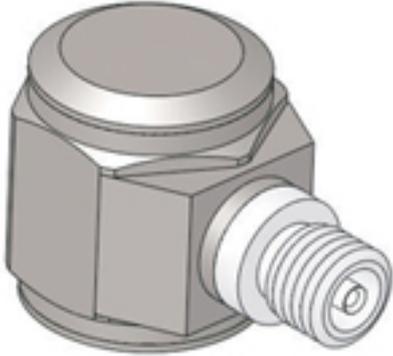


## Piezoelectric Sensing for Product Testing

Dave Change, Dytran Instruments, [www.dytran.com](http://www.dytran.com)



A continuing trend among OEM's and design engineers has been increased reliance upon mechanical impact testing of product prototypes and packaging, as a means of simulating the ruggedness, durability and performance of materials and structures within their intended usage environment. This type of testing is often conducted within third-party test laboratory environments, and helps manufacturers to ensure product reliability and conformance to specific industry testing or regulatory standards.

Equally prevalent is the use of piezoelectric accelerometers to satisfy application requirements. These types of sensors allow an engineer to collect the necessary real-time data to make smart design modifications at the prototype stage, ultimately saving manufacturing time and cost, and improving the durability of product and packaging designs. The unique benefits of piezoelectric sensors,



versus other types is their overall versatility, high reliability and flexibility, in terms of size, shape, sensitivity, measurement range, operating temperature range and mounting configurations. Especially when testing smaller structures, selected accelerometers and cables must be miniature enough to fit into space constrained environments. They must also be lightweight, to minimize mass loading of the test structure, a phenomenon which could affect overall measurement accuracy and stability. Use of both IEPE and charge mode piezoelectric accelerometers for this type of testing encompasses a wide range of markets and environments, from package testing, to portable electronic devices, and aircraft landing gear assemblies. Just a few examples of typical mechanical impact testing applications incorporating the use of piezoelectric accelerometers include:

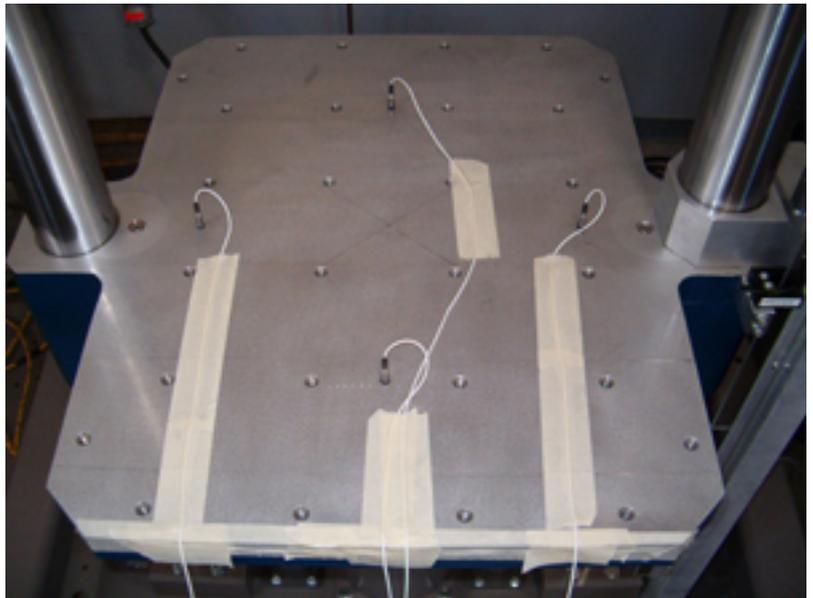
### **Product and Package Structural Integrity Testing/Stress Screening**

In these applications, piezoelectric accelerometers are used with servo hydraulic vibration test systems, drop testers, compression testers and shakers to assess whether product packaging is rugged enough to withstand repeated effects of potential shock and vibration within its intended usage environment, as well as under compressive load conditions to which they may be subjected, during shipping and transport of the product itself.

## Piezoelectric Sensing for Product Testing

Published on Electronic Component News (<http://www.ecnmag.com>)

---



Overall product performance, as well as packaging, can be affected by dropping, crushing, or adding of external force or weight. The ability of both manufacturer and transport entity to preserve product performance characteristics in shipment and transit is a major goal of package integrity testing.

The application environment of such testing is typically a laboratory environment. The article under test is typically a sample product enclosed in a prototype package. Accelerometers are mounted to the actual packaged product, typically as close to the center of gravity as possible. Test engineers will then measure acceleration and time histories, SRS and FFT's. Displacement measurements may also be used to assist with deflection estimates during dynamic events, such as impact and vibration. In this testing environment, accelerometers and cables must be small, lightweight, reliable and rugged. Depending on the application, they may also need to withstand thermal cycling environments.

For packaging integrity testing applications where temperature is not a concern, use of miniature, IEPE-type piezoelectric sensors is recommended. The Dytran model 3225F1, for example, offers 10 mV/g sensitivity and a 500 g measurement range. Weighing just 0.6 g, the sensor incorporates a small, lightweight removable cable and offers adhesive mounting capabilities. With these characteristics, the sensors can be mounted on a variety of space constrained areas of the test structure, while minimizing the effects of mass loading, making them ideal for package integrity testing applications, as well as environmental stress screening and PC board vibration response testing.

For product testing applications where a slightly larger accelerometer with high sensitivity is desired, a miniature IEPE-type piezoelectric accelerometer is available which offers 50 mV/g sensitivity and 100 g range, with side connector and adhesive mounting. This accelerometer also features corrosion resistant, stainless steel housing, and weighs just 2.5 g, making it suitable for use in product structural testing and environmental stress screening of packaging. For product and package testing applications where thermal cycling is a key component, use of a low-profile charge mode piezoelectric accelerometer is recommended. Within these examples, sensor size remains the most critical factor.



### **Small Appliance and Portable Electronic Device Testing/Environmental Stress Screening**

Overall product durability and performance are critical testing elements for the successful market launch of sensitive portable electronic devices, home appliances and other consumer products. The goal of this type of product design prototype testing is to determine whether these products will be able to perform as specified over the duration of their intended useful life under actual customer use, as well as to assess effects on the product of short-duration high level mechanical shock and vibration inputs introduced by accidental dropping or shaking. Electronic device manufacturers often opt for environmental stress screening (ESS), which places a new product or component under thermal cycling and vibration, to attempt to determine the components most likely fail within a product design, and assess the underlying conditions surrounding that failure.

Like product and packaging integrity testing, the application environment is typically also a testing lab, with a sample prototype product as the test article. Testing methods can include use of compression testing, drop testers and shock tests. Among the most common, shock tests are used to accurately measure the fragility of products, evaluating how they respond when subjected to a particular shock input. Shock test data is key information necessary to ensure any product is capable of withstanding its intended "real world" use. Product tests are performed to provide input and response data in the form of acceleration, strain, vibration

## Piezoelectric Sensing for Product Testing

Published on Electronic Component News (<http://www.ecnmag.com>)

---

response characteristics and various shock response spectra.

For sensitive electronic device applications, use of an extremely miniature piezoelectric accelerometer is required, typically one weighing a little as one gram or less, which can be installed into the delicate internal structure of PC boards, laptop computers and computer disk drives and mobile phones. This application requirement is especially critical, as adding mass to the test article can potentially damage delicate internal electronic components and assemblies. The accelerometer must offer high sensitivity, be rugged enough to withstand high levels of shock and vibration inputs and have flexibility in mounting options. In consumer products and home appliance testing, where a larger accelerometer can be used, miniature sensors are available with a rugged stainless housing, mass down to 2.5 g, along with 10 mV/g sensitivity and 50 g measurement range. Such sensors may be used just as effectively within a general product testing environments, as they can for the critical testing of aircraft landing gear assemblies for commercial aviation manufacturers.

In aircraft landing gear impact testing, assemblies and their related components, including shock absorbers and aircraft tires, are able to handle the severe shock and vibration inputs and higher temperature conditions of a typical aircraft landing condition, in compliance with to FAA and other industry safety and performance standards. One example of a solution that addresses these requirements is a teardrop shaped charge mode accelerometer offering a compact design and 316L stainless steel housing, weighing 4 g with a through hole mounting configuration and high temperature operation to 500°F

So, what lies in the future of sensing technologies for these application environments? As OEMs begin to come out of recession, emphasis on major product launches with mitigated risk and streamlined manufacturing costs will continue to drive the need for this type of testing. In terms of technologies, reliance upon piezoelectric accelerometers to satisfy application requirements continues, with demand for continued miniaturization, higher sensitivities and higher temperature performance. As these testing and technology trends continue, Dytran Instruments will continue to introduce products that support these needs, offering value, flexibility, cost-effective customization and specials, and speed to market with new products.

Dave Change is Technical Director, Dytran Instruments. For more information, contact Dytran Instruments Incorporated, 21592 Marilla St., Chatsworth, CA 91311; (818) 700-7818; [www.dytran.com](http://www.dytran.com) [1]

**Source URL (retrieved on 04/02/2015 - 12:26am):**

<http://www.ecnmag.com/articles/2010/06/piezoelectric-sensing-product-testing>

### Links:

[1] <http://www.dytran.com>