Cincinnati Sub-Zero

How to Prepare for Shock, Mechanical Vibration Testing

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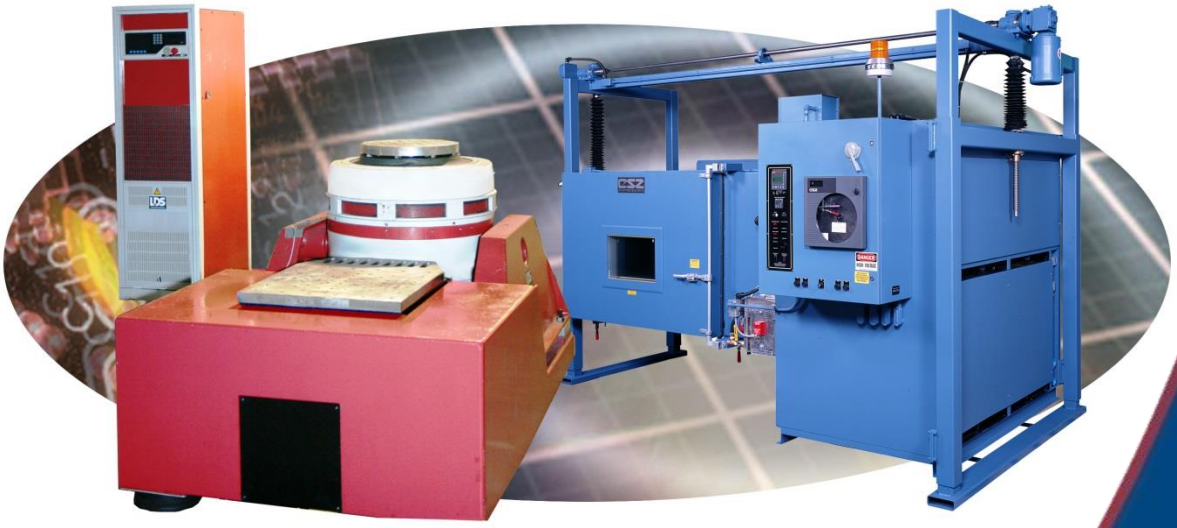

A key element of the new product development cycle for companies in the automotive, military, medical device, and electronics industries is shock and mechanical vibration testing. For unbiased collection of data about how a prototype will ultimately perform in its future application, as well as to determine lifespan and point of failure, it is crucial to select the third-party testing service provider whose expertise, equipment, and testing procedures are best suited to meet your needs.

Here are six questions to ask when evaluating and comparing potential shock and mechanical vibration testing providers.

1. What is your product?

Your testing laboratory will need to know the specifics of your prototype: the number of samples to be tested, their dimensional size, weight, and any specifications unique to the product (such as material composition, structure, and construction). It's important to also consider the environment in which the tested product will ultimately be used. Detailing the anticipated types of stresses will help your testing laboratory determine the types of mechanical vibration and shock testing methodologies to employ in simulating actual use, as well as any extremes. Often overlooked—but critically important to yield the most accurate data—is the need to use the actual fixturing that will ultimately be employed to secure the prototype during testing. Always provide the testing laboratory with any supporting or integral components that will be associated with the item. If those pieces are not available, be sure that the testing facility has the means to reproduce those fixturing items as closely as possible to the relevant specifications so they can best replicate the application.

2. What is your testing timeframe?

Depending on the parameters of your testing needs, the timeframe to respond to your request for quotation (RFQ), to setup for your test, and to conduct the actual testing process will vary. Variables include the specification standard(s) your prototype is being tested to, the number of samples being tested (either simultaneously or in sequence), and the number of setups required. If your testing company operates more than one laboratory, your wait time may be reduced. Another way to save time is to invest in a face-to-face meeting to discuss your testing needs and parameters, if possible. Although it is extremely helpful for your testing provider to receive a written document detailing your requirements, a sit down discussion can often result in both time and cost savings.

3. **What are your test specifications?**

Depending on your industry and your prototype's application, there are a multitude of commercial, automotive, medical, and military mechanical shock and vibration standards—as well as a broad range of customer-defined test specifications—that your testing provider can implement. The most common vibration and mechanical shock testing capabilities include random, sinusoidal, mixed mode, transportation, packaging, and gunfire. Inquire about your facility's vibration testing capabilities—including force output, axes, displacement, velocity,

acceleration (sinusoidal and random), and frequency range—to ensure that they can generate the simulation that will produce the most relevant results to your needs. Although certain facilities, including ours, can induce mechanical shocks up to 100Gs and random vibration up to 45Gs, the equipment itself may have some limitations, such as the maximum weight of the item to be tested. Inquire about your service provider's testing chamber capabilities. Further, depending on your testing lab's abilities, additional parameters can be applied In conjunction with your mechanical shock and vibration testing specifications. A properly-equipped facility can add extreme temperatures (either gradually or rapidly to simulate thermal shock), force, humidity, corrosion, and salt spray conditions to your testing process as required by the test specifications. A sampling of such test specifications is included below.

Sampling of Test Specifications Involving Mechanical Shock and Vibration

Specifications	Title	Types of Products
AKLV-03	Airbag Systems, Mechanical Shock, Temperature, Humidity, Thermal Shock, Altitude	Airbag Inflators
EN98003	Heat Age, Thermal Shock Humidity, Temperature & Mechanical Shock	Airbag Inflators
EN980058	High Temperature Storage, Thermal Shock and Humidity, Random Vibration	Airbag Inflators
ASTM D 775-80	Drop Test for Loaded Boxes	Any Products shipped, Picture Frames, Phones, Radios
ASTM D 999-86	Vibration Testing of Shipping Containers	Shipping Containers
ASTM D 4728	Random Vibration Testing of Shipping Containers	Shipping Containers
CEI/IEC 68 Series	Vibration, Thermal Shock, Shock, Bump	Medical Products Commercial and Military
CEI/IEC 61373	Rolling Stock Equipment Shock & Vibration Tests	
CEI/IEC 60068-2-6	Environmental Testing: Vibration Test; 5th & 6th Editions	
CEI/IEC 60068-2-27	Environmental Test: Shock Test	
CEI/IEC 60068-2-29	Environmental Testing: Bump Test	
CEI/IEC 60068-2-34	Environmental Testing: Random Vibration	
CEI/IEC 60068-2-36	Environmental Testing: Random Vibration	
CEI/IEC 60068-2-64	Environmental Testing: Vibration Testing	
GM-CM20217	Thermal Shock, Salt Spray, Vibration Heat Resistance, Steering Wheel Specification	

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Specifications	Title	Types of Products
GM-CM20221	Thermal Shock, Salt Spray, Vibration Heat Resistance, Steering Wheel Specification	Steering Wheels DAB & PAB
GMW3118GS-5-2-V-1	Thermal Shock, Temperature/Humidity, Shock/Vibration, Drop, Salt Fog Test	PAB, DAB, Steering Wheels, Roofrails
Japanese Industrial Std. JIS D 1601	Vibration, Impact and Water Resistance Tests	Speakers, Electronics
MIL-STD-810C	Temperature/Humidity, Vibration, Altitude, and Salt	
MIL-STD-810D	Temperature/Humidity, Vibration, Altitude, and Salt	
MIL-STD-810E	Temperature/Humidity, Vibration, Altitude, and Salt	
MIL-STD-810F	Temperature/Humidity, Vibration, Altitude, and Salt	
MIL-STD-810G	Temperature/Humidity, Vibration, Altitude, and Salt	Display Panel, Controller
MIL-STD-167-1	Mechanical Vibrations	
MIL-STD-901C	Shock Test H.I.	
MIL-STD-1344-A	Method 2004.1 Shock SP. Pulse	
RTCA/DO 160	Vibration, Humidity, Shocks, Crash Safety, Salt Spray	Commercial, Military
SAE USCAR-24	Inflator Technical Requirements and Validation	Airbag Inflators

4. What types of data do you expect the testing to generate?
Be clear about the types of data you intend the mechanical shock and vibration testing to generate. The majority of prototype testing is designed to reveal the durability of the sample(s), the maximum stress levels that can be withstood until failure, temperature limitations, anticipated life cycle, and the ability of the product to function post-testing. Upon the conclusion of the test, your testing laboratory should provide you with a certificate of testing, log of the testing performed, documented issues (along with details called out in specification), list of the equipment used, and the equipment's calibration dates.

5. Where is the testing laboratory located?
Because of the time and expense associated with travel, the geographic proximity of a testing laboratory to your facility should be considered. Many prototypes are accompanied by a company representative, such as a design engineer, who witnesses the testing procedures, as well as gathers additional information during the testing process. A reputable testing provider should not have an issue with your presence, or with your desire to use your own instrumentation to monitor your prototype while it is being exposed to vibration or shock.

6. Is the testing laboratory accredited?
To confirm the accuracy of the work your testing laboratory will perform, inquire as to their number of years in the field, their equipment calibration records, and their maintenance policies. Further, determine if they are an A2LA Accredited Test Laboratory. This nonprofit, non-governmental membership society provides laboratory accreditation based on internationally accepted criteria (ISO/IEC 17025:2005) to determine a lab's technical competence. Using an A2LA Accredited laboratory ensures that the testing, calibration, and measurement data you receive is both accurate and reliable.

About the Author
William E. Jackson has spent 30 years in the product testing industry and the last 18 years as the operations laboratory manager of CSZ Testing Services' facility in Cincinnati, Ohio. CSZ Testing Services Inc. is a leading environmental test laboratory located in the Cincinnati, OH and Detroit, MI area. The company offers high quality environmental, corrosion, climatic, HALT and HASS, and shock and vibration testing services.