

Intertek

ETL SEMKO

FMVT[®] MACHINE

Accelerated Test Equipment for Electro-Mechanical Products



Bringing highly reliable products to market faster and with lower development costs – this is a goal of every product development group.

A patented method of accelerated stress testing from Intertek ETL SEMKO, **Failure Mode Verification Testing**, can do all of the above. And while **FMVT®** has been proven to effectively cut testing time and costs in the short-term, it can also result in higher quality components, parts and systems; with huge overall costs savings in the long run, i.e., lower warranty claims – more satisfied customers.

What is FMVT®?

Failure Mode Verification Testing (FMVT®) is a patented ETL SEMKO process which employs highly accelerated test methods in a manner intended to reveal inherent design weaknesses. The process utilizes known sources of “stress” which are amplified to magnitudes that are limited by “reasonable” failure modes. A reasonable failure mode may be defined as a failure which could conceivably occur throughout the life of a product. Typical stress sources include: 6-degree of freedom (DOF) vibration (broad frequency range and uniform frequency distribution), temperature, humidity, voltage variation, contamination, UV or solar light, and dynamic loading. Through a product review process, the exact stress sources and conditions would be determined and reviewed with the client prior to initiating the test. By exposing a design to a combined set of amplified environments/stresses, multiple failure modes (and their sequence and distribution) are produced; a full test typically takes 3 to 5 days.

Traditional reliability testing only tells the developer whether the product “passed” a certain set of conditions, but nothing else. FMVT testing uncovers the hidden flaws in a product and exposes them to the developer – then they can be corrected and the product improved.

Advantages of the FMVT® Process

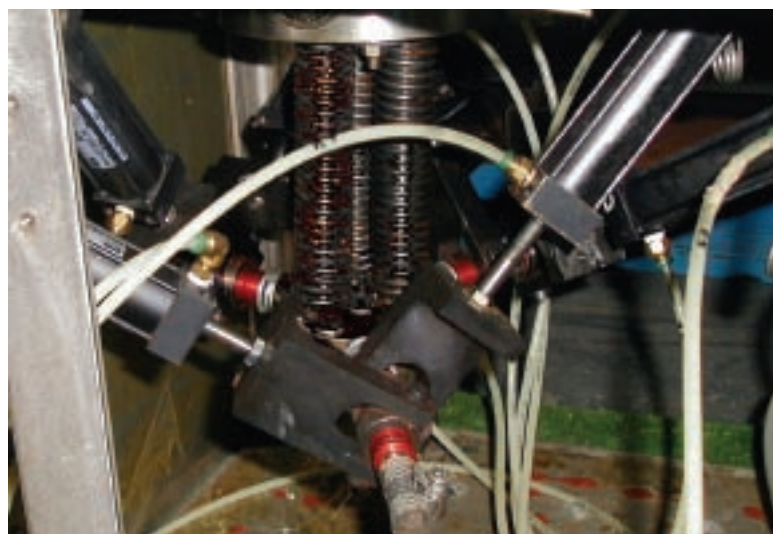
- Identifies real failure modes and their root causes.
- Assists in increasing product quality by exposing failure modes that may not be detected in traditional testing.
- Reduces development time by identifying failure modes during the design verification stage.
- Reduces testing time and costs. FMVT® allows for earlier and fewer full system tests.
- Reduces number of required prototypes for testing.

The “Heart” of the FMVT® Process

Vibration is often used in FMVT as a source of mechanical energy input. Since the FMVT method requires an input of increasing levels of all stress sources, vibration levels must be intensified throughout the testing. Strain, and damage accumulation occurs much faster when the applied vibration frequency activates the natural frequency of the product or its components. The application of failure mode testing to electro-mechanical devices such as hard drives, cell phones and larger assemblies has engendered a need for lower frequency vibrations. Therefore, the FMVT machine is designed to cover a wide range of frequencies with significant energy input – much greater than any other vibration source.

FMVT Machine Characteristics

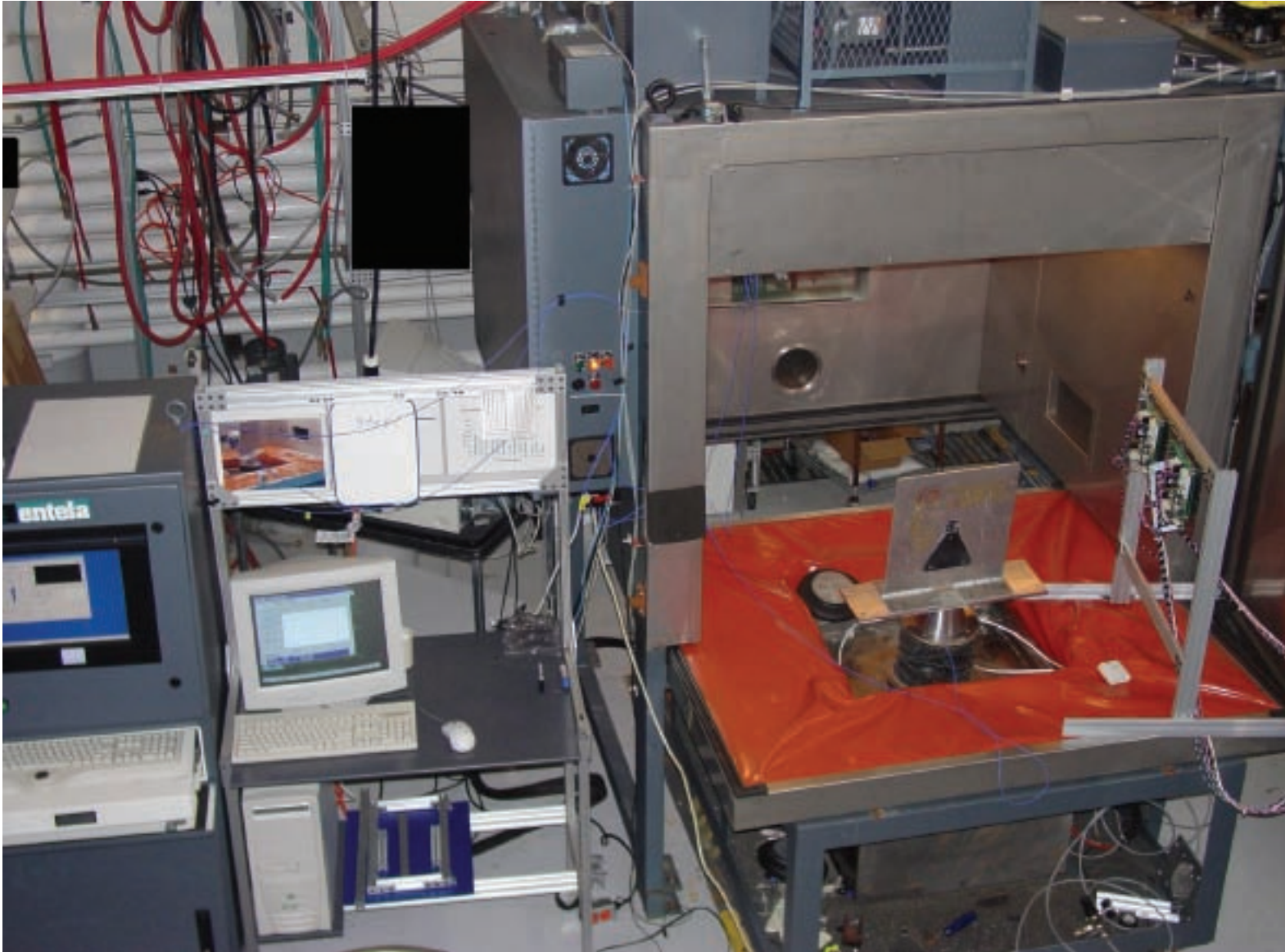
Patented six (6) degrees of freedom vibration machine designed to produce three (3) translation and three (3) rotation degrees of motion with a Random vibration range from ~2 Hz to ~2500 Hz, and up to 4 inches of displacement at the lower frequencies, at a maximum of 60 G's. Proprietary software and control system allows the user to select peak g, gRMS, or displacement and record and repeat the test profile.



FMVT Random Vibration Generator - Six-axis vibration (three translations, three rotations) is imparted to the test object through a central shaft.

Example of an FMVT® Installation

The following photo shows an installation of an FMVT machine in a client's product testing laboratory. This specific client manufactures consumer and industrial products, ones that are widely varied in size and complexity. The manufacturer uses his FMVT facility to help in product development efforts, in warranty chases and in production control. Other features of this installation are shown in the photos labeled “FMVT Options”.



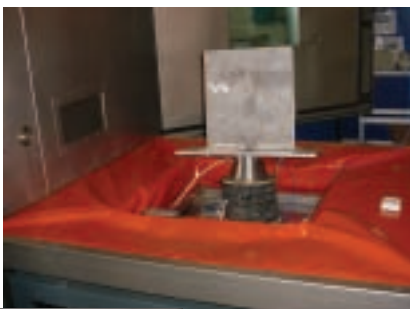
FMVT Machine installed under a flexible rubber dam, on a sliding track that moves the test unit and FMVT machine into the environmental chamber. The programmable FMVT and chamber controllers are on the left of this photo. The chamber is equipped with an LN₂ facility for fast cooling, a rapid heat exchanger for fast heating, and water vapor injector system for humidity control. The overall system is also equipped with a programmable power supply for electrical stress on the test products, plus thermocouples, accelerometers and strain gages for process control.

FMVT Options



Air Supply System ▲

Floating Rubber Dam ▼



Air Filter ▶



Humidity Supply ▶

Electrical Power Supply Controller ▶



FMVT Costs*

The following is a list of BUDGETARY costs and suggestions for optional auxiliary equipment. Intertek ETL SEMKO only manufactures and warrants the FMVT machine. However, because Intertek ETL SEMKO is a service oriented testing firm, we have a wide range of experience with specifying and installing equipment in our own laboratories and in client laboratories to which we have provided consultation, management and/or staffing.

FMVT systems can be supplied “Turn Key” or with Intertek providing only the FMVT machine plus consultation services.

- 1) FMVT Machine – \$160,000
- 2) Warranty: 90 Days or 1000 hours of operation, covers parts, labor (US Only) and Travel due to defective parts, material or workmanship. 1 Year or 1000 Hours of Operation - covers defective parts, material or workmanship.
- 3) Initial Machine Operational Training - 40 hours of training at an Intertek facility (Grand Rapids, MI or Livonia, MI) is required upon purchase of the machine – \$4,000 - Included in the cost of the machine.
- 4) Initial Machine Setup & Checkout - 24 hours of on-site support for setup and checkout of the machine - Included in the cost of the machine.
- 5) Two (2) year Consulting Agreement - includes annual on-site training of company personnel, machine checkup & repair – \$20,000.

Auxiliary Equipment (non-Intertek)

(Estimated Costs)

- 1) Agree Style Environmental Chamber (~54" X 54" X 40") with double doors, rubber dam, sliding rail system, water vapor injector system, programmable controller – \$55,000
- 2) Water Heater/Chiller – \$5,000
- 3) LN₂ Storage & feed facility – \$10,000
- 4) Air Compressor and Refrigerated Dryer 10 HP, 35 SCFM – \$7,000
- 5) California Instruments AC/DC Programmable Power Supply – \$12,000.

Laboratory Utilities:

- 1) Compressed Air - Instrument Grade (-30°C dew point, oil-free, and < 3 micron particulate filtration) Two air drops - Pilot Air (3/8 NPT) Main Pneumatic Control (1/2 NPT). Total air 30 scfm at 150 psi
- 2) Electric - 16 Amps, 120 Vac, 60 Hz, Independently Grounded. 13A - Full load amps.
- 3) Water and drain

*Prices subject to change

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