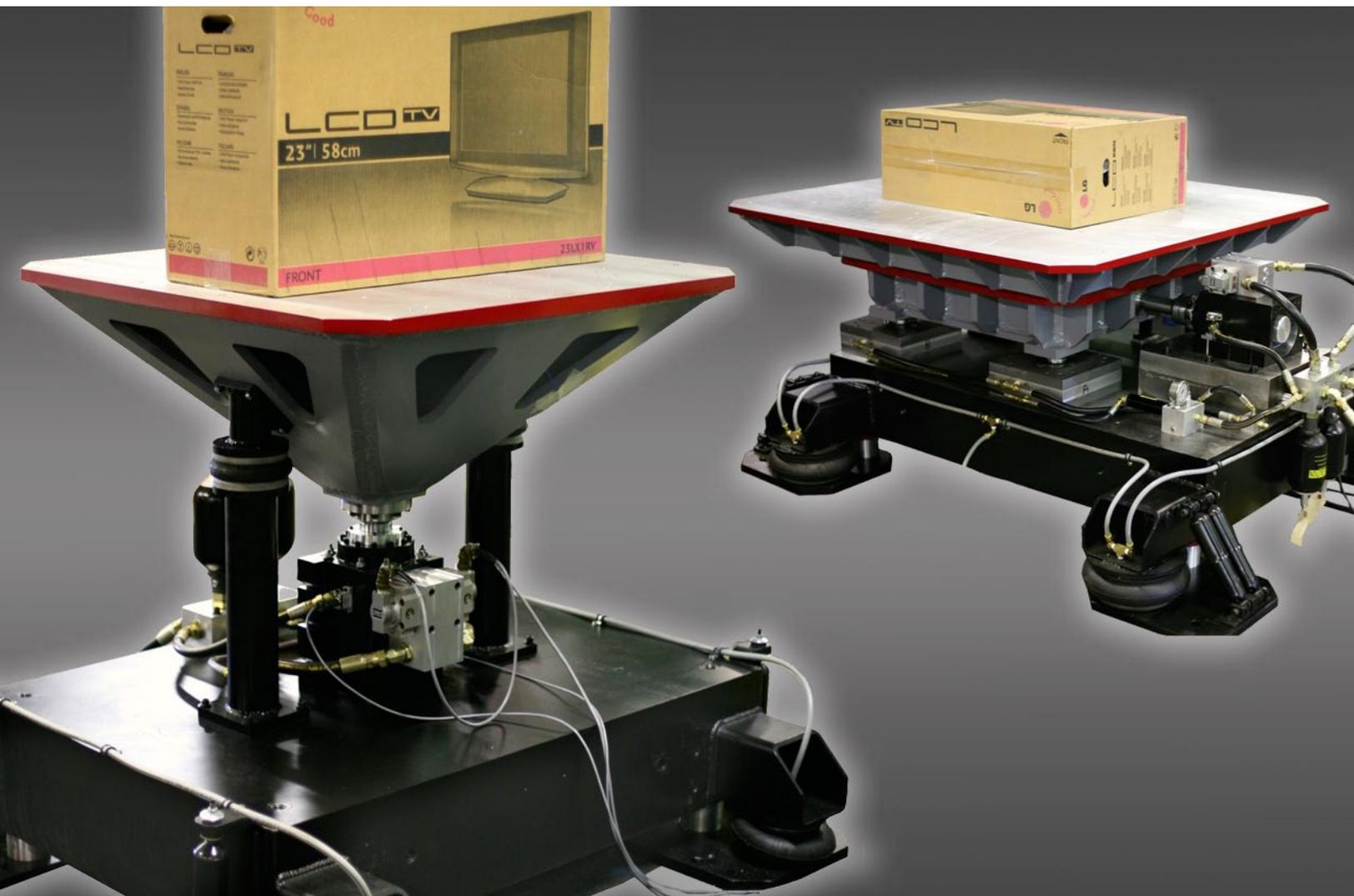


## HV Series™ Test Systems | Hydraulic Vibration



# Experience. Technology. Value.

# The Difference. HV Series™.

**The Difference.** Our philosophy is simple. Provide a system designed for optimum performance and ensure the highest degree of confidence.

for more details on our hydraulic vibration systems, visit  
[www.labequipment.com/hvseries.html](http://www.labequipment.com/hvseries.html)



### Accumulator Assembly

Pressurized gas bladders help provide a constant and smooth supply of fluid to the actuator.



### Hi-Performance Tables

Aluminum alloy or magnesium table weldments provide the most rigid tables for higher frequency testing and superior uniformity, unmatched in the industry.

### 1-G Supports (as needed)

Reduces load on actuator by 1g of acceleration. Also provides anti-rotation of table during operation. Not used on smaller tables.

### Hydrostatic Bearing Actuator

State-of-the-art hydrostatic bearing actuators are self-centering, with no piston rings or hi-pressure seals providing long-life with little maintenance. This means unsurpassed control & balance for off-centered loads.

### Servo Valve

We use industry standard valves to regulate how much (displacement) and how fast (frequency) high pressure fluid needs to flow through the actuator.

### Reaction Mass

Solid steel mass mounted on a damped air-mount suspension provides highest possible system stability and minimal velocity loss at low frequencies.

### Air Bag Isolators System

Isolates vibration between the system and your foundation during operation.

**3 Year  
actuator  
warranty**



\*included but not pictured are hydraulic power supply and control system

**Performance  
down to  
1Hz**

**Performance  
up to  
500Hz**

## test types

With the HV Series you can perform sine, random, resonance search and dwell, sine-on-random, random-on-random, Kurtosion™ and classical shock type tests.

## field data

Play back your field data recorders in real-time or convert them to power spectral density (PSD) curves with the HV Series™. Either way, we make it simple for you to get the most out of the data you've collected.

# System Selection

**Answer These Questions First** - There are many types of vibration systems to choose from: mechanical (fixed or manually adjusted displacement), electro-dynamic, and servo-hydraulic. These are some of the more commonly used systems for package or product reliability testing. Answer the questions below and you will quickly realize which system is right for you.

## size & weight?

This will determine how large of a vibration table will be needed, as well as determine the force needed to move both the table and your test item. Typically electro-dynamic systems have limitations on how large and heavy your test item can be, so a servo-hydraulic system would be better suited for larger, heavier payloads.

## sine and random?

Sine (also known as sinusoidal) as it pertains to vibration testing, is a repeating motion with a measureable amplitude and frequency, typically used for determining resonant frequencies in a product or package. It is also used for low frequency repetitive-shock testing. Mechanical systems can typically vary the frequency throughout some range, but are limited to a fixed amplitude. Servo-hydraulic systems have the ability to vary both amplitude and frequency at the same time (or acceleration (g) - the result of a given frequency and displacement).

Random vibration is simply that; random. It is a constantly changing vibration, and best described in a power spectral density (PSD) curve. A PSD plot presents random vibration as an average intensity. Random vibration is desirable for package testing because this type of motion occurs in the real world. Servo-hydraulics can perform both sine and random, where mechanical systems are limited to sine only.

## frequency range?

Many vibration studies have shown that most ground transportation environments present vibration frequencies between 1-200Hz, with air transportation environments presenting frequencies between 1-300Hz. If you're performing sine sweep for resonance testing, 1-200Hz is typical, but some may go out to 500Hz. In all cases you should refer to the testing standards required by your customer. In many cases a reference will be made to a test organization such as ISTA, ASTM, ISO etc. They will spell out the test frequencies for both sine and random when applicable. Electro-dynamic systems typically are unable to provide vibration frequencies below 5Hz, where the greatest displacement occurs, so servo-hydraulics are the ideal choice to meet the low frequency requirements of the various transportation environments.

## acceleration levels?

Acceleration is the change in velocity over a period of time. In simpler terms, acceleration will be determined by the amount of movement (displacement) and speed (frequency) of your test item. In vibration testing, acceleration is measured in units of (g) for sine, and (g)rms for random vibration. In vibration testing, it is the combination of the required acceleration and the total moving weight that determines what force the actuator will need to be. The basic formula for determining force is:  $F=MA$ , where M is the mass and A is acceleration.

**How To Size the Right System** - Once you've decided on a servo-hydraulic vibration system, the next step is to determine the right size system for your testing needs. Now, and in the future. L.A.B will ensure you have the right system and be within your budget.

## table size & performance

We start with the size of your largest test item. The table must be physically large enough to hold your test item and must have sufficient performance (frequency range) to meet your test requirements. In most cases the table construction is an aluminum weldment, but when more rigid tables are needed for increased performance, magnesium will be used. The combined weight of the table and test item are used in determining the size of the reaction mass and force actuator.

## hydraulic power supply (hps)

The hydraulic power supply is what feeds high pressure hydraulic fluid to the actuator (via the servo-valve) forcing it to move. The power supply must provide sufficient pressure and flow to the servo-valve to meet the demand of your test requirements. Since the flow is regulated and limited by the flow rating of the servo-valve, the power supply flow rating will typically be sized at or below the servo-valve rating, but never below the highest flow requirements of your test.

## force actuator

The actuator is what moves the table and subsequently your test item on the table. The actuator is driven by hydraulic fluid and must be sized correctly to handle the weight of both the table and test item at the acceleration (g) needed to meet your test requirement. Both sine and random acceleration levels must be considered when sizing. The actuator is rated in "pounds or kilograms of force", and can be listed as static or dynamic force (dynamic = 66% of static). The actuator also contains a stroke rating (displacement), typically 4 or 6 inches peak-to-peak (p-p). The maximum p-p stroke is determined by finding the highest acceleration (g) at the lowest frequency of your test requirement.

## control system

A basic control scheme consists of 2 accelerometers (one for table control and one for the test item), a vibration controller and a servo controller. The basic control process starts with a demand generated by the vibration controller (your test profile), comparing it against the table accelerometer feedback (current status), then sending a signal to the servo-valve controller (the adjusted demand), controlling the servo-valve movement. This is an instantaneous closed-loop control process. The vibration controller is at the heart of the system, where sine and random test profiles are created and the "demand vs. actual" control takes place.

## servo-valve

The servo-valve directs the flow of high pressure hydraulic fluid to both ends of the actuator in alternating sequence forcing the actuator to move. The amount of flow and duration determines the displacement and frequency at which the actuator moves. The servo-valve type and size is based on the flow requirements of the actuator (larger actuators have greater flow area) and frequency needed by your test requirements.

## reaction mass

The reaction mass is the anchor of the HV Series system providing the necessary support and stabilization for the system during testing. The reaction mass weight should typically be 2-3 times the combined weight of the table and test item to provide adequate support. In cases of very tall test items with a higher center of gravity, heavier reaction masses will be necessary.

## random vibration, power spectral density (psd), and kurtosis?

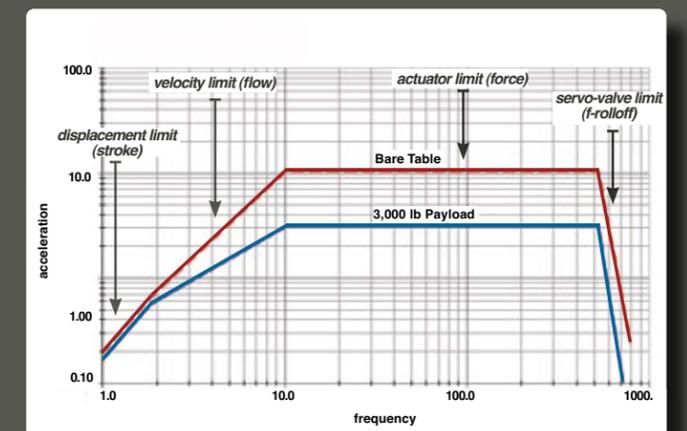
Random vibration in simplest terms is a motion which is non-deterministic, meaning that future behavior cannot be precisely predicted. One can describe any mode of transportation as random. Random vibration can be characterized by taking acceleration (g) measurements and plotting them against frequency. Furthermore, you can simulate and accelerate those measurements in the laboratory with a hydraulic vibration system. A Power Spectral Density curve represents the average intensity at each critical frequency. By testing to a PSD profile, you are exposing your test item to continuous average intensities, thus providing an "accelerated" test.

Kurtosis can take random testing to the next level. Kurtosis provides users with a means of performing random tests that have more severe amplitude distributions than a normal random control distribution. This provides a better simulation to what is measured in actual product environments. In simple terms kurtosis control allows your product to spend more time at the more severe amplitudes of a given random vibration test. Kurtosis control can be "dialed" to higher or lower levels and is available as an option with our vibration control package.

## performance curves tell the whole story

A sine performance curve is the best way to express the overall performance of a given hydraulic vibration system. It illustrates the combined result of the selected components.

To determine if a system fits your needs, you must plot your acceleration and frequency requirement. If it falls underneath the curve, the system is sized correctly.



# System Components

## Hi-Performance Tables

- Computer aided design utilizing Finite Element Analysis (FEA)
- Up to 500Hz performance
- Large variety of table sizes to choose from
- High strength aluminum alloy or magnesium
- Advanced weldment and stress relieved
- Uniform vibration across entire surface
- Mounting threaded inserts included, various sizes and patterns available



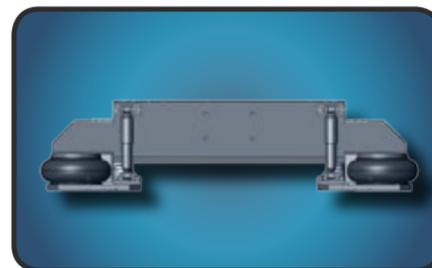
## Hydrostatic Bearing Actuator

- 4-inch (102mm) stroke standard/6-inch (152mm) optional
- High force, large diameter piston
- High static load capability with no metal-to-metal contact
- Pressurized oil bearings with no inherent friction ensures high accuracy
- No piston rings or high pressure seals means little to no wear
- Requires less maintenance and longer lasting than competitors actuators



## Reaction Mass

- Solid steel mass mounted on an air-mount suspension
- Isolates vibration forces from surrounding structures
- Minimized floor loading so system can be used on commercial grade floor
- Optimal size reduces system velocity-loss meaning a smaller hydraulic power supply can be used
- Extended corner plates provide added stability and easy-access during installation



## Hydraulic Power Supply (HPS)

- Provides water cooled, filtered, high pressure oil to servo-actuator
- Soft-start provides long life and reliability
- Sized according to need, up to 120HP
- Filter, temperature and low level safeties built-in
- Remote control of HPS permits it to be isolated at long distances
- Back-up visual temperature and level gauge included
- Uses standard DTE-25 grade hydraulic fluid



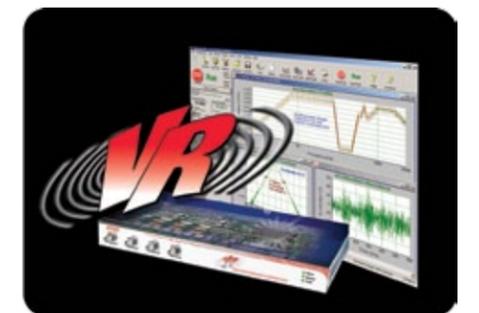
## Servo-Valve

- Two-stage or three-stage high performance valves
- Nozzle-flapper design with mechanical feedback
- One or two valve configurations depending on performance needs
- Up to 500Hz, high flow capability
- 3000 psi operating pressure
- Internal filtration



## Vibration, Servo Controllers

- Open architecture means flexibility in using any vibration controller that fits your needs
- As low as 1Hz control to meet ISTA and ASTM random test profiles
- Vibration controller operates with off-the-shelf PC
- Available in 2, 4, 8 or 16 channel configurations
- Includes sine and random testing as standard; resonance search and dwell, sine-on-random, random-on-random, classic shock, field data replication, and kurtosis control optional
- Intuitive graphical interface with custom reporting



## optional features

- Stacking fences to prevent test items from sliding off table
- Additional channels for monitoring product or package
- Increased system performance (table, force or frequency)
- Software control modules such as Field Data Replication to play back recorded field data back in real-time

## technical service/support

- Traceable calibration services
- Preventive maintenance agreements to keep your equipment like-new
- Extended warranties available
- On-site operator training included
- Laboratory certification services
- Local service in all major markets
- 1 year free software updates/additional software maintenance optional

# HV Series System Specifications

Models start with table size and then configured to meet your test requirements. Typical maximum payload weight for any system below is 5,000lbs (2,268Kg).

## Vertical Table Sizes

- 24 x 24 inches (610 x 610mm) - **24**
- 36 x 36 inches (914 x 914mm) - **36**
- 48 x 48 inches (1.2 x 1.2M) - **48**
- 60 x 60 inches (1.5 x 1.5M) - **60**
- 72 x 72 inches (1.8 x 1.8M) - **72**
- 84 x 84 inches (2.1 x 2.1M) - **84**
- 88 x 60 inches (2.2 x 1.5M) - **88**
- 160 x 90 inches (4.0 x 2.3M) - **160**

Model

**HV-xx**

## Horizontal Table Sizes

- 39 x 39 inches (1.0 x 1.0M) - **39**
- 60 x 60 inches (1.5 x 1.5M) - **60**

Model

**HVH-xx**

<b>Reaction Mass*</b>	3,000lbs (1,360Kg) to 30,000lbs (13,600Kg)
<b>Hydrostatic Bearing Actuator*</b>	<i>Static:</i> 3,000 f-lbs (1,500 f-kg) to 30,000 f-lbs (15,000 f-kg) <i>Dynamic:</i> 1,800 f-lbs (1,500 f-kg) to 18,000 f-lbs (15,000 f-kg)
<b>1-G Supports</b>	On 48 inch (1.2m) tables or higher, as required
<b>Maximum Stroke</b>	4 inch (102mm) standard, <b>6 inch (152mm) plus optional</b>
<b>Frequency Range</b>	1-300Hz standard on tables up to 60 inches (1.5M), <b>500Hz optional</b> 1-200Hz standard on tables 72 inches (1.8M) to 160 inches (4.0M)
<b>Servo Valve Flow*</b>	5 gpm (19 lpm) to 50 gpm (190 lpm)
<b>Vibration Controller</b>	DSP-based, 24-bit, 120 dB dynamic range, built-in TEDS, 13,000 lines of random
<b>Servo Controller</b>	+/-100mA output current, -5dB @16kHz frequency response, <0.01% @2000Hz distortion
<b>Hydraulic Power Supply*</b>	7.5HP (3 gpm/11 lpm flow) to 120HP (60 gpm/227 lpm flow)

\*denotes range of selection to choose from.

## UTILITIES

<b>Electrical</b>	Hydraulic Power Supply: 380V/3Ph/50Hz or 460V/3Ph/60Hz (amperage based on horse-power size) Vibration & Servo Controllers: 115V/1Ph/60Hz or 220V/1Ph/50Hz
<b>Compressed Air</b>	80-100psi (550-690kPa), filtered and regulated, for air bag isolators and 1-G support (where applicable).
<b>Tap Water</b>	30-60psi (205-415kPa), filtered and regulated, for cooling hydraulic power supply. Alternate oil-coolers are available upon request.

### Included with each system:

- Pre-installation documentation when order is placed
- Full set of electronic & hard copy operation manual documentation
- One day on-site training and demonstration
- 1 year full warranty/3 year warranty on actuator
- Software updates for one year

