



**ISTA 3L:  
GENERALIZED  
E-COMMERCE  
RETAILER  
FULFILLMENT TEST**

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# HOW DOES TESTING HELP MY BUSINESS AND THE ENVIRONMENT?

**The decisions supported by pre-shipment performance testing of packaged products can minimize product damage throughout distribution and optimize resource usage through effective package design, improving your bottom line and reducing our environments exposure to waste.**

The need for testing comes from the difficulty of predicting what will happen in large-scale operations, coupled with the requirement to make decisions prior to implementation. Essentially, every test comes from the need to make a decision. The test results provide the decision maker with information to help maximize correct decisions. The decisions supported by pre-shipment performance testing of transport packaging are typically about how well the package will protect the contents during distribution.

Product damage has 10 to 15 times the environmental impact of packaging. Packaging's most critical function from a sustainability perspective is to reduce and prevent product damage. Product damage of any sort is a huge problem. If the package does such a bad job of protecting the product that the consumer can't use it, you've failed before you've even begun. Damage to the product is the worst case scenario for supply chain players and the environment.

Not only does damage impact brand image with the customer, but it is a worst-case sustainability outcome since both the product and package become waste. Replacing damaged products accounts for a much higher greenhouse gas output and resource usage than does packaging. This is estimated to be five to 30 times more than the environmental impact of packaging. Damage prevention also reduces unnecessary extra shipments due to returns and replacements.

Studies by The ULS (Use Less Stuff) Report and the Industry Council for Packaging and the Environment (INCPEN) show that packaging only accounts for 7% to 10% of the total environmental impact of a product. By protecting the product, a small amount of packaging significantly reduces the relatively large amount of environmental (and economic) waste that can result from product breakage, spoilage, mishandling and/or misuse.

Material and optimization choices to increase overall packaging sustainability should not increase risk of product damage.



# WHO IS THE INTERNATIONAL SAFE TRANSIT ASSOCIATION (ISTA)?

The International Safe Transit Association (ISTA) is a global alliance of shippers, carriers, suppliers, testing laboratories, and educational and research institutions focused on the specific concerns of transport packaging. Our mission is to empower organizations and their people to minimize product damage throughout distribution and optimize resource usage through effective package design.

In the pursuit of this mission, ISTA develops testing protocols and design standards using our ANSI accredited consensus standards development process that define how packages should perform to ensure protection of their contents during the ever-changing risks of the global distribution environment. ISTA serves as a global certifying body for testing facilities that can perform these tests. There are hundreds of certified testing labs globally that provide commercial testing services and can perform ISTA 3L-Generalized E-commerce Retailer Fulfillment testing. ISTA staff does not have any testing facilities and does not perform testing as a service.



# WHAT IS ISTA 3L?

ISTA 3L is a research-based, data-driven testing protocol that simulates the hazards experienced when product orders, fulfilled by retail corporations, are shipped directly to consumers. It allows users to evaluate a packaged product's capability to withstand the supply chain hazards experienced when transporting and handling packaged-products from receipt into an e-commerce retailer fulfillment operation through to the end consumer.

3L specifically focuses on packaged-products being shipped in their own containers (SIOC), through the following phases an e-commerce retailer fulfillment supply chain:

1. E-commerce retailer processing, including fulfillment
2. Outbound to consumer, either single parcel or less-than-truckload (LTL) shipment methods

Each one of the phases along the supply journey involves additional touch points, and with each touch point comes with the opportunity for packaging fatigue or failure.

This test is appropriate for nine different types of packaged products. The different types of packaged products are determined through the consideration of four criteria:

- Retailer Outbound Shipment Method,
- Retailer Fulfillment Center Handling Method,
- Packaged Product Weight
- Product Category

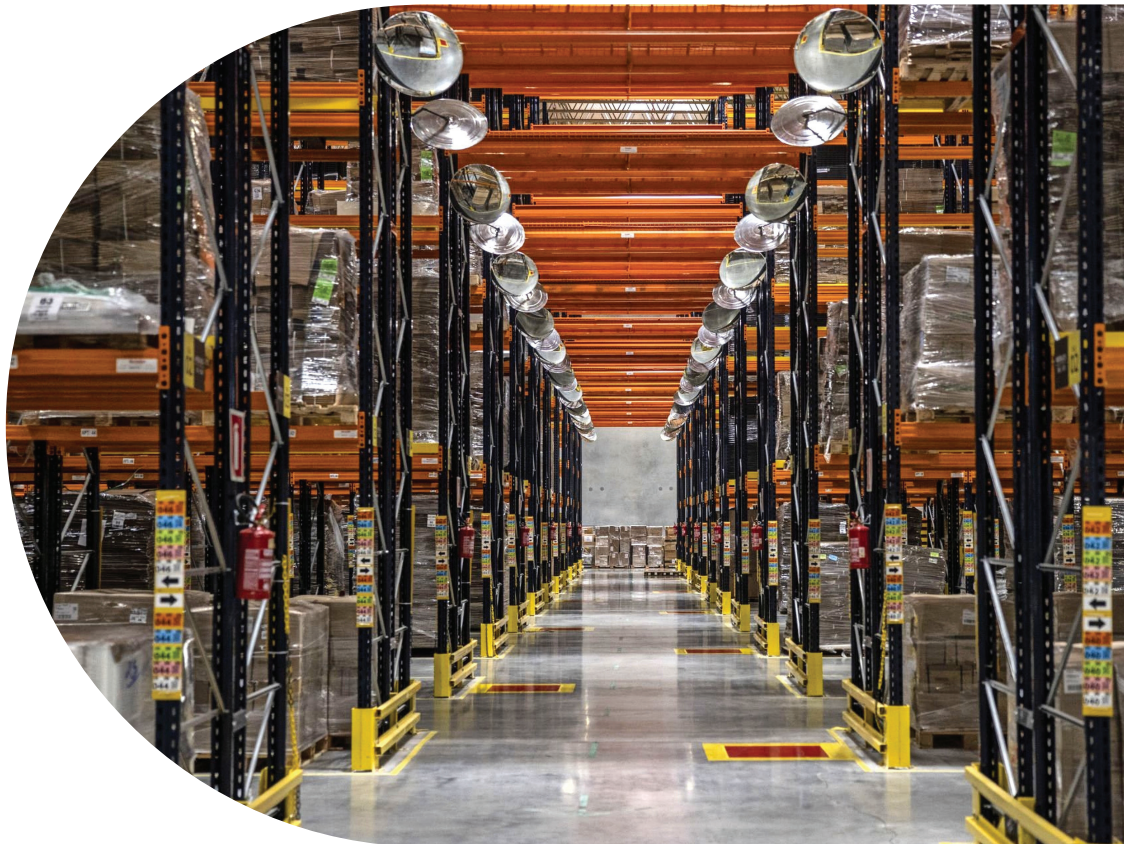
» [SEE THE FULL TEST OR THE OVERVIEW](#) for more detail.



# WHY WAS ISTA 3L DEVELOPED?

ISTA 3L was developed with the goal of publishing an industry standard protocol that accounts for the typical supply chain hazards generally found across multiple ecommerce retailers. This enables a foundational understanding of packaged product performance for this market in a general fashion and improves speed to market through a unified retailer approach.

The traditional retail supply chain journey from manufacturing to brick-and-mortar retail store typically involves approximately five to seven touch points. The e-commerce supply chain disrupts this traditional journey resulting in longer transit legs and more touches for packaged products as they travel to their ultimate destination: the doorstep of a consumer. "Direct" shipment to the consumer often involves 20 or more touch points, creating new design hurdles for many packaging designers. Gaining an understanding of these touch points and the resulting hazards they pose to packaged products, as well as the common practices employed by e-retailers, is critical to designing optimized packaging for this supply chain.



# HOW WAS ISTA 3L DEVELOPED?

**ISTA 3L was developed by combining data from relevant testing protocols, observational data collected within multiple retailer fulfillment locations, broad industry feedback, and correlation of field damages to laboratory testing results.**

Research was conducted at several e-commerce fulfillment centers of leading e-commerce retailers accounting for nearly half of the market share in the United States. This involved deploying subject matter experts into the field to identify, and through observations, quantify all hazard elements and packaging flows. The collected data was compared against the existing ISTA 6-Amazon.com-SIOC, ISTA 3A, and ISTA 3B test protocols (gap analysis) to serve as a foundation for creating ISTA 3L which accounts for multiple retailers.

The ISTA Standards Council reviewed the research and concluded that the hazards found within retailer e-commerce fulfillment operations, as well as the delivery means to the end consumers, are generally similar across retailers and are well suited for standardization. The field study also showed the hazards aligned well with the test elements found within ISTA 6-Amazon.com-SIOC. To further confirm these conclusions, the Council approved the formation of a workgroup to seek broad industry input on the matter.

A diverse workgroup of nearly 50 individuals shared their expertise in designing packaging for multiple e-commerce retailers. This included experiences with different field damage types and alternative methods for approaching the challenge of understanding protective performance of a packaged-product system. After much discussion, the workgroup provided its recommendation to the council via a vote. The recommendation was to combine ISTA 3A 'smalls' test elements with current elements of ISTA 6-Amazon.com-SIOC, and then conduct a series of correlation testing to prove the viability of the protocol.

To validate the proposed test protocol, ISTA's Standards Council sought out appropriate packaged products to subject to the proposed test. The correlation effort looked at both packaged products experiencing frequent damage and those experiencing minimal damage in the field. The results of the lab testing were then compared to actual field shipment results. This provided a level of confidence that the test was performing appropriately for both products that are experiencing frequent damage issues in the field as well as products that are experiencing limited damage during shipment.

# WHAT IS INVOLVED IN TESTING AND WHY?

ISTA 3-Series testing protocols, such as 3L, are General Simulation Performance Tests that provide a laboratory simulation of the damage-producing motions, forces, conditions and sequences of transport environments. ISTA 3-Series tests are applicable across broad sets of circumstances, such as a variety of vehicle types and routes or a varying number of handling exposures. Test characteristics include shaped random vibration, package drop testing at various heights, dynamic compression, vertical and/or horizontal compression, and optional atmospheric conditioning such as tropical wet or winter/frozen.

A packaged product encounters four basic categories of hazards during its journey to the end consumer: shock, vibration, compression and atmospheric. The distribution hazard is accounted for in a controlled, repeatable manner within a laboratory. The laboratory event might not be a direct replication of the distribution hazard but rather a means of accounting for those forces exerted onto the packaged product. As an example, during distribution packages encounter other packages when traveling on automated conveying systems. Those shock forces are reproduced in a laboratory using a free-fall drop test machine. The following table summarizes some of these relationships:

Distribution Hazard	Test Category	Laboratory Test Type
Handling Drop, Conveyor Sortation Package on Package Impact, etc.	Shock	Free-Fall Drop
Stacking within a Warehouse	Vertical Compression	Compression Machine or Static Load
Stacking within a Vehicle	Dynamic Compression	Top Load Compression Combined with Random Vibration
Clamp Handling	Horizontal Compression	Clamp Test Machine or Compression Machine
Vehical Transportation	Random Vibration	Vertical Random Vibration Machine
Forklift Handling, Palletized Packaged Products	Shock	Forklift Handling Course
Atmospheric Conditions, Temperature & Humidity	Atmospheric	Environmental Chamber

» FOR MORE INFORMATION on the hazards that could be encountered in this supply chain and the potential implications to your packaged-products, see **ISTA's Touchpoints** publication on E-retailer Fulfillment.





# WHERE CAN I GET A COPY OF ISTA 3L?

ISTA members can download ISTA 3L at no cost.  
Non-members can purchase a copy of ISTA 3L for \$95 USD.

[» Get ISTA 3L](#)



## HOW DO I FIND PACKAGING DESIGN HELP?

There are numerous ISTA members that can help you prepare your packaging for e-commerce. You can use the ISTA member search tool to find companies to help you with package design, test equipment, packaging supplies and much more.

The search tool provides a global listing of testing facilities and supplier partners. You can filter the listing by selecting the specific service you seek such as packaging design, packaging consultancy and more. Many ISTA certified labs offer additional services like package design, distribution environment measuring, problem solving and more.

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[» FIND ISTA CERTIFIED LABS & PACKAGING RELATED SERVICES](#)

# HOW IS ISTA 3L DIFFERENT FROM ISTA 3A OR ISTA 3B?

**ISTA 3L is a generalized E-commerce Retailer Fulfillment test. It accounts for transit hazards experienced in E-commerce retailer fulfillment systems and incorporates test elements from ISTA 3A and ISTA 3B to account for final delivery to consumers where appropriate.**

The test is built upon research that was contrasted against existing test elements found within ISTA 6-Amazon.com-SIOC, 3A and 3B. ISTA 3A is a general simulation of the parcel shipping network, and 3B is a general simulation of the less-than-truckload (LTL) shipping network. Both parcel carriers and LTL carriers are commonly leveraged by retailers for final delivery of packaged products to the end consumers; therefore, those existing test elements were incorporated in an e-commerce fulfillment retailer test.

Additionally, research showed that the hazards found within retailer e-commerce fulfillment operations as well as the delivery means to the end consumers are similar regardless of the retailer. As such, they are well suited for general standardization, and the study showed they compared and aligned well with the test elements found within ISTA 6-Amazon.com-SIOC.



# HOW IS ISTA 3L DIFFERENT FROM ISTA 6-AMAZON.COM-SIOC?

**ISTA 3L is non-retailer specific e-commerce Retailer Fulfillment test that accounts for the supply chain hazards generally found across multiple e-commerce retailers. The test is built upon research that was contrasted against existing test elements found within ISTA 6-Amazon.com-SIOC as well as ISTA 3A and 3B.**

Research showed that the hazards found within retailer e-commerce fulfillment operations, as well as the delivery means to the end consumers, are similar regardless of the retailer. As such, they are well suited for general standardization, and the study showed they comparable and well-aligned with the test elements found within ISTA 6-Amazon.com-SIOC as well as ISTA 3A and 3B.

ISTA 6-Amazon.com-SIOC is a general simulation test for “Ships In Own Container” (SIOC) packaged products shipped through Amazon’s distribution system to the final customer destinations. This testing protocol was developed by combining data from previous studies or transportation environments, relevant testing protocols, Amazon Fulfillment Center environment visual observations and documented standard operating procedures, and customer feedback.

ISTA 3A is a general simulation of the parcel shipping network, and 3B is a general simulation of the less-than-truckload (LTL) shipping network. Both parcel carriers and LTL carriers are commonly leveraged by retailers for final delivery of packaged products to the end consumers; therefore, those existing test elements were incorporated in both ISTA 3L as well as ISTA 6-Amazon.com-SIOC.



# WHAT ARE THE STEPS TO HAVE MY PACKAGED-PRODUCT TESTED?

1. Find a lab
2. Submit a packaged product
3. Timing & cost
4. Define pass and fail criteria
5. Receive a report

## 1. Find a lab

Find a lab with the capabilities that you need with ISTA's "Find A Lab" search tool on [ISTA.org](https://www.ista.org). A helpful tip: filter the list with Protocol 3L to find a lab that is certified to conduct this test. Additionally, ISTA classifies the testing laboratories we certify in two ways:

**COMMERCIAL:** Labs that have little to no restrictions to their customer base. Generally independent, third-party testing facilities.

**LIMITED:** Labs that have policy restriction regarding their customer base. Generally, suppliers who test only for customers, or product manufacturers with in-house labs.

To arrange for testing services, contact a lab directly. The [» FIND A LAB](#) feature allows you to search geographically and/or by procedure capability.

Many of these labs also offer package design, distribution environment measuring, problem solving and other consulting services.

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## 2. Submit a packaged product

Both products and packages should be as close as possible to actual production items. Pre-production prototypes such as handmade samples, CAD-generated one-of-a-kind or short-run samples, etc. are usually not sufficiently representative of production items to yield meaningful test results. It may be appropriate to conduct preliminary tests of a product and package early in the development cycle, but final official testing should be performed with actual production items. Samples should not have been previously tested or shipped to a test lab without over-packaging or other consideration.

**For fragile items**, five samples are required for this test procedure. Fragile items are defined as items that easily break or could leak during the distribution process. This includes any item containing:

- Glass, ceramic, porcelain or clay
- Liquids, semi-liquids or solids that can become liquid at high temperatures (above 70 degrees Fahrenheit)

**For non-fragile items**, one sample is required for this test procedure.

If the sample is a palletized or a unitized load and this is the intended configuration for shipment to the end consumer, then this is constituted a single packaged product.

TV/monitors are considered non-fragile items. Establishment of a TV/monitor test type reduces test variability and in turn allows for greater repeatability through fewer samples.

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### 3. Submit a packaged product

An ISTA-certified lab will assist in providing a quote for testing services. ISTA-certified labs are independently owned and operated businesses that establish timing and pricing at their own discretion. As such, timing and pricing can vary depending on the business you contact. ISTA has a strong anti-trust policy. We don't get involved in pricing matters.

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### 4. Define pass and fail criteria

These determinations are dependent on the particular product, package, distribution system, market, customers, and other factors and can vary widely. Therefore, product damage and allowable package degradation must be defined by the shipper, manufacturer, damage claim group, and/or other stakeholders and interested parties. In most cases, the shipper/manufacturer is in the best position to define product damage due to detailed familiarity with the product. Sometimes others may contribute to these determinations, including carriers and test lab personnel. But in any case, definition and agreement should be reached cooperatively among all entities concerned with safe arrival of the shipment, low damage rates, cost effective packaging, etc.

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### 5. Receive a report

An ISTA-certified lab will issue a report thoroughly documenting the configuration, materials and construction of the tested product and package as well as the test results, options selected, calculations made and any deviations. Photo documentation should also supplement the detailed written descriptions.



INTERNATIONAL SAFE TRANSIT ASSOCIATION

## CONNECT WITH US



1400 Abbot Road, Suite 380  
East Lansing, MI 48823-1900 USA



[ista.org](http://ista.org)



[+1] 517.333.3437



[ista@ista.org](mailto:ista@ista.org)



[fb.com/ISTAconnect](https://fb.com/ISTAconnect)



[twitter.com/ISTAconnect](https://twitter.com/ISTAconnect)



[linkedin.com/company/ISTAconnect](https://linkedin.com/company/ISTAconnect)