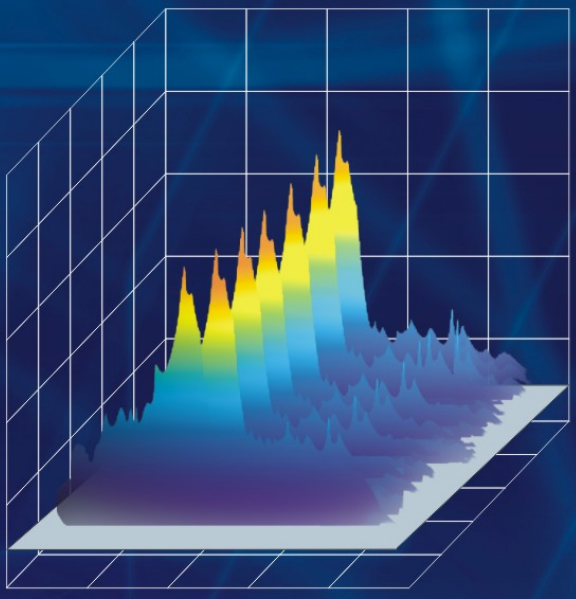
AIR COOLED 'M' SERIES — II
VIBRATION TESTING SYSTEMS

◎Classical Shock
◎Random Test
◎Sine-on-Random
◎Swept Sine
◎Sine and Random on Random
◎Step Sine
◎Sine Resonance Phase Track & Dwell
◎Random-on-Random
◎Shock Response Spectra
◎Road Simulation



◎Shaker Systems
◎Power Amplifier
◎Vertical Guidance System
◎Guided Oil Film Slip Tables
◎Hydrostatic Bearing Slip Tables
◎Load Bearing Platform
◎Head Expanders
◎Customized Fixtures
◎Combined Vibration - Climatic System
◎Vibration Control System

ets solutions
ADVANCING TECHNOLOGY IN DYNAMIC TESTING

Vibration Testing System — 'M' Series-II

Vibration system rating from
4,000 kgf to 7,000 kgf.

System Models:

MPA408/M437A
MPA712/M544A
MPA712/M748A
MPA714/M748A

The 'M' Series-II vibration testing system is ideal for screening of medium sized assemblies with high acceleration test requirements. The 'M' Series-II also meets typical vibration test requirements of other medium to large sized electronic assemblies, automotive parts, aviation and avionics parts. The 'M' Series-II is designed to meet military and international test standards including MIL, ASTM, IEC, ISO, BS and JIS. A wide diameter armature with high cross axial stiffness will allow for using a proportioned head expander to test multiple specimens simultaneously yet achieving good vibration transmissibility ratio. Other test requirements including transportation vibration simulation, combined vibration-climatic test and seismic simulations for small size components can easily be fulfilled by the 'M' Series-II.

Features

The Performance

- Specimen payload up to 800 kg
- Excellent random performance meeting ISO standard with 3 sigma peak current rating
- Armature diameters ranges from 370 mm to 480 mm
- Up to 51mm continuous displacement
- Test frequency up to 2,500 Hz

The Shaker

- Rugged trunnion design with bearing guidance
- Air bag or elastomer isolator built-in reducing dynamic floor stress
- Light weight composite armature coil for high acceleration performance
- Roller-truss flexure suspension system with high cross axial stiffness

The Amplifier

- Integrated with high performance MPA 400 or MPA 700 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

Operational Reliability & Safety

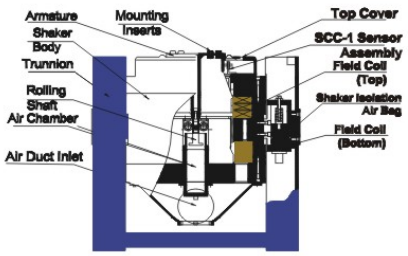
- ✓ Simple system operation
- ✓ State-of-the-art microprocessor logic control unit
- ✓ High energy conversion efficiency (greater than 90%)
- ✓ Reasonably priced optimal performance system for major test standards
- ✓ Compact shaker and amplifier size saving valuable floor space
- ✓ Shaker air cooled 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

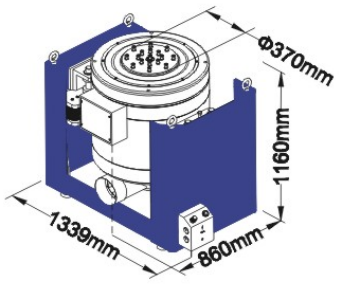
Compatibility

- ✓ 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

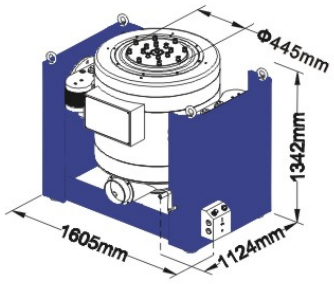
Serviceability

- ✓ 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





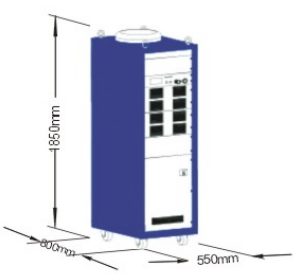
Metric



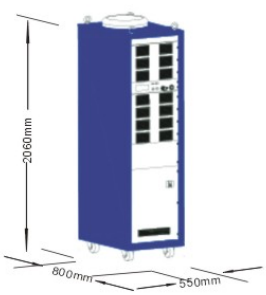
Metric

System Model	MPA408/M437A	MPA712/M544A
Sine Force	4,000 kgf	5,000 kgf
Random Force	4,000 kgf	5,000 kgf
Shock Force (6 ms)	8,000 kgf	10,000 kgf
Usable Frequency Range	DC-2,700 Hz	DC-2,700 Hz
Continuous Displacement①	51 mm	51 mm
Shock Displacement	51 mm	51 mm
Max. Velocity (Sine)	2 m/s	2 m/s
Max. Acceleration (Sine)	981 m/s²	981 m/s²
Shaker Unit	**M437A**	**M544A**
Armature Diameter	370 mm	445 mm
Effective Moving Element Mass	35 kg	50 kg
Load Attachment Points	16 stainless steel inserts	16 stainless steel inserts
Inserts Size (Standard)	M10	M12
Grid Pattern (Diameter, Circle)	8 on 150 mm Φ; 8 on 300 mm Φ	8 on 203.2 mm Φ; 8 on 406.4 mm Φ
Nominal, Bare Table ②	2,250 Hz	2,100 Hz
Max. Static Payload	500 kg	800 kg
Natural Frequency-Thrust Axis	<5 Hz	<5 Hz
Stray Flux Density ③	Less than 10 gauss	Less than 10 gauss
Dimension(Uncrated)(L x Wx H)	1339x860x1160 mm	1605x1124x1342 mm
Shaker Weight (Uncrated)	2,470 kg	4,300 kg
Amplifier Unit	**MPA408**	**MPA712**
Amplifier Output	40 kVA	60 kVA
Total Harmonic Distortion (At Rated Output)	From DC(0.1 Hz) to 500 Hz less than 0.5%; From 500 Hz to 5000 Hz less than 1.0%	
Signal-Noise-Ratio	More than 65 dB at 100 V rms output, 10 KΩ 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 KΩ for full output (120 V rms)	
Amplifier Frequency Response ④	From DC(0.1 Hz) to 2,000 Hz: ±1.5 dB; From DC(0.1 Hz) to 3,000 Hz:±2.5 dB	From DC(0.1 Hz) to 2,000 Hz: ±1.5 dB; From DC(0.1 Hz) to 2,800 Hz:±2.5 dB
Switching Frequency	112 kHz	112 kHz
Max. Output Voltage	120 V rms	120 V rms
Max. Output Current Per Module (Continuous)	50 A rms	50 A rms
Max. Output Current Per Module (Transient)	150 A rms	150 A rms
Amplifier Efficiency	> 90%	> 90%
Dimension(Uncrated)(L x Wx H)	550x800x1850 mm	550x800x2060 mm
Amplifier Weight (Uncrated)	590 kg	800 kg
Blower Unit	**HP-4**	**HP-4**
Power Requirement	15 kW	15 kW
Air Flow	1.36 m³/s	1.36 m³/s
Air Pressure	0.075 kgf/cm²	0.075 kgf/cm²
Dimension(Uncrated)(L x Wx H)	1050x897x1970 mm	1050x897x1970 mm
Weight (Uncrated)	290 kg	290 kg

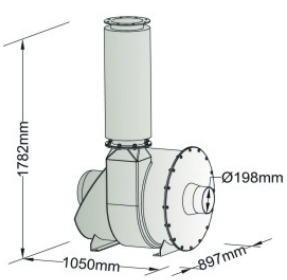
MPA400 Series

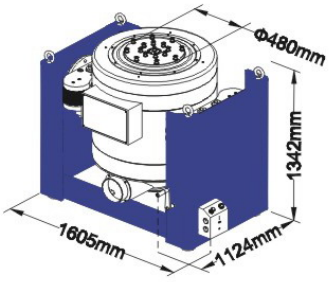


MPA700 Series

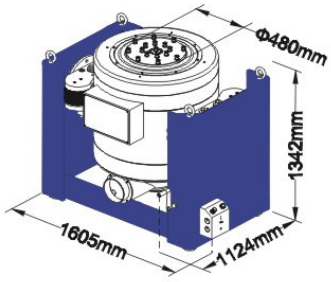


HP-4





Metric



Metric

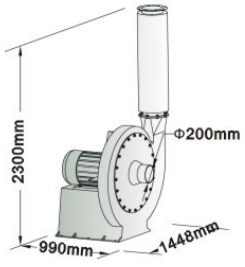
MPA712/M748A	MPA714/M748A
6,400 kgf	7,000 kgf
6,400 kgf	7,000 kgf
12,800 kgf	14,000 kgf
DC-2,500 Hz	DC-2,500 Hz
51mm	51 mm
51mm	51 mm
1.8 m/s	1.8 m/s
981 m/s^2	981 m/s^2

M748A	M748A
480 mm	480 mm
64 kg	64 kg
16 stainless steel inserts	16 stainless steel inserts
M12	M12
8 on 203.2 mm Φ ; 8 on 406.4 mm Φ	8 on 203.2 mm Φ ; 8 on 406.4 mm Φ
2,100 Hz	2,100 Hz
800 kg	800 kg
<5 Hz	<5 Hz
Less than 10 gauss	Less than 10 gauss
1605x1124x1342 mm	1605x1124x1342 mm
4,500 kg	4,500 kg

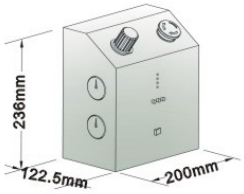
MPA712	MPA714
60 kVA	66 kVA
From DC(0.1 Hz) to 500 Hz less than 0.5% ;From 500 Hz to 5000 Hz less than 1.0%	
More than 65 dB at 100 V rms output, 10 KΩ input termination with rated resistive load	
Less than 0.05% of full output voltage with 10% change in line voltage	
1.5 V rms into 10 KΩ for full output (120 V rms)	
From DC(0.1 Hz) to 2,000 Hz: ±1.5 dB; From DC(0.1 Hz) to 2,800 Hz:±2.5 dB	
112 kHz	112 kHz
120 V rms	120 V rms
50 A rms	50 A rms
150 A rms	150 A rms
> 90%	> 90%
550x800x2060 mm	550x800x2060 mm
800 kg	810 kg

HP-5	HP-5
30 kW	30 kW
1.41 m^3/s	1.42 m^3/s
0.092 kgf/cm^2	0.094 kgf/cm^2
990x1448x2300 mm	990x1448x2300 mm
450 kg	450 kg

HP-5



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.

$F = (Ma + Mf + Ms) * A$

Where:

F = Shaker required Rated Force (N)
Ma = Armature Effective Mass
Mf = Fixtures mass
Ms = 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.

$V = \pi f D$

$V = 61.48 G / f$

$G = 0.0511 f^2 D$

$G = 0.0163 V f$

	SI Units	Gravitational Units	Imperial Units
Force (F)	N	kgf	lbf
Mass	kg	kg	lbs
Acceleration (A)	m/s^2	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^2
Length	1 inch = 25.4 mm
Velocity	1 m/s = 39.37 in/s

Remarks

① Test payload should be less than 10% of shaker weight.
② Natrual frequency at ± 5% tolerance.
③ Measured at 152mm above armature table. Contact us for lower gauss level requirement.
④ Sine mode, resistive load.
⑤ Optional Remote Control Panel.
⑥ Amplifier power rating includes the field supplies and blower motor.

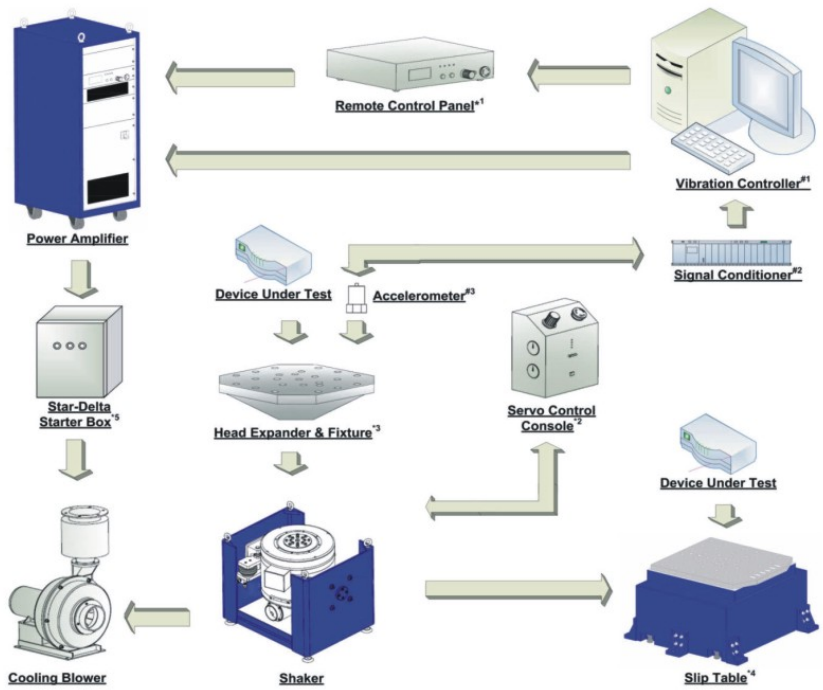
Vibration Testing and Why?

The use of vibration in Environmental Stress Screening (ESS) has expanded from the past in purely military applications until today commonly applied in the commercial sector. The use of ESS becomes a standard customer-defined requirement in the aerospace and defence-related products to ensure safe operation of critical equipment. Commercial product manufacturers today typically have full ESS programs in place with vibration test or combined with thermal cycling. The ESS programs are designed to comply with military and other international standards such as MIL, ASTM, IEC, ISO, BS etc.

The use of vibration in ESS has been proven to be a way to increase product reliability. It is also a tool to assist engineers in the product development process. Simulating the environment condition on the developing product will allow the design engineer to classify and analyse screening data to identify problem areas and recommend early corrective action.

Vibration testing as a part of ESS ensures the occurrence of failures in the product infantile period is precipitated "artificially". These failures then occur before the units leave the manufacturing facility, dramatically improving field reliability. The optimal screening will maintain field failure cost savings.

Vibration Testing System Setup



Prerequisite System Components

#1 Vibration controller required for test profiling control. ETS shakers are compatible with all major vibration controllers.

#2 Signal Conditioner required to provide current source for accelerometer or function as a charge amplifier.

#3 Accelerometer built-in amplifier type or charge-type for signal feedback to vibration controller or data acquisition.

ETS is able to provide a complete system package with a suitable controller of your choice. Please contact ETS for a quote.

Shaker Accessories Units

*1 Optional Remote Control Panel with full logic module replication function at remote site of up to 500 m.

*2 Servo Control Console for static and dynamic and armature auto-centering.

*3 Customised head expanders and fixtures. Contact ETS for more information.

*4 Different sizes of slip table available for horizontal testing. Contact ETS for more information.

Operating Environmental Data

Operating Environment	MPA408/M437A	MPA712/M544A	MPA712/M748A	MPA714/M748A
Max. Heat Rejection to Air(Shaker)(kW)	2.76	3.5	4.05	4.6
Max. Heat Rejection to Air(Amplifier)(kW)	5.63	7.5	9	9.9
Max. Heat Rejection to Air(Blower)(kW)	12.75	12.75	12.75	12.75
Working Ambient Temperature (℃)*	5~35	5~35	5~35	5~35
Working Ambient Pressure (mPa)	0.1	0.1	0.1	0.1
Relative Humidity (Non Condensing)	≤80%	≤80%	≤80%	≤80%
Max. Acoustic Noise(dB)	92	92	92	92
Temperature Range of Air Flow at Shaker Inlet (℃)	0~35	0~35	0~35	0~35
Air Line Supply Required (Compressed Air Supply) (bar)	8	8	8	8
Input Voltage (Standard)	380VAC, 50 Hz, 3 Phase			
Power Requirements(kW)	70	85	110	120

*Full power to 35℃, derate at 5% per ℃ to 50℃.

System Options

System Options	MPA408/M437A	MPA712/M544A	MPA712/M748A	MPA714/M748A
Table Inserts				
M10	■	□	□	□
M12	□	■	■	■
1/2"UNC	□	□	□	□
3/8"UNC	□	□	□	□
Internal Load Support	■	■	■	■
Thermal Barrier	□	□	□	□
Unibase Slip Table	□	□	□	□
Air Caster	□	□	□	□
Degauss Coil	■	■	■	■
Air Compensator	□	□	□	□
Air Isolated Trunnion	■	■	■	■
Geared Aided Rotation (Ratchet Crank)	■	□	□	□
Geared Aided Rotation(Chain Wheel Reducer)	□	■	■	■
Servo Control Console(SCC-1 Unit)	■	■	■	■
Auxiliary Interlock Unit (AIU)	□	□	□	□
Remote Control Panel (RCP)	□	□	□	□

■ Standard □ Optional – Not Available

Specifications are correct at the time of publication. In keeping with our commitment to continuous product improvement, the information herein is subject to change. ETS reserves the rights to amend specifications without prior notice.

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