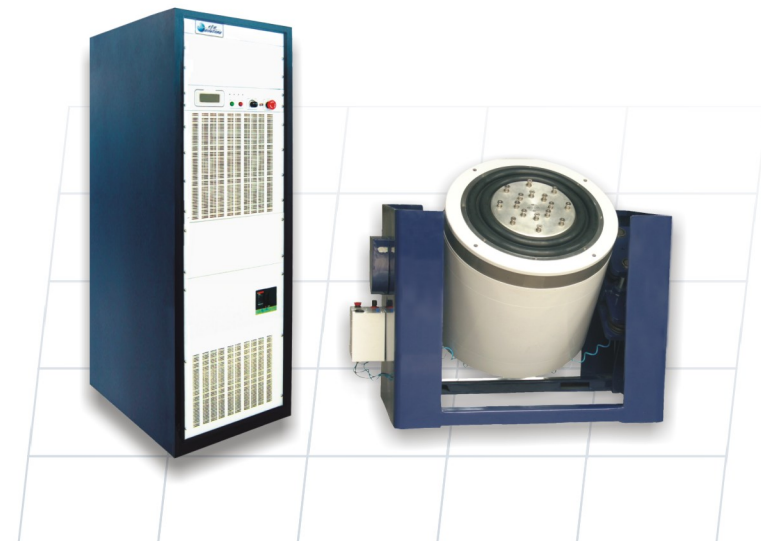


# Vibration Testing System — 'LS' Series

Vibration system rating from 1,500 kgf (3,300 lbf) to 4,000 kgf (8,800 lbf).

## System Models:

- MPA404/LS232A
- MPA406/LS232A
- MPA406/LS437A
- MPA408/LS437A



The Long Stroke Series vibration testing systems are designed for long stroke displacement test requirements normally performed by hydraulic shakers. Compared to a hydraulic shaker where maximum test frequency is typically around 400 Hz. The Long Stroke Series is capable of testing up to 3,000 Hz with a maximum of 100 g (bare table) bounded by 2 m/s maximum velocity. This provides users time and cost savings for wide test requirements. These shakers are suitable for test application such as package testing and vehicle testing.

## Features

### The Performance

- Specimen payload up to 800 kg (17,600 lbs)
- Excellent random performance meeting ISO standard with 3 sigma peak current rating
- Armature diameters ranges from 320 mm to 370 mm (12.6 inch to 14.6 inch)
- Up to 100mm (4 inch) continuous displacement
- Test frequency up to 3,000 Hz

### The Shaker

- Rugged trunnion design with bearing guidance
- Air bag isolator built-in reducing dynamic floor stress
- Dual layer reinforced armature for high acceleration performance
- Roller bearing flexure with load support bearing suspension system achieving high cross axial stiffness

### The Amplifier

- Integrated with high performance MPA400 Series amplifier
- Modular designed amplifier
- 12 kVA power module with two self-reliant compact 6 kVA sub-modules
- High modulation switching frequency
- High signal to noise ratio
- Low total harmonic distortion
- Individual power module operation indication light

### The Accessories

- Air load support for armature centering
- Dynamic and static armature centering available
- Rotary worm-gear built-in for uni-base slip table
- Thermal barrier for combined climatic chamber test available
- Remote control capabilities available

## Benefits

- Simple system operation
- State-of-the-art microprocessor logic control unit
- High energy conversion efficiency (greater than 92%)
- Reasonably priced optimal performance system for major test standards
- Compact shaker and amplifier size saving valuable floor space

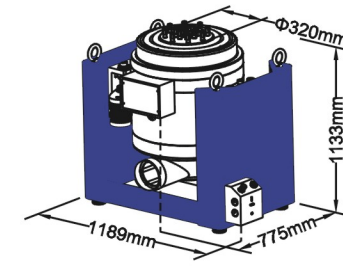
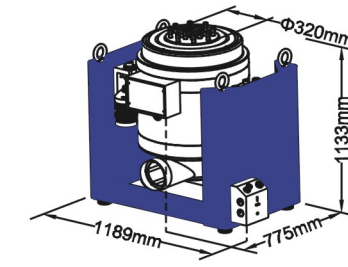
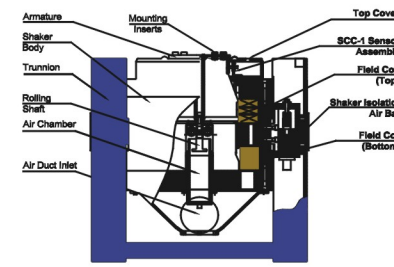
- Shaker air cooled by rugged outdoor blower for continuous long period operation
- Air cooled amplifier power electronics for safe and reliable operation
- Designed to reduce reliance on mechanical switch gears with CPU logic controlled
- All-encompassing fuse protection designs for high current system components
- Detailed scope of system interlock protections
- Complies with USA, European and international safety and EMC regulations

Operational Efficiency & Safety

- Compatible with any vibration controller
- Remote control panel available with full functional features
- Low profile body design ready for chamber integration
- Integration with unibase or standalone slip table

- Simple initial self system setup
- Interactive diagnostic "System Status" displayed on LCD
- Easy maintenance and rapid servicing
- Full three years warranty on armature and field coil
- Worldwide spare parts support

Compatibility Serviceability

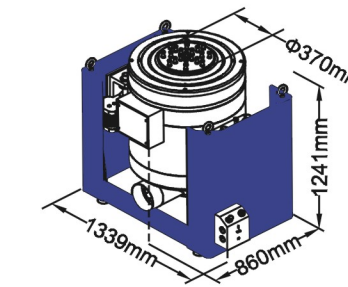
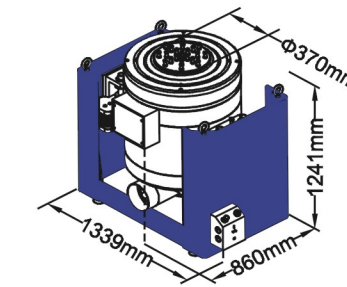
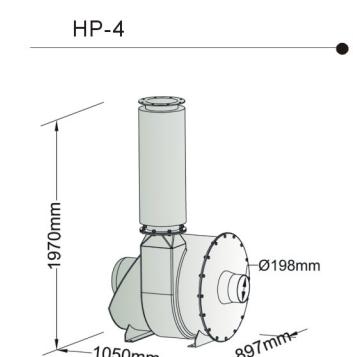
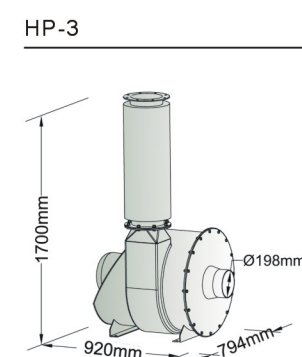
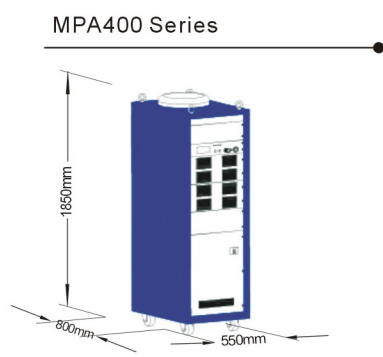


System Model	MPA404/LS232A		MPA406/LS232A	
	American	Metric	American	Metric
Sine Force	3,300 lbf	1,500 kgf	4,400 lbf	2,000 kgf
Random Force	3,300 lbf	1,500 kgf	4,400 lbf	2,000 kgf
Shock Force (6 ms)	6,600 lbf	3,000 kgf	8,800 lbf	4,000 kgf
Usable Frequency Range	DC-3,000 Hz	DC-3,000 Hz	DC-3,000 Hz	DC-3,000 Hz
Continuous Displacement <sup>①</sup>	3.54 inch	90 mm	3.54 inch	90 mm
Shock Displacement	4 inch	100 mm	4 inch	100 mm
Max. Velocity (Sine)	78.7 in/s	2 m/s	78.7 in/s	2 m/s
Max. Acceleration (Sine)	70 g	686.7 m/s <sup>2</sup>	90 g	828.3 m/s <sup>2</sup>

Shaker Unit	LS232A		LS232A	
	American	Metric	American	Metric
Armature Diameter	12.6 inch	320 mm	12.6 inch	320 mm
Effective Moving Element Mass	48.4 lbs	22 kg	48.4 lbs	22 kg
Load Attachment Points	16 stainless steel inserts		16 stainless steel inserts	
Inserts Size (Standard)	M10	M10	M10	M10
Grid Pattern (Diameter, Circle)	8 on 120 mm φ; 8 on 250 mm φ		8 on 120 mm φ; 8 on 250 mm φ	
Nominal, Bare Table <sup>②</sup>	2,400 Hz	2,400 Hz	2,400 Hz	2,400 Hz
Max. Static Payload	660 lbs	300 kg	660 lbs	300 kg
Natural Frequency-Thrust Axis	<5 Hz	<5 Hz	<5 Hz	<5 Hz
Stray Flux Density <sup>③</sup>	Less than 5 gauss		Less than 5 gauss	
Dimension (Uncrated) (L x W x H)	46.8x30.5x44.6 inch	1189x775x1133 mm	46.8x30.5x44.6 inch	1189x775x1133 mm
Shaker Weight (Uncrated)	3,740 lbs	1,700 kg	3,740 lbs	1,700 kg

Amplifier Unit	MPA404		MPA406	
	American	Metric	American	Metric
Amplifier Output	16 kVA	16 kVA	21 kVA	21 kVA
Total Harmonic Distortion (At Rated Output)	From DC(0.1 Hz) to 500 Hz less than 0.5%; From 500 Hz to 4,500 Hz less than 1.0%			
Signal-Noise-Ratio	More than 65 dB at 100 V rms output, 10 K Ω input termination with rated resistive load			
DC Stability	Less than 0.05% of full output voltage with 10% change in line voltage			
Input Drive	1.5 V rms into 10 K Ohms for full output (120 V rms)			
Amplifier Frequency Response <sup>④</sup>	From DC(0.1 Hz) to 4,500 Hz: ± 3 dB; From 10 Hz to 3,000 Hz: ± 1dB			
Switching Frequency	112 kHz	112 kHz	112 kHz	112 kHz
Max. Output Voltage	120 V rms	120 V rms	120 V rms	120 V rms
Max. Output Current Per Module (Continuous)	50 A rms	50 A rms	50 A rms	50 A rms
Max. Output Current Per Module (Transient)	150 A rms	150 A rms	150 A rms	150 A rms
Amplifier Efficiency	> 90%	> 90%	> 90%	> 90%
Dimension (Uncrated) (L x W x H)	21.7x31.5x72.8 inch	550x800x1850 mm	21.7x31.5x72.8 inch	550x800x1850 mm
Amplifier Weight (Uncrated)	1,188 lbs	540 kg	1,210 lbs	550 kg

Blower Unit	HP-3		HP-3	
	American	Metric	American	Metric
Power Requirement	7.5 kW	7.5 kW	7.5 kW	7.5 kW
Air Flow	2457.99 ft <sup>3</sup> /m	1.16 m <sup>3</sup> /s	2479.18 ft <sup>3</sup> /m	1.17 m <sup>3</sup> /s
Air Pressure	0.766 PSI	0.054 kgf/cm <sup>2</sup>	0.78 PSI	0.055 kgf/cm <sup>2</sup>
Dimension (Uncrated) (L x W x H)	39.3x33.1x65.0 inch	920x794x1700 mm	39.3x33.1x65.0 inch	920x794x1700 mm
Weight (Uncrated)	572 lbs	230 kg	572 lbs	230 kg



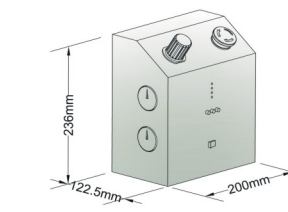
System Model	MPA406/LS437A		MPA408/LS437A	
	American	Metric	American	Metric
Sine Force	6,732 lbf	3,060 kgf	8,800 lbf	4,000 kgf
Random Force	6,732 lbf	3,060 kgf	8,800 lbf	4,000 kgf
Shock Force (6 ms)	13,464 lbf	6,120 kgf	17,600 lbf	8,000 kgf
Usable Frequency Range	DC-2,500 Hz	DC-2,500 Hz	DC-2,500 Hz	DC-2,500 Hz
Continuous Displacement <sup>①</sup>	3.54 inch	90 mm	3.54 inch	90 mm
Shock Displacement	4 inch	100 mm	4 inch	100 mm
Max. Velocity (Sine)	78.7 in/s	2 m/s	78.7 in/s	2 m/s
Max. Acceleration (Sine)	90 g	828.3 m/s <sup>2</sup>	100 g	981 m/s <sup>2</sup>

Shaker Unit	LS437A		LS437A	
	American	Metric	American	Metric
Armature Diameter	14.6 inch	370 mm	14.6 inch	370 mm
Effective Moving Element Mass	75 lbs	34 kg	75 lbs	34 kg
Load Attachment Points	20 stainless steel inserts		20 stainless steel inserts	
Inserts Size (Standard)	M10	M10	M10	M10
Grid Pattern (Diameter, Circle)	4 on 100 mm φ; 8 on 200 mm φ; 8 on 300 mm φ		4 on 100 mm φ; 8 on 200 mm φ; 8 on 300 mm φ	
Nominal, Bare Table <sup>②</sup>	2,200 Hz	2,200 Hz	2,200 Hz	2,200 Hz
Max. Static Payload	1,100 lb	500 kg	1,760 lb	800 kg
Natural Frequency-Thrust Axis	<5 Hz	<5 Hz	<5 Hz	<5 Hz
Stray Flux Density <sup>③</sup>	Less than 5 gauss		Less than 5 gauss	
Dimension (Uncrated) (L x W x H)	53.3x33.9x48.8 inch	1355x860x1241 mm	53.3x33.9x48.8 inch	1355x860x1241 mm
Shaker Weight (Uncrated)	6,160 lbs	2,800 kg	6,160 lbs	2,800 kg

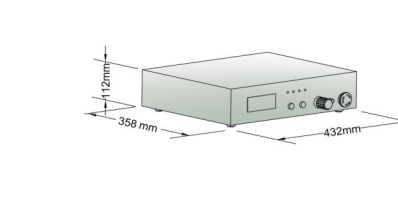
Amplifier Unit	MPA406		MPA408	
	American	Metric	American	Metric
Amplifier Output	30 kVA	30 kVA	40 kVA	40 kVA
Total Harmonic Distortion (At Rated Output)	From DC(0.1 Hz) to 500 Hz less than 0.5%; From 500 Hz to 4,500 Hz less than 1.0%			
Signal-Noise-Ratio	More than 65 dB at 100 V rms output, 10 K Ω input termination with rated resistive load			
DC Stability	Less than 0.05% of full output voltage with 10% change in line voltage			
Input Drive	1.5 V rms into 10 K Ohms for full output (120 V rms)			
Amplifier Frequency Response <sup>④</sup>	From DC(0.1 Hz) to 4,500 Hz: ± 3 dB; From 10 Hz to 3,000 Hz: ± 1dB			
Switching Frequency	112 kHz	112 kHz	112 kHz	112 kHz
Max. Output Voltage	120 V rms	120 V rms	120 V rms	120 V rms
Max. Output Current Per Module (Continuous)	50 A rms	50 A rms	50 A rms	50 A rms
Max. Output Current Per Module (Transient)	150 A rms	150 A rms	150 A rms	150 A rms
Amplifier Efficiency	> 90%	> 90%	> 90%	> 90%
Dimension (Uncrated) (L x W x H)	21.7x31.5x72.8 inch	550x800x1850 mm	21.7x31.5x72.8 inch	550x800x1850 mm
Amplifier Weight (Uncrated)	1,210 lbs	550 kg	1,298 lbs	590 kg

Blower Unit	HP-3		HP-4	
	American	Metric	American	Metric
Power Requirement	7.5 kW	7.5 kW	15 kW	15 kW
Air Flow	2521.56 ft <sup>3</sup> /m	1.19 m <sup>3</sup> /s	2563.94 ft <sup>3</sup> /m	1361 m <sup>3</sup> /s
Air Pressure	0.88 PSI	0.062 kgf/cm <sup>2</sup>	0.923 PSI	0.075 kgf/cm <sup>2</sup>
Dimension (Uncrated) (L x W x H)	39.3x33.1x65.0 inch	920x794x1700 mm	41.3x35.3x70.2 inch	920x794x1700 mm
Weight (Uncrated)	572 lbs	230 kg	572 lbs	290 kg

### Servo Control Console (SCC-1 Unit)



### Remote Control Panel (RCP)



## Basic Guide on Choosing Shaker

### Guide 1 - Determine Required Shaker Force Rating

Using the fundamental formula (F = MA), to determine the required shaker force rating. Below is a more detailed illustration.

$$F = (M_a + M_f + M_s) * A$$

- Where:
- F = Shaker required Rated Force (N)
  - M<sub>a</sub> = Armature Effective Mass
  - M<sub>f</sub> = Fixtures mass
  - M<sub>s</sub> = Test Specimen Mass
  - A = Acceleration

### Guide 2 - Calculating Displacement and Velocity Factor

Below is an illustration on the fundamental sinusoidal vibration relationship between acceleration, velocity, displacement and frequency.

	SI Units	Gravitational Units	Imperial Units
Force (F)	N	kgf	lbf
Mass	kg	kg	lbs
Acceleration (A)	m/s <sup>2</sup>	G	G
Frequency (f)	Hz	Hz	Hz
Displacement (D)	mm (pk - pk)	mm (pk - pk)	in (pk - pk)

### Useful Conversion Factor

Force	1 kgf = 9.807 N	1 kgf = 2.2 lbf
Mass	1 kg = 2.2 lbs	
Acceleration	1 G = 9.807 m/s <sup>2</sup>	
Length	1 inch = 25.4 mm	
Velocity	1 m/s = 39.37 in/s	

### Remarks

- Test payload should be less than 10% of shaker weight.
- Natural frequency at 5% tolerance.
- Measured at 152 mm above armature table. Contact us for lower gauss level requirement.
- Sine mode, resistive load.
- Optional Remote Control Panel.
- Amplifier power rating includes the field supplies and blower motor.