



ista | OVERVIEW

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Horizontal Impact Testing for Unrestrained Unitized Loads

ISTA Data Depot Test

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ISTA Data Depot test elements are individual in nature and are intended to:

- Introduce developmental test elements into the public domain to catalog more in-depth correlation examples to refine the test element(s) as needed,
- Be an a la carte test element that can be used independently or in conjunction with other tests.

When properly executed, ISTA Data Depot tests may provide tangible benefits of:

- Assisting the validation of a new test element
- Fill a gap with other full generalized supply chain based standard test protocols
- There are three sections to this Test: Overview, Testing and Documentation
- **Overview** provides general knowledge required before testing **and**
- **Testing** presents the specific instructions to do laboratory testing **and**
- **Documentation** indicates what data shall be recorded to ensure effective future reference.

Two systems of weights and measures are presented in ISTA test procedures: SI (Metric) or English system (Inch-Pound). Metric units are shown first followed by the Inch-Pound units in parentheses; there are exceptions in some tables (when shown separately).

Familiarity with the following units and symbols used in this document is required:

For measuring	SI units and symbols	English units and symbols
Weight	kilograms (kg) or grams (gm)	pounds (lb)
Distance	meters (m) or millimeters (mm)	feet (ft) or inches (in)
Volume	Cubic centimeters (cm ³)	Cubic inches (in ³)
Density	kilograms per cubic meter (kg/m ³)	pounds per cubic inch (lb/in ³)
Temperature	Celsius (°C)	Fahrenheit (°F)
Absolute Pressure	Kilopascal (kPa)	Pounds per square inch (psi)

- Either system may be used as the unit of measure (standard units), **but**
- The standard units chosen shall be used consistently throughout the procedure.
- Units are converted to two significant figures **and**
- Not exact equivalents.

VERY IMPORTANT:

The entire document shall be read and understood before proceeding with a test.

VERSION DATE
Last TECHNICAL Change:
MARCH 2021
(Initial Release)

Last EDITORIAL Change:
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For complete listing of Procedure Changes and Version Dates go to www.ista.org

Preface

This Test is for unitized loads of similar retail or institutional packaged-products that are mechanically handled with equipment similar to a forklift or pallet jack.

A unitized load is defined as one or more products or packaged-products usually on a skid or pallet, but always secured together for distribution as a single load. Examples would be a stretch wrapped pallet load of individual containers, a single non-packaged machine banded to a pallet or a pallet with a corrugated tray, tube and a cap.

- It can be used to evaluate load stability.
- The test levels are based on general data, including standard horizontal restrained impacts like ISTA 3E and ASTM D4169, and may not always correlate to the impact levels that occur in an unrestrained situation.
- The package and product are considered together and not separately.
- Some conditions of transit, such as moisture, pressure or unusual handling, may not be covered.

Other ISTA Procedures may be appropriate for different conditions or to meet different objectives.

Specific suggestions:

- This test can be an optional test conducted with other generalized unit load tests like 3E and 3B. Since this test is in a development stage, sharing how the test results correlate to known field results would be helpful for ISTA as the organization works to validate the method.

Refer to Guidelines for Selecting and Using ISTA Procedures and Projects for additional information.

Scope

This Test predicts load stability and horizontal shifting issues when unitized packaged-products are handled mechanically in an unrestrained manner.

Product
Damage
Tolerance and
Package
Degradation
Allowance

The shipper shall determine the following prior to testing:

- what constitutes damage to the product **and**
- what damage tolerance level is allowable, if any, **and**
- the correct methodology to determine product condition at the conclusion of the test **and**
- the acceptable package condition at the conclusion of the test **and**
- maximum horizontal shifting (MHS) allowance at rest following each impact (Example: 10% of the sample height or other user defined value established and confirmed by responsible stakeholder).

Samples

For additional information on this determination process refer to *Guidelines for Selecting and Using ISTA Procedures and Projects*.

Samples should be the untested actual package and product, but if one or both are not available, the substitutes shall be as identical as possible to actual items.

Number of samples required:

One sample (unitized load) is required for the tests in this procedure. If the sample is regularly handled double stacked, it is recommended that the testing is executed with two samples stacked. If two samples are tested in a stacked configuration, the entire stack is considered the Unit Under Test (UUT). An alternative to the stacked approach is to use a second pallet with test weight. Effort should be made to replicate the height and weight distribution of the test sample with the pallet of test weight.

Note: This testing can pose a safety hazard related to unit load tipping / collapsing (especially if testing in a double stacked configuration). Caution must be taken during the execution.

Replicate Testing Recommended:

To permit an adequate determination of representative performance of the packaged-product, ISTA:

- Requires the procedure to be performed one time, **but**
- Recommends performing the procedure five or more times using new samples with each test.
- Refer to *Guidelines for Selecting and Using ISTA Procedures and Projects* for additional information on statistical sampling.

NOTE:

Packages that have already been subjected to the rigors of transportation cannot be assumed to represent standard conditions. In order to ensure testing in perfect condition, products and packages shipped to certified laboratories for testing must be:

- over-packaged for shipment to the laboratory **or**
- repackaged in new packaging at the laboratory.

OVERVIEW OF TEST: Unrestrained Impacts

NOTE:

It is important to thoroughly document the configuration, materials, and construction of the tested product and package. Significant variations in performance can sometimes be caused by seemingly insignificant differences. Photo documentation is strongly recommended to supplement detailed written descriptions.

The tests shall be performed on each test sample in the sequence indicated in the following tables:

Test
Sequence

Sequence #	Test Category	Test Type	Test Level	For ISTA Certification
1	Atmospheric Preconditioning	Temperature and Humidity	Ambient	Required
2	Atmospheric Conditioning	Controlled Temperature and Humidity	Temperature and humidity chosen from chart	Optional
3	Shock (Alternative methods allowed – select one test type)	Incline Impact with Leveling Wedge	Impact Speed of: Varies based on risk tolerance	Required
		Horizontal Impact	Change of Velocity of: Varies based on risk tolerance	

Equipment
Required
Atmospheric
Conditioning

Atmospheric Conditioning:

- Humidity recorder complying with the apparatus section of ISO 2233 or ASTM D 4332.
- Temperature recorder complying with the apparatus section of ISO 2233 or ASTM D 4332.

Optional Atmospheric Conditioning

- Chamber and Control apparatus complying with the apparatus section of ISO 2233 or ASTM D 4332.

The following alternatives are acceptable for the equipment required for the Impact Test:

Equipment
Required
Shock

Type of Shock Test	Equipment	In compliance with the apparatus section of:
Incline Impact	Incline impact tester with leveling wedge	ASTM D 880 (Incline impact tester) and ISO 10531 (Leveling wedge)
Horizontal Impact	Horizontal impact tester	ASTM D4003