TOP 3 FAILURE MODES DURING DISTRIBUTION TESTING

ERIC LAU, SENIOR TEST ENGINEER

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WESTPAK
EXCELLENCE IN TESTING

WESTPAK, INC. | 83 Great Oaks Blvd. | San Jose, CA 95119 | Phone (408) 224-1300 | www.westpak.com
10326 Roselle St. | San Diego, CA 92121 | Phone (858) 623-8100

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Introduction

Countless hours and significant investment is made in the design and development of a new product. When your new product is finally ready for release to production, how confident are you that it will safely reach your customer and/or installation site without damage?

> "I found Westpak very easy to work with. There were clear lines of communication, and all testing and reporting was completed as committed."
> B.T.

The package system generally cannot be completed until the final product is available; this places significant pressure on the packaging system design team. Package system development is normally an iterative process and takes time to complete. Oftentimes the package development process gets neglected in the schedule altogether or not given sufficient time to complete as the product launch date closes in.

The best way to avoid a possible recall due to product damage during distribution is to subject your packaged product to a series of distribution tests (oftentimes referred to as package performance testing). Here's a primer on the topic and the Top 3 Failure Modes During Distribution Testing we've experienced at WESTPAK.

What is Distribution Testing?

Distribution testing is the practice of providing a consistent and repeatable basis for evaluating, in a laboratory, the ability of products and their packaging systems to withstand the hazards that will be encountered in the distribution (or shipping) environment. Testing is accomplished by subjecting packaged products to a variety of tests such as vibration, impact, compression and altitude extremes. Distribution tests replicate real-world distribution hazards, at the 3 sigma level, that are encountered in all distribution environments.

The optimum protective package system consists of a product (of known ruggedness) and a package which together provide sufficient resistance to damage during distribution without wasteful over-packaging.

Laboratory testing provides repeatability and consistency. When your product or package is redesigned, it can be subjected to the exact same test inputs as its predecessor. This approach provides comparative results giving you the opportunity to choose the best configuration.

Distribution Hazards – Top 3 Failure Modes

> "Quality and professionalism were high and responsiveness was good. The overall commitment to scheduling was also very good."
>
> H.S.

Vibration Hazards

Vibration is unavoidable in any distribution environment. Whether the vibration source is a courier truck, train, airplane, or even a car trunk, there is a 100% chance that your packaged product will be subjected to vibration.

The most typical product/package failure from vibration hazards is the cushion system not being able to properly attenuate (or dampen) the resonances of the product. Using a cushion material that is improperly loaded (weight/area) can cause the product to resonate at higher amplifications, eventually leading to fatigue, reduced reliability, or product failure.

One can determine if this is a potential issue by performing vibration testing in the lab. If the cushion system does not properly attenuate your product's critical frequencies, typically a redesign of the cushion or using a different cushion density can be a simple solution. In more extreme cases the product's design may require improvement; oftentimes this is a more practical and economically feasible approach.

Impact Hazards

A cushion system must also be able to properly absorb mechanical shock during an impact, enough so that the shock level experienced by the product is lower than the fragility of the unit.

The most common impact failure is caused because the incorrect cushion material or static loading was specified for the application; this can lead to physical damage or the product arriving dead on arrival (DOA). Cushioning material that is too stiff is very similar to not having a cushion system at all. However, a cushion that is not stiff enough may result in the cushion system bottoming-out during an impact and the product making contact with the impact surface. Either error in the package system can result in the transfer of impact energy directly to the product that exceeds its fragility limit.

One can easily determine the package system's ability to sustain impacts by subjecting it to a series of impact or drop tests in a controlled laboratory environment.

> "I think you are doing a great job, and I would recommend Westpak to others. You have always had the right equipment in good working order. But the biggest asset, in my opinion, is the staff. Your Test Engineers have always presented themselves in a helpful, friendly manner."
>
> A.H.

Compression Hazards

During distribution the ability to withstand compressive loads during stacking is determined by both the product and the package system working together. As soon as the outer package (or shipper) fails to hold the load, compressive forces are distributed directly onto the product. Ideally the product is able to withstand the subjected loads.

Using a lower cost material such as a recycled material may save money initially, however this typically leads to compression failures as we've seen in laboratory testing.

A compression test can easily determine how much load the package system can sustain and, if it does, how the package may fail in the actual distribution environment.

Conclusion

During the design process, design teams need to be aware of the hazards the product will encounter during distribution. Knowing how to properly design the package to withstand these hazards is as crucial as the product development process.

Conducting laboratory testing provides repeatability and offers the opportunity to compare and evaluate design options. Lab testing can usually be accomplished in less than a day and can fully evaluate the package system's effectiveness. Once problem areas are identified, issues can be resolved with a package or product redesign.

A distribution study will accurately quantify the distribution environment the packaged product will encounter in the transportation cycle. WESTPAK offers vibration, impact, compression, altitude testing plus simulation of other real-world distribution hazards.

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