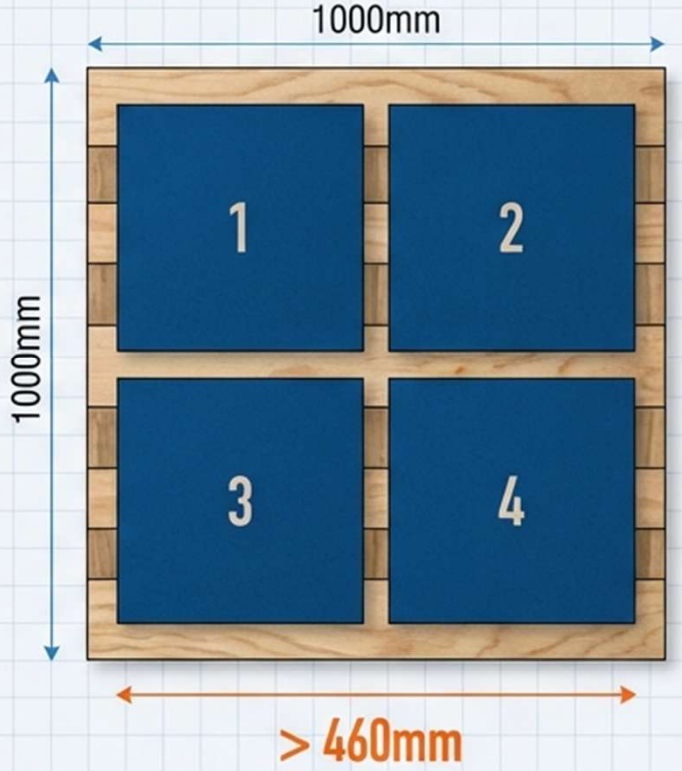
Siam Intercorp



Sides ≤ 460mm = 1 Stack



One Side > 460mm = 2 Stacks



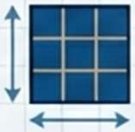
Both Sides > 460mm = 4 Stacks

CALCULATING THE TOP LOAD WEIGHT

Siam Intercorp

$$Top\ Load = Density \times Area \times (H - h)$$

Density: 96 kg/m^3 (Standard Freight Density)



Area: Surface Area of Package Top (L x W)

H: Shipping Height Limit (2.7 m)

h: Height of Test Package

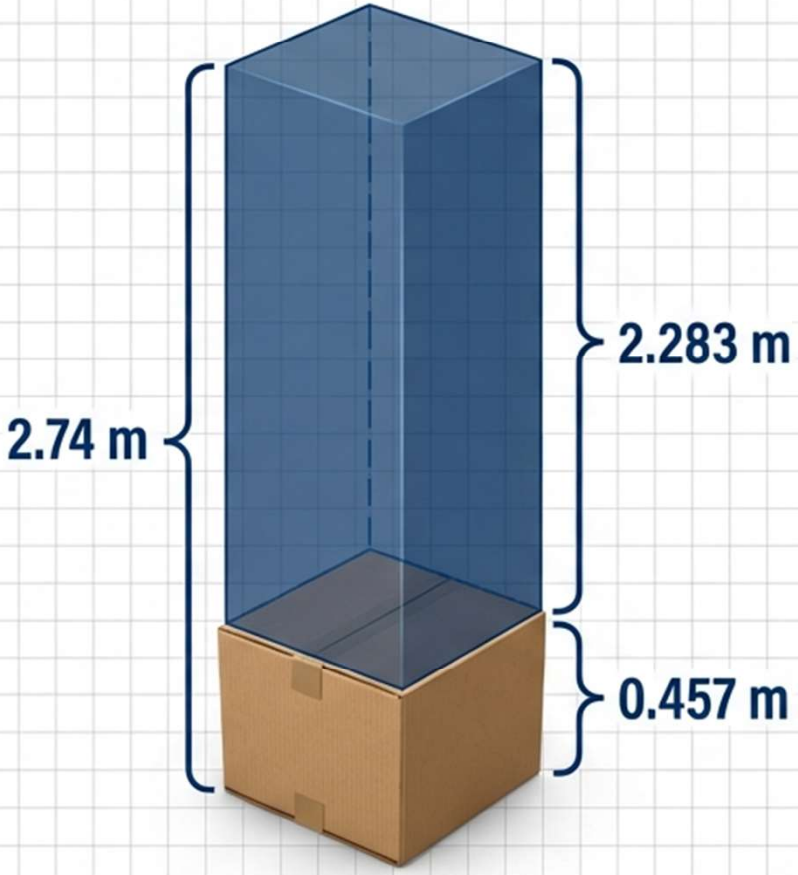
CALCULATION EXAMPLE

Siam Intercorp (Thailand) Co.,Ltd.

Package: 0.508 m × 0.610 m × 0.457 m

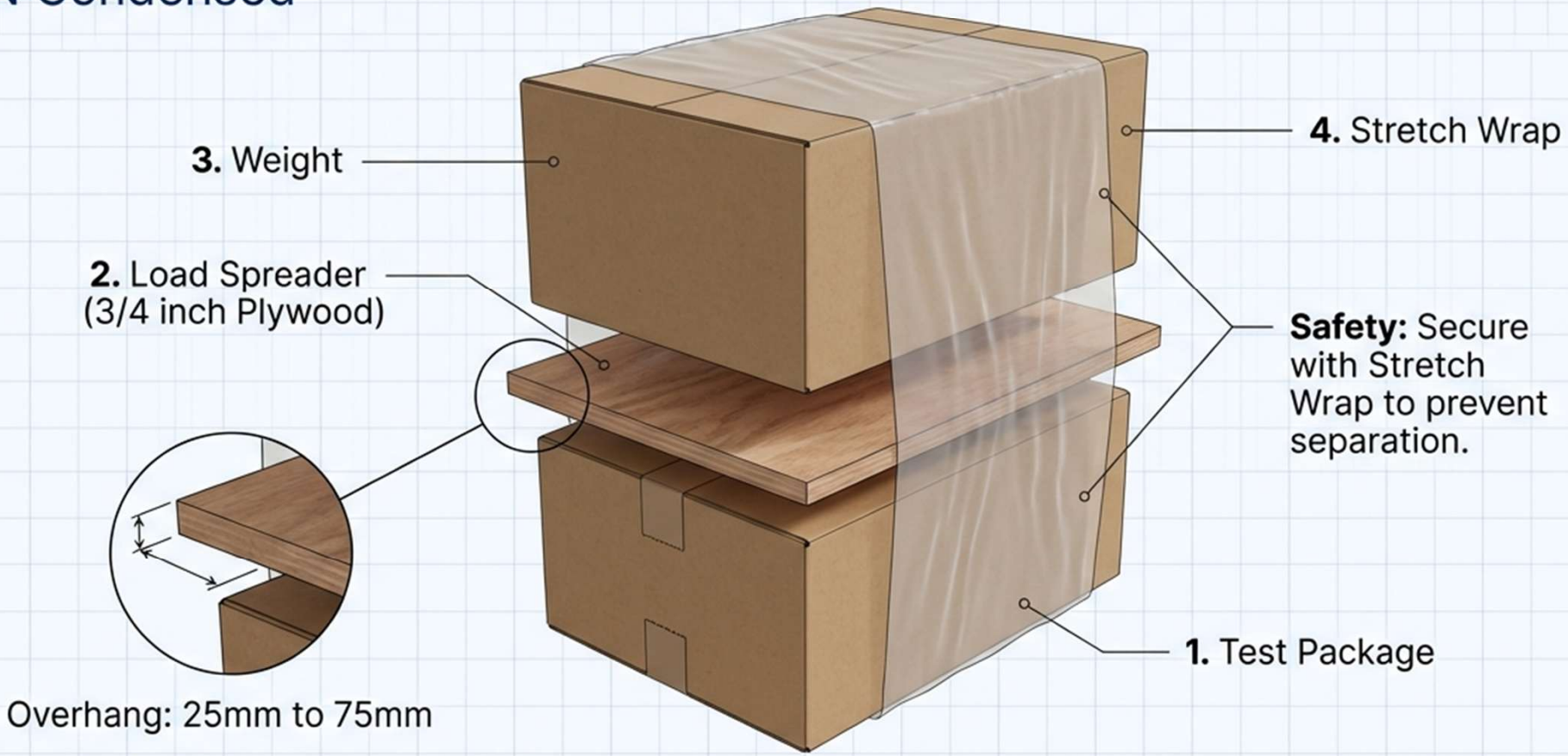
1. Area: 0.508 × 0.610 = 0.310 m^2
2. Column Height: 2.74 m (Truck) – 0.457 m (Box) = 2.283 m
3. Weight: 96 × 0.310 × 2.283

= 68 kg



TOP LOAD APPARATUS: PARCEL

DIN Condensed



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COMPARISON: SINUSOIDAL VS. RANDOM

ASTM D 999 (Sinusoidal)

- **Motion:** Fixed / Repetitive.
- **Goal:** Find Weak Points (Resonance).
- **Best For:** R&D, Component Analysis, Limited Equipment.

ASTM D 4728 (Random)

- **Motion:** Dynamic / Chaos Simulation.
- **Goal:** Real-World Distribution Simulation.
- **Best For:** Final Validation, Amazon/ISTA Compliance.

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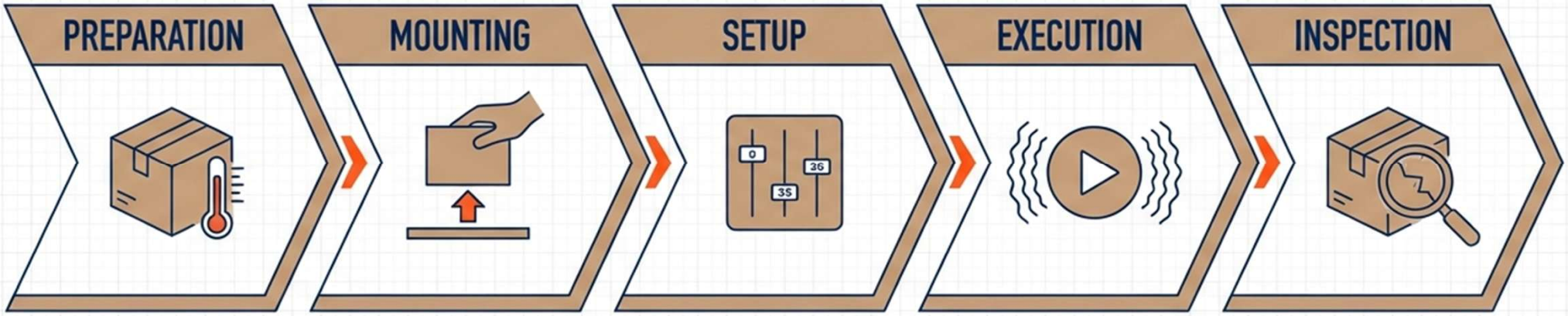
THE TESTING WORKFLOW



Conditioning	Orientation & Top Load	Amplitude or Grms Profile	Run Method A, B, C or Random	Damage Analysis

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QUALITY PRODUCT BY QUALITY SERVICE

Comprehensive Vibration Testing Solutions