IMV CORPORATION

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*The specifications and design are subject to change without notice.

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Dynamic Simulation System
Full Lineup Catalogue

IMV CORPORATION

World’s leading supplier of high reliability vibration test systems

Wide range of industries benefit through quality and reliability improvements

Since it was founded in 1957, IMV has been proud to be at the forefront of research and development in vibration testing systems, supplying technical-ly-advanced systems, with safety and reliability as first priorities.

The range of IMV vibration test systems includes single-axis and simultaneous muti-axis systems for up to six degrees of freedom simulation. A range of vibration and diagnostic instruments are also available. Engineering consultancy services to assist customers with vibration measurement, analysis and testing can also be provided.

IMV designs, manufactures, markets and maintains vibration-test systems which simulate actual vibration environments, and measuring systems which record and analyse vibration created or experienced by a product. IMV can also provide test laboratory and consultancy services.

We are proud to be contributing to the safety and reliability of a wide range of products by working with the automotive, aerospace, electrical machinery and structural engineering industries to solve problems caused by vibration.

Our policy is to continue to develop our skills and products to ensure we continue to provide the best possible service to our clients.







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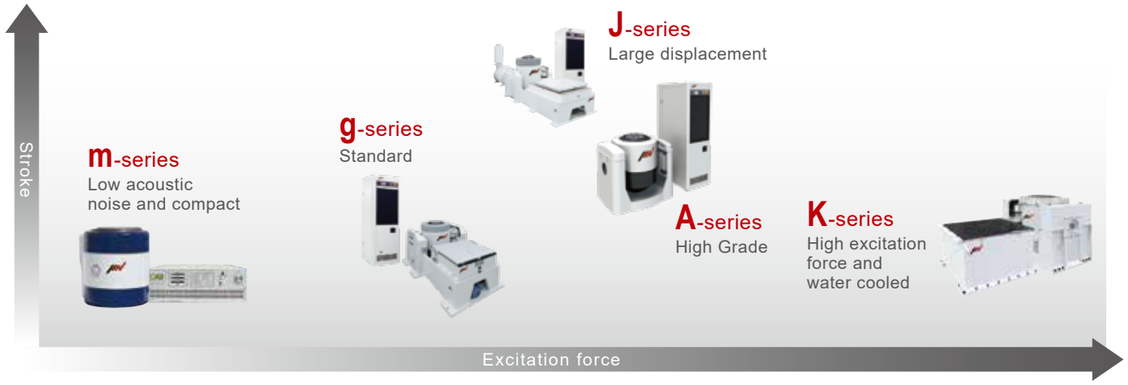
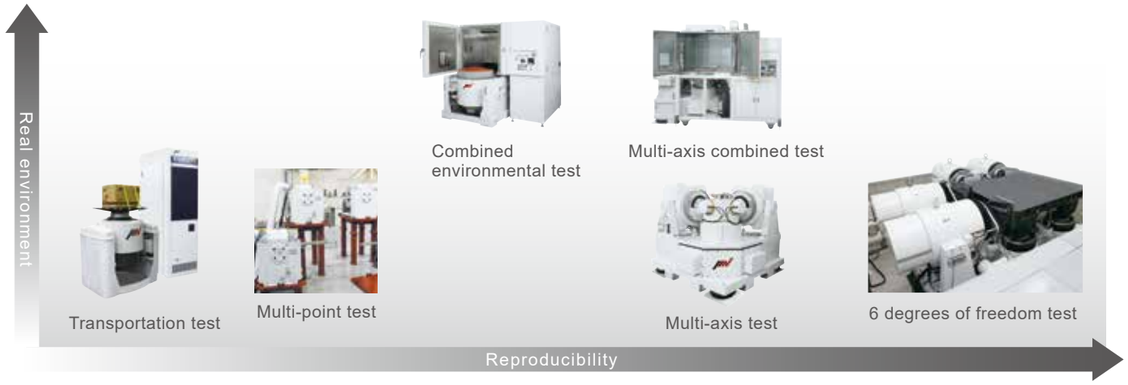
Series Arrangements

Vibration Test Systems Lineup Chart





			Automotive parts	Aerospace	Electronic parts		Information and telecommunication equipment	Precision equipment	Electrical equipment	Transportation environment	Usage environment
A-series **J-series** **g-series**	**High Grade Range** **Large Displacement Range** **Standard Range**	P09 P13 P15	Car audio, Navigation system, Door mirror, Inverter, Motor, Light associated part, ECU associated part, Solenoid, Car-mounted meter, Electric power station motor, Combination meter, Fuel pump, Inlet system part, Hybrid associated part, Battery, Electric pump, Muffler, Catalyst, Fuel battery, ABS coil, Seat belt, Breaking system	Personal monitor TV, Communications equipment, Resin product, Seal material, Dish, Chair, Aircraft engine component, Space environmental utilization, Airborne equipment	LCD TV, Connector component, Car mounted electric component, General purpose motor, In-rack equipment, PC, Printed circuit board, Impact from transportation		Navigation system, Car mounted telecommunication equipment, Vending machine on the expressway, Industrial motor, Antenna associated component, Large antenna	Industrial robot, Digital camera, Lens, Optical equipment, Surface mounter associated component, Mobile phone, Copy machine, Video camera	Withstanding voltage transformer, Fuel battery, Inverter associated component, Space battery, Large lithium battery	Rail vehicle component, Construction equipment, Shipping on a rough road	Combination meter, Instrumental panel associated component, Solar system, Other car-mounted component, PC
K-series	**High Excitation Force Water Cooled Range**	P17	Brake, Catalyst, Heat insulation, Hydraulic sensor, Starter, Alternator, Muffler, Hybrid motor, Battery, Sensor, Dynamo, Power unit	Satellite equipment, Propeller engine	Servomotor, Refrigerator, Heater, Washing machine, Major electronics		Large parabolic antenna, Antenna associated component	———	Large battery equipment	Rail vehicle component, Railway component	Display
m-series	**Low Acoustic Noise and Compact Range**	P19	Air-conditioner vent, ETC, ITS device, Car-mounted sensor, Car audio, Navigation system	———	Board, Mobile phone, Mobile products, Electronic component, Compact motor		ETC for motorcycle, Mobile phone	Medical equipment, Usage board, Digital camera, Semiconductor component	———	———	Structure(miniature)
DC-series	**2-Axis Changeover Systems**	P35	Radiator, Car air-conditioner module, Compressor	Aviation communication equipment, Aircraft component	Real environmental shipping, Car audio, LCD panel, Domestic electric appliances		Navigation system, Car audio, Bracket	Video camera, Car audio, Copy machine, Multi-function printer	Large battery equipment, Power board, Control board	Cushioning material, Packing material, Transportation equipment	Earthquake simulation system, Earthquake resistance test system
TC-series	**3-Axis Changeover Systems**	P36	Radiator, Car air-conditioner module								
DS-series	**2-Axis Simultaneous Systems**	P37	Radiator, Car air-conditioner module, Back mirror								
TS-series	**3-Axis Simultaneous Systems**	P38	Car audio, Navigation system, Air-conditioner, Vibration insulation mount, Radiator								
TTS-series	**6 Degrees of Freedom Systems**	P39	Ride quality, Construction equipment, Cutaway body	———	———		———	———	Battery	———	Cabin for construction equipment

Vibration Test Systems
Basic Systems

Approach to low noise

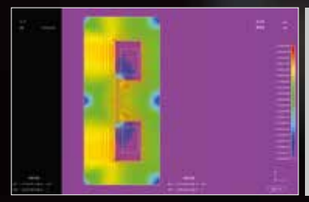
Careful attention to the design of the top cover using airflow modeling reduces the air velocity and the resulting acoustic noise.

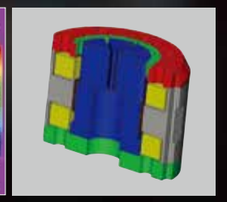
Upper (armature) support system PS Guide

High vibration levels place extreme stress on the main parts of the vibration generator. The Parallel Slope Guide (PSG) uses a patented design to achieve a highly durable armature support which also gives excellent performance. The design provides sufficient stiffness to cross-axis forces and produces low distortion at all levels of vibration.

One of the world's largest class air-cooled shaker systems

By taking advantage of the latest finite-element analysis tools, the magnetic circuit and cooling designs used in the IMV air-cooled range enable higher force ratings (to 74 kN) to be achieved. Air-cooled systems are lower cost both to install and to maintain compared to water-cooled systems.





Simple confirmation of reduction of CO_2 and electricity consumption

When combined with the IMV 'K2' vibration controller, the ECO-shaker system computes and displays electricity savings in real-time. A report of energy consumption can be produced after each test.

Energy-saving results screen

Ecology

Environmentally-friendly vibration systems

Automatic energy saving

ECO-shaker is an electrodynamic vibration test system in which the output of the power amplifier, power input to the vibration generator and cooling blower speed are automatically optimised, according to the payload and test requirements.
Complicated manual settings are no longer needed.
Changes in the operating environment or in test level are accommodated without operator intervention.

[Features]

- Only vibration test levels need to be set
- Automatic response to changes in sample under test or test level
- Continuous monitoring of temperatures used to control blower speed

*Operation condition selection system and method (JP Patent No. 4231095)
*Operation condition selection system and program (JP Patent No. 4263229)

Vibration controller K2+

Effect of energy saving

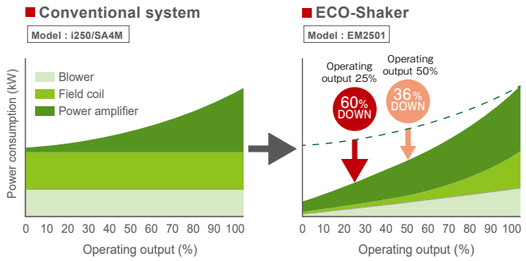
The lower the system output, the more energy saving can be achieved.

Calculation method: Calculation of CO_2 reduction, referring to actual data of our i250/SA4M (Maximum force 32 kN)

Conditions: 1) Random 2) Average operating output: 25 %
3) Average operating ratio per year: 70 %
*Results may vary for systems, test conditions and cases.

Save up to 80 % on your running costs

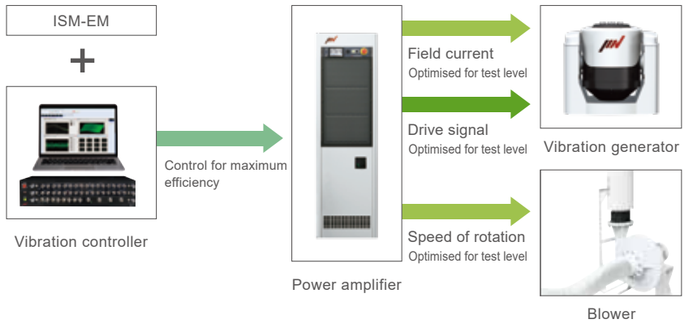
Reduce yout CO^2 emissions by up to 80 %



Comparison of power consumption with the conventional system

Operation of ISM-EM (Power consumption)

Minimising the energy consumption of a conventional vibration test system would require complex calculation and adjustments to suit the test requirements. The Integrated Shaker Manager (ISM-EM) technology incorporated within the ECO-shaker system automatically controls the power amplifier output, field level and blower speed to achieve the maximum efficiency under all test conditions.



Upgrading existing systems

ISM-EM technology can be added to existing IMV vibration test systems by installing the ISM-EM module and additional software. Contact IMV or your local distributor for further information and delivery.

Existing system + ISM-EM unit

Example design

Improvement of working conditions

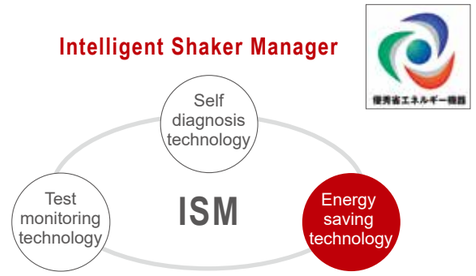
Ensuring the vibration system is operating efficiently not only saves money; it also can reduce noise levels and heat dissipation into the workplace. This improves the working environment and can simplify initial installation.

Blower

Energy saving type vibration test system [ECO-Shaker]

Vibration test systems consume a lot of electricity. IMV has developed environmentally friendly products which minimise the required electric power and cut down electric consumption and CO2 emissions. Due to the great contribution to the promotion of efficient use of energy, the technology of ECO-Shaker received the Chairman's award from The Machinery Federation in 2012.

Intelligent Shaker Manager



[Saving energy technology]
ISM-EM
EM:Energy Manager

Contribution to the environment

Many countries have introduced legislation, such as the Clean Development Mechanism in the Kyoto Protocol, and the EU Energy Efficiency Directive, obliging businesses and their products to be more energy-efficient. The IMV ECO-shaker systems help to meet these regulations.

A-series

High Grade Range

A30/EM3HAG

A new standard created by listening to our customers.

A wider range of test requirements and higher test specifications.
A-series meets the needs for such a versatile test environment.
Advanced automatic energy saving, high level of functionality and a protected test environment.
A-series improves the working environment of vibration testing.

[Improvement of performance]
[User friendly and Secure]
[User first principle]

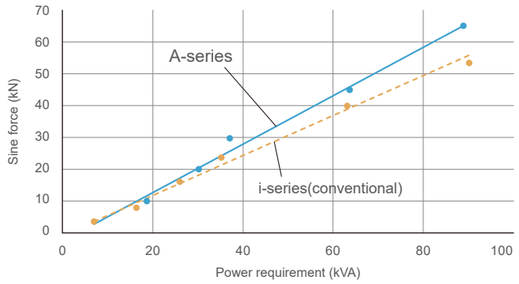
Improvement of performance

A-series meets the demand

A wider range of test requirements and higher test specifications.
A-series meets the needs for such a versatile test environment.

Improvement in excitation force

When compared with the conventional i- & J-series, the A-series has increased relative excitation force.
・Increased force per system power requirement
・Increased force per system mass
・Increased force per system size



Standard 76.2 mmp-p displacement *Only for A30, A45, A65, A74

A-series has a displacement of 76.2 mmp-p (3-inch stroke), which provides a good balance within the specifications for velocity, acceleration and displacement.
This single system can be used for a very wide variety of tests.

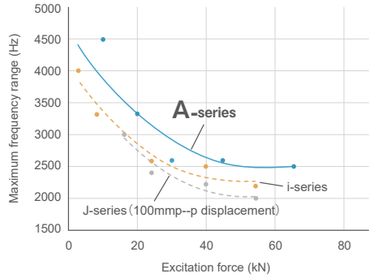
i-series (conventional)
51 mmp-p displacement

A-series

J-series (conventional)
100 mmp-p displacement

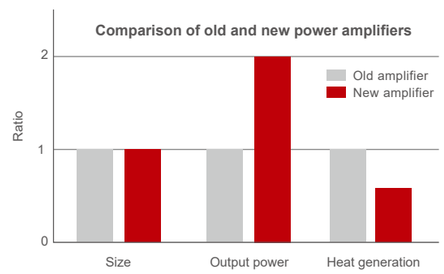
Increase in frequency range

In addition to the increased displacement of 76.2 mmp-p, the maximum frequency range is also increased when compared to the i- and J-series.



Introduction of new power module

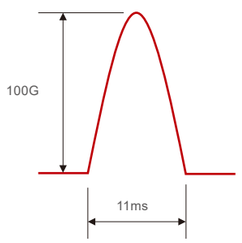
By developing a power amplifier that uses a new next generation Silicon Carbide power module, IMV has achieved low noise and high efficiency.
This new power module is standard-issue for all A-series models.



High velocity shock testing

Where a test requires a high shock velocity, traditional shaker systems use a matching transformer to achieve the necessary lower field voltage. Since IMV's ECO-system has complete control over the field level, the field value can be adjusted to increase the maximum shock velocity capability of the system. By entering the specified shock profile into IMV's K2 controller. The field level in the shaker is automatically adjusted to ensure that the required velocity is achieved. A-series (EM amplifier model) provides a maximum of 4.6 m/s shock velocity testing.

Examples of shock test



	Model	i220/SA1HAG
i-series (conventional)	Rated Force Shock (kN)	16
	Maximum Velocity Shock (m/s peak)	2.2
	Maximum Displacement (mmp-p)	51
	Maximum Load (kg)	Not achievable (not enough velocity and displacement)

	Model	No applicable product	J230/SA3HAG	J240/SA4HAG	J250/SA6HAG	J260/SA7HAG	No applicable product
J-series (conventional)	Rated Force Shock (kN)	-	40	55	80	108	-
	Maximum Velocity Shock (m/s peak)	-	2.4	2.4	2.4	2.4	-
	Maximum Displacement (mmp-p)	-	100	100	100	100	-
	Maximum Load (kg)	-	Not achievable (not enough velocity)				-

	Model	A11/EM1HAG	A22/EM2HAG	A30/EM3HAG	A45/EM4HAG	A65/EM5HAG	A74/EM8HAG
A-series	Rated Force Shock (kN)	22 (16.5)	44 (36)	60 (50)	90 (80)	130 (120)	180 (160)
	Maximum Velocity Shock (m/s peak)	2.5 (3.5)	2.5 (3.5)	2.5 (3.5)	2.5 (3.5)	2.5 (3.5)	2.5 (3.5)
	Maximum Displacement (mmp-p)	51 (55)	51 (55)	76.2	76.2	76.2	76.2
	Maximum Load (kg)	5	14	17	30	48	86

*Maximum load on bare table

User friendly and Secure

A-series changes

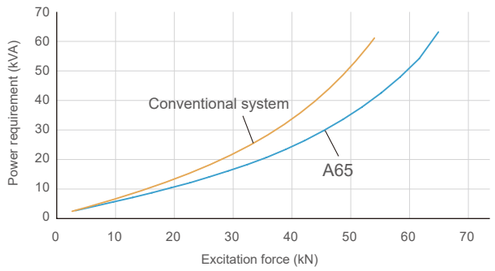
Advanced automatic energy saving, high level of functionality and a protected test environment.

A-series provides a better working environment for vibration testing.

Lower power consumption

In comparison with the same class of conventional systems (i-, J-series), the A-series achieves lower power consumption. With an automatic energy-saving function, increased energy savings are achieved across all force ranges.

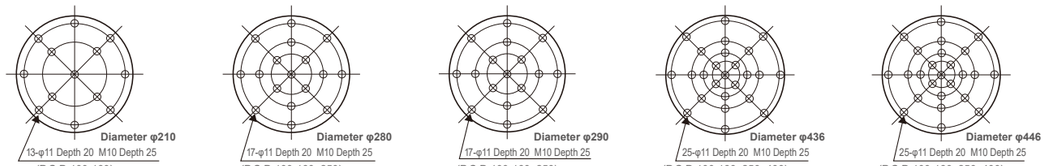
Comparison of consumed power per excitation force



International safety standards

A-series complies with international safety standards.

Table Insert Pattern (Unit:mm)



Specifications

System Model			A11/ SA1HAG	A11/ EM1HAG	A22/ SA2HAG	A22/ EM2HAG	A30/ SA3HAG	A30/ EM3HAG	A45/ SA4HAG	A45/ EM4HAG	A65/ SA5HAG*7	A65/ EM5HAG*7	A74/ EM6HAG*7	A74/ EM8HAG*7	A74/ EM10HAG*7
System Specifications	Frequency Range (Hz)		0–4500*4	0–4500*4	0–3300	0–3300	0–2600	0–2600	0–2600	0–2600	0–2600*5	0–2600*5	0–2600*5	0–2600*5	0–2600*5
	Rated Force	Sine (kN)	11	11	22	22	30	30	45	45	65	65	74	74	74
		Random (kN rms)*1	11	11	22	22	30	30	45	45	65	65	74	74	74
		Shock (kN)	22	22	44	44	60	60	90	90	130	130	148	180	222
		High Velocity Shock (kN)	-	16.5	-	36	-	50	-	80	-	120	120	160	170
	Maximum Acc.	Sine (m/s²)	1000	1000	1000	1000	900	900	900	900	900	900	1000	1000	1000
		Random (m/s² rms)	630	630	630	630	630	630	630	630	630	630	630	630	630
		Shock (m/s² peak)	2000	2000	2000	2000	1818	1818	1800	1800	1806	1806	2000	2000	2000
		High Velocity Shock (m/s² peak)	-	1500	-	1636	-	1515	-	1600	-	1666	1621	2000	2000
	Maximum Vel.	Sine (m/s)	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0
		Shock (m/s peak)	2.5	2.5	2.5	2.5	2.5	2.5	2.5	2.5	2.5	2.5	2.5	2.5	2.5
		High Velocity Shock (m/s peak)	-	3.5	-	3.5	-	3.5	-	3.5	-	3.5	3.5	3.5	3.5
	Maximum Disp.	Sine (mmp-p)	51	51	51	51	76.2	76.2	76.2	76.2	76.2	76.2	76.2	76.2	76.2
		High Velocity Shock (mmp-p)	-	55	-	55	-	76.2	-	76.2	-	76.2	76.2	76.2	76.2
	Maximum Travel (mmp-p)		64	64	64	64	82	82	82	82	82	82	82	82	82
	Maximum Load (kg)		200	200	300	300	400	400	600	600	1000	1000	1000	1000	1000
	Power Requirements (kVA)*2		20.4	20.4	30	30	36	36	57	57	83	83	100	100	100
	Breaker Capacity (A)*3		40	40	60	60	75	75	100	100	150	150	250	250	250
Vibration Generator	Model		A11	A11	A22	A22	A30	A30	A45	A45	A65	A65	A74	A74	A74
	Armature Mass (kg)		11	11	22	22	33	33	50	50	72	72	74	74	74
	Armature Diameter (φmm)		210	210	280	280	290	290	436	436	446	446	446	446	446
	Allowable Eccentric Moment (N•m)		294	294	700	700	850	850	1550	1550	1550	1550	1550	1550	1550
	Dimensions (mm) W × H × D		946 × 827 × 676	946 × 827 × 676	1038 × 955 × 775	1038 × 955 × 775	1100 × 1048 × 840	1100 × 1048 × 840	1232 × 1215 × 1040	1232 × 1215 × 1040	1310 × 1253 × 1040	1310 × 1253 × 1040	1310 × 1253 × 1040	1310 × 1253 × 1040	1310 × 1253 × 1040
	Shaker Body Diameter (φmm)		585	585	678	678	725	725	825	825	925	925	925	925	925
	Mass (kg)		1080	1080	1600	1600	2100	2100	3200	3200	4200	4200	4200	4200	4200
Power Amplifier	Model		1BGH1-A11	2BGH1-A11	1BGH2-A22	2BGH2-A22	1BGH3-A30	2BGH3-A30	1BGH4-A45	2BGH4-A45	1BGH5-A65	2BGH5-A65	2BGH6-A74	2BGH8-A74	2BGH10-A74
	Maximum Output (kVA)		12	12	24	24	31	31	44	44	68	68	100	100	100
	Dimensions (mm) W × H × D		580 × 1950 × 850	580 × 1950 × 850	580 × 1950 × 850	580 × 1950 × 850	580 × 1950 × 850	580 × 1950 × 850	580 × 1950 × 850	1160 × 1950 × 850	580 × 1950 × 850	1160 × 1950 × 850	1160 × 1950 × 850	1160 × 1950 × 850	1160 × 1950 × 850
	Mass (kg)		280	470	350	560	520	590	900	1000	1000	1150	1340	1850	2400
Controller	Vibration Controller		See Vibration Controller K2												
Cooling	Cooling Method		Air cooling												
	Blower	Dimensions (mm) W × H × D*6	1023 × 2285 × 531	1023 × 2285 × 531	929 × 2175 × 534	929 × 2175 × 534	1043 × 2335 × 640	1043 × 2335 × 640	1160 × 2405 × 787	1160 × 2405 × 787	1294 × 2540 × 871	1294 × 2540 × 871	1462 × 2800 × 927	1462 × 2800 × 927	1462 × 2800 × 927
		Mass (kg)	150	150	150	150	150	150	250	250	268	268	320	320	320
		Wattage (kw)	4.0	4.0	4.0	4.0	5.5	5.5	11	11	18.5	18.5	30	30	30
		Duct Hose Diameter (φ)	125	125	200	200	200	200	250	250	250	250	250	250	250

*1 Random force ratings are specified in accordance with ISO5344 conditions. Please contact IMV or your local distributor with specific test requirements.
*2 Power supply: 3-phase 380/400/415/440 V, 50/60 Hz. A transformer is required for other supply voltages.
*3 Breaker capacity for 400 V
*4 Above 4000 Hz, the force rolls-off at a rate of -6 dB/oct.
*5 Above 2000 Hz, the force rolls-off at a rate of -12 dB/oct.
*6 Specification above applies to 50 Hz. Dimensions change for 60 Hz.
*7 An export license is required for exporting the shaker system of over 50 kN sine force.
*The specification shows the maximum system performance. For long-duration tests, system must be de-rated up to 70%.
Continuous use at maximum levels may cause failure. Please contact IMV if your system operates at more than 70%.
*For random vibration tests, please set the test definition of the peak value of acceleration waveform to operate at less than the maximum acceleration of shock.
*Frequency range values vary according to the sensor and vibration controller.
*Armature mass and acceleration may change when a chamber is added.

CE UKCA

J-series

Large-Displacement Range

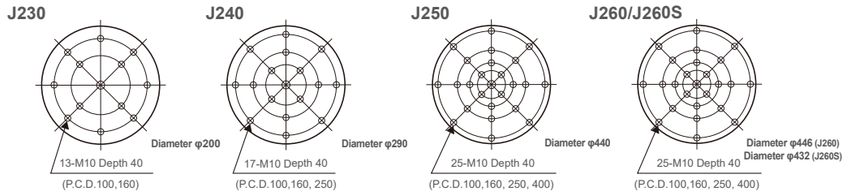
J240/SA4HAG
(With a slip table)

J-series accommodates high-velocity and large-displacement testing

Long-duration shock tests require high velocity and large displacement.
J-series is a high-functionality system that offers usability and durability with features that accommodate high-velocity and large-displacement testing.

[Expanded maximum test range] • Maximum velocity of Sine force: 2.4 m/s • Maximum velocity of Shock force: 4.6 m/s • Maximum displacement: 100 mmp-p
[Patented upper (armature) support system PS Guide] Parallel Slope Guide is standard
[All models can be directly paired with a climatic chamber]

Table Insert Pattern (Unit: mm)



Specifications

System Model			J230/SA3HAG	J230S/SA7HAG	J240/SA4HAG	J240/SA6HAG	J250/SA5HAG	J250/SA6HAG	J260/SA7HAG*7	J260S/SA16HAG*7
System Specifications	Frequency Range (Hz)		0–3000	0–3000	0–2400	0–2400	0–2200	0–2200	0–2600*4	0–2000
	Rated Force	Sine (kN)	16	16	24	24	35	40	54	54
		Random (kN rms)*1	16	16	24	24	35	40	54	54
		Shock (kN)	40	40	55	70	70	80	108	196
	Maximum Acc.	Sine (m/s^2)	941	888	923	923	777	888	857	857
		Random (m/s^2 rms)	658	622	646	646	544	622	600	600
		Shock (m/s^2 peak)	2000	2000	2000	2000	1555	1777	1714	2000
	Maximum Vel.	Sine (m/s)	2.4	2.4	2.4	2.4	2.4	2.4	2.4	2.4
		Shock (m/s peak)	2.4	3.5	2.4	3.6	2.4	2.4	2.4	4.6
	Maximum Disp.	Sine (mmp-p)	100	100	100	100	100	100	100	100
	Maximum Travel (mmp-p)		120	120	120	120	120	120	116	116
	Maximum Load (kg)		300	300	400	400	600	600	1000	1000
	Power Requirements (kVA)*2		28	38	38	52	53	57	86	96
	Breaker Capacity (A)*3		50	75	75	100	100	100	150	225
Vibration Generator	Model		J230	J230S	J240	J240	J250	J250	J260	J260S
	Armature Mass (kg)		17	18	26	26	45	45	63	63
	Armature Diameter (φmm)		200	200	290	290	440	440	446	432
	Allowable Eccentric Moment (N•m)		700	700	850	850	1550	1550	1550	1550
	Dimensions (mm) W×H×D		1124×1079×850	1124×1079×850	1234×1145×890	1234×1145×890	1463×1301×1100	1463×1301×1100	1527×1319×1100	1632×1388×1130
	Shaker Body Diameter(φmm)		630	630	720	720	860	860	920	920
	Mass (kg)		1800	1800	2400	2400	3500	3500	4100	5000
	Model		1BGH3-J230	1BGH7-J230	1BGH4-J240	1BGH6-J240	1BGH5-J250	1BGH6-J250	1BGH7-J260	1BGH16-J260S
Power Amplifier	Maximum Output (kVA)		23	30	34	40	50	57	70	76
	Dimensions (mm) W×H×D		580×1950×850	580×1950×850	580×1950×850	580×1950×850	580×1950×850	580×1950×850	1160×1950×850	1740×1950×850
	Mass (kg)		330	500	440	1000	880	910	1400	3200
Controller	Vibration Controller		See Vibration Controller K2							
Cooling	Cooling Method		Air cooling							
	Blower	Dimensions (mm) W×H×D*5	1044×2285×704	1044×2285×704	929×2175×534	929×2175×534	1160×2405×787	1160×2405×787	1160×2405×787	1160×2405×787
		Mass (kg)	150	150	150	150	250	250	250	250
		Wattage (kw)	3.7	3.7	5.5	5.5	11	11	15	15
		Duct Hose Diameter (φ)	200	200	200	200	250	250	250	250

Eco Specifications

System Model			J230/EM3HAG	J240/EM4HAG	J250/EM5HAG	J250/EM6HAG	J260/EM7HAG*7
System Specifications	Frequency Range (Hz)		0–3000	0–2400	0–2200	0–2200	0–2600*4
	Rated Force	Sine (kN)	16	24	35	40	54
		Random (kN rms)*1	16	24	35	40	54
		Shock (kN)	40	55	70	80	108
		High Velocity Shock (kN)*6	30	48	68	77	96
	Maximum Acc.	Sine (m/s^2)	941	923	777	888	857
		Random (m/s^2 rms)	658	646	544	622	600
		Shock (m/s^2 peak)	2000	2000	1555	1777	1714
		High Velocity Shock (m/s^2 peak)*6	1764	1846	1511	1711	1523
	Maximum Vel.	Sine (m/s)	2.4	2.4	2.4	2.4	2.4
		Shock (m/s peak)	2.4	2.4	2.4	2.4	2.4
		High Velocity Shock (m/s peak)*6	3.5	3.5	3.5	3.5	3.5
	Maximum Disp.	Sine (mmp-p)	100	100	100	100	100
		High Velocity Shock (mmp-p)*6	100	100	100	100	100
	Maximum Travel (mmp-p)		120	120	120	120	116
	Maximum Load (kg)		300	400	600	600	1000
	Power Requirements (kVA)*2		28	38	53	57	86
	Breaker Capacity (A)*3		50	75	100	100	150
Vibration Generator	Model		J230	J240	J250	J250	J260
	Armature Mass (kg)		17	26	45	45	63
	Armature Diameter (φmm)		200	290	440	440	446
	Allowable Eccentric Moment (N•m)		700	850	1550	1550	1550
	Dimensions (mm) W×H×D		1124×1079×850	1234×1145×890	1463×1301×1100	1463×1301×1100	1527×1319×1100
	Shaker Body Diameter (φmm)		630	720	860	860	920
	Mass (kg)		1800	2400	3500	3500	4100
Power Amplifier	Model		2BGH3-J230	2BGH4-J240	2BGH5-J250	2BGH6-J250	2BGH7-J260
	Maximum Output (kVA)		23	34	50	57	70
	Dimensions (mm) W×H×D		580×1950×850	580×1950×850	1160×1950×850	1160×1950×850	1160×1950×850
	Mass (kg)		380	490	930	960	1400
Controller	Vibration Controller		See Vibration Controller K2				
Cooling	Cooling Method		Air cooling				
	Blower	Dimensions (mm) W×H×D*5	1044×2285×704	929×2175×534	1160×2405×787	1160×2405×787	1160×2405×787
		Mass (kg)	150	150	250	250	250
		Wattage (kw)	4.0	4.0	11	11	15
		Duct Hose Diameter (φ)	200	200	250	250	250

*1 Random force ratings are specified in accordance with ISO5344 conditions. Please contact IMV or your local distributor with specific test requirements.
*2 Power supply: 3-phase 380/400/415/440 V, 50/60 Hz. A transformer is required for other supply voltages. *3 Breaker capacity for 400 V
*4 Above 2000 Hz, the force rolls-off at a rate of -12 dB/oct. *5 Specification above applies to 50 Hz. Dimensions change for 60 Hz.
*6 For high velocity option *7 An export license is required for exporting the shaker system of over 50 kN sine force.
*The specification shows the maximum system performance. For long-duration tests, system must be de-rated up to 70%.
Continuous use at maximum levels may cause failure. Please contact IMV if your system operates at more than 70%.
*For random vibration tests, please set the test definition of the peak value of acceleration waveform to operate at less than the maximum acceleration of shock.
*Frequency range values vary according to the sensor and vibration controller.
*Armature mass and acceleration may change when a chamber is added.

CE UKCA

g-series
Standard Range

g220/SA1HAG
(With a slip table)

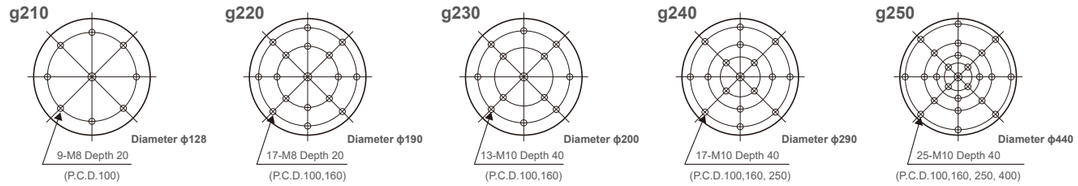
The g-series is a standard range and easier to maintain than custom products.

The g-series is also available with the alternative, cost efficient DMA-series amplifier range.
Please check for details

[Maximum test range] •Maximum acceleration: 1250 m/s² •Maximum velocity: 3.5 m/s •Maximum displacement: 51 mmp-p •Maximum loading mass: 600 kg

[All models can be directly paired with a climatic chamber.]

Table Insert Pattern (Unit: mm)



Specifications

System Model			g210/SA1HAG	g220/SA1HAG	g230/SA2HAG	g240/SA3HAG	g250/SA4HAG	g250/SA5HAG
System Specifications	Frequency Range (Hz)		0–4000	0–3300	0–3000	0–2600	0–2500	0–2500
	Rated Force	Sine (kN)	3	8	16	24	32	40
		Random (kN rms)*1	3	8	16	24	32	40
		Shock (kN)	9	16	32	48	64	80
	Maximum Acc.	Sine (m/s²)	1000	1250	1250	1200	914	1142
		Random (m/s² rms)	700	875	875	840	640	800
		Shock (m/s² peak)	2000	2000	2000	2000	1828	2000
	Maximum Vel.	Sine (m/s)	2.2	2.2	2.2	2.2	2.2	2.2
		Shock (m/s peak)	2.2	2.2	2.2	2.2	2.2	2.2
	Maximum Disp.	Sine (mmp-p)	30	51	51	51	51	51
	Maximum Travel (mmp-p)		40	60	64	68	68	68
	Maximum Load (kg)		120	200	300	400	600	600
	Power Requirements (kVA)*2		6.8	16.4	26	36	51	57
	Breaker Capacity (A)*3		15	30	50	75	100	100
Vibration Generator	Model		g210	g220	g230	g240	g250	g250
	Armature Mass (kg)		3	6.4	12.8	20	35	35
	Armature Diameter (φmm)		128	190	200	290	440	440
	Allowable Eccentric Moment (N•m)		160	294	700	850	1550	1550
	Dimensions (mm) W × H × D		868 × 700 × 458	1020×903×550	1124 × 957 × 860	1234 × 997 × 890	1463 × 1187 × 1100	1463 × 1187 × 1100
	Shaker Body Diameter (φmm)		458	550	630	720	860	860
	Mass (kg)		350	900	1500	2000	3000	3000
Power Amplifier	Model		SA1HAG-g10	SA1HAG-g20	SA2HAG-g30	SA3HAG-g40	SA4HAG-g50	SA5HAG-g50
	Maximum Output (kVA)		5	10	20	30	40	50
	Dimensions (mm) W × H × D		580 × 1950 × 850	580 × 1950 × 850	580 × 1950 × 850	580 × 1950 × 850	580 × 1950 × 850	580 × 1950 × 850
	Mass (kg)		240	280	300	410	850	880
Controller	Vibration Controller		See Vibration Controller K2					
Cooling	Cooling Method		Air cooling					
	Blower	Dimensions (mm) W × H × D*5	600 × 1905 × 557	808 × 2085 × 733	1044 × 2285 × 704	929 × 2175 × 534	1160 × 2405 × 787	1160 × 2405 × 787
		Mass (kg)	45	85	150	150	250	250
		Wattage (kw)	0.4	1.5	3.7	5.5	11	11
		Duct Hose Diameter (φ)	125	125	200	200	250	250

Eco Specifications

System Model			g220/EM1HAG	g230/EM2HAG	g240/EM3HAG	g250/EM4HAG	g250/EM5HAG
System Specifications	Frequency Range (Hz)		0–3300	0–3000	0–2600	0–2500	0–2500
	Rated Force	Sine (kN)	8	16	24	32	40
		Random (kN rms)*1	8	16	24	32	40
		Shock (kN)	16	32	48	64	80
		High Velocity Shock (kN)*6	10	23	36	49	63
	Maximum Acc.	Sine (m/s²)	1250	1250	1200	914	1142
		Random (m/s² rms)	875	875	840	640	800
		Shock (m/s² peak)	2000	2000	2000	1828	2000
		High Velocity Shock (m/s² peak)*6	1562	1796	1800	1400	1800
	Maximum Vel.	Sine (m/s)	2.2	2.2	2.2	2.2	2.2
		Shock (m/s peak)	2.2	2.2	2.2	2.2	2.2
		High Velocity Shock (m/s peak)*6	3.5	3.5	3.5	3.5	3.5
	Maximum Disp.	Sine (mmp-p)	51	51	51	51	51
		High Velocity Shock (mmp-p)*6	51	51	51	51	51
	Maximum Travel (mmp-p)		60	64	68	68	68
	Maximum Load (kg)		200	300	400	600	600
	Power Requirements (kVA)*2		16.4	26	36	51	57
	Breaker Capacity (A)*3		30	50	75	100	100
Vibration Generator	Model		g220	g230	g240	g250	g250
	Armature Mass (kg)		6.4	12.8	20	35	35
	Armature Diameter (φmm)		190	200	290	440	440
	Allowable Eccentric Moment (N•m)		294	700	850	1550	1550
	Dimensions (mm) W × H × D		1020 × 903 × 550	1124 × 957 × 860	1234 × 997 × 890	1463 × 1187 × 1100	1463 × 1187 × 1100
	Shaker Body Diameter (φmm)		550	630	720	860	860
	Mass (kg)		900	1500	2000	3000	3000
Power Amplifier	Model		EM1HAG-g20	EM2HAG-g30	EM3HAG-g40	EM4HAG-g50	EM5HAG-g50
	Maximum Output (kVA)		10	20	29	40	50
	Dimensions (mm) W × H × D		580 × 1950 × 850	580 × 1950 × 850	580 × 1950 × 850	1160 × 1950 × 850	1160 × 1950 × 850
	Mass (kg)		280	350	460	900	930
Controller	Vibration Controller		See Vibration Controller K2				
Cooling	Cooling Method		Air cooling				
	Blower	Dimensions (mm) W × H × D*5	808 × 2085 × 733	1044 × 2285 × 704	929 × 2175 × 534	1160 × 2405 × 787	1160 × 2405 × 787
		Mass (kg)	85	150	150	250	250
		Wattage (kw)	1.5	4.0	4.0	11	11
		Duct Hose Diameter (φ)	125	200	200	250	250

*1 Random force ratings are specified in accordance with ISO5344 conditions. Please contact IMV or your local distributor with specific test requirements.
*2 Power supply: 3-phase 380/400/415/440 V, 50/60 Hz. A transformer is required for other supply voltages.
*3 Breaker capacity for 400 V
*4 Above 2000 Hz, the force rolls-off at a rate of -12 dB/oct.
*5 Specification above applies to 50 Hz. Dimensions change for 60 Hz.
*6 For high velocity option
*7 An export license is required for exporting the shaker system of over 50 kN sine force.
*The specification shows the maximum system performance. For long-duration tests, system must be de-rated up to 70%.
Continuous use at maximum levels may cause failure. Please contact IMV if your system operates at more than 70%.
*For random vibration tests, please set the test definition of the peak value of acceleration waveform to operate at less than the maximum acceleration of shock.
*Frequency range values vary according to the sensor and vibration controller.
*Armature mass and acceleration may change when a chamber is added.

CE UKCA

K-series

High-Excitation-Force Water-Cooled Range

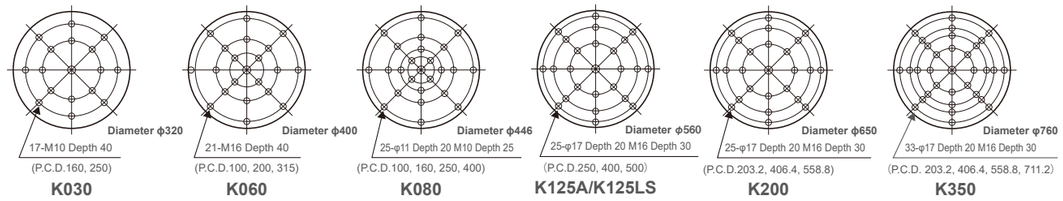
K350
(With a slip table)

High-excitation-force and silent water-cooled system for improving your test environment

K-series, the high-excitation-force water-cooled vibration-simulating test systems fully developed by IMV. Advanced performance from the K-series will significantly improve your test environment.

[Silent system design] The water-cooling system produces neither the intake nor exhaust sounds that an air-cooling system does.
[Record of significant accomplishments] IMV has developed the most advanced water-cooled system.

Table Insert Pattern (Unit: mm)



Specifications

System Model			K030/SA4HAG	K062/SA8HAG*6	K080/SA10HAG*6	K100A/SA14HAG*6	K125A/SA18HAG*6	K100LS/SA16HAG*6	K125LS/SA20HAG*6	K200/SA24HAG*6	K350/SA36HAG*6
System Specifications	Frequency Range (Hz)		0–3000	0–2500	0–2500	0–2500	0–2500	0–2000	0–2000	0–2000	0–2000
	Rated Force	Sine (kN)	30.8	61.7	80	100	125	100	125	200	350
		Random (kN rms)*1	21.5	61.7	80	100	125	100	125	200	315
		Shock (kN)	61.6	123.4	160	200	250	200	250	400	700
	Maximum Acc.	Sine (m/s^2)	1000	1000	1000	1000	1000	1000	1000	1000	1000
		Random (m/s^2 rms)	557	700	700	700	700	700	700	700	700
		Shock (m/s^2 peak)	2000	2000	2000	2000	2000	2000	2000	2000	2000
	Maximum Vel.	Sine (m/s)*3	1.8	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0
		Shock (m/s peak)	1.8	2.0	2.0	2.0	2.0	2.0	2.0	2.4	3.5
	Maximum Disp.	Sine (mmp-p)	51	51	51	51	51	100	100	76.2	76.2
	Maximum Travel (mmp-p)		58	60	59	62	62	116	116	86	94
	Maximum Load (kg)		500	1000	1000	2000	2000	2000	2000	2000	3000
	Power Requirements (kVA)*2		49	87	100	150	170	170	190	300	325
	Breaker Capacity (A)*4		100	150	175	300	300	300	350	600	400/200
Vibration Generator	Model		K030	K060	K080	K125A	K125A	K125LS	K125LS	K200	K350
	Armature Mass (kg)		27	40	60	80	80	100	100	200	350
	Armature Diameter (φmm)		320	400	446	560	560	560	560	650	760
	Allowable Eccentric Moment (N•m)		980	980	1550	2450	2450	2450	2450	4900	4900
	Dimensions (mm) W×H×D		1100×1090×824	1380×1085×1000	1595×1200×1050	1776×1373×1300	1776×1373×1300	1990×1546×1370	1990×1546×1370	2465×1908×1740	3020×2306×2080
	Shaker Body Diameter (φmm)		760	900	1000	1100	1100	1100	1100	1260	1630
	Mass (kg)		3000	3700	5000	7000	7000	8000	8000	19000	40000
Power Amplifier	Model*7		1BGH4-K030	1BGH8-K060	1BGH10-K080	1BGH14-K125A	1BGH18-K125A	1BGH16-K125LS	1BGH20-K125LS	1BGJ24-K200	1BGH36-K350
	Maximum Output (kVA)		33	60	100	98	124	124	155	320	400
	Dimensions (mm) W×H×D		1160×1950×850	1160×1950×850	1160×1950×850	1740×1950×850	1740×1950×850	1740×1950×850	1740×1950×850	2900×1950×850	4060×1950×850
	Mass (kg)		950	1350	1500	2500	2600	2600	3300	5000	5450
Controller	Vibration Controller		See Vibration Controller K2								
Cooling	Cooling Method		Shaker: Water cooling/Power Amplifier: Air Cooling								
	Primary Cooling Water (ℓ/min)		195	260	390	390	390	390	390	650*5	650*5
	Heat Exchanger	Dimensions (mm) W×H×D	580×1700×850	580×1700×850	580×1700×850	580×1700×850	580×1700×850	580×1700×850	580×1700×850	1050×1900×850	1200×1950×1400
		Mass (kg)	400	400	400	400	400	400	400	600	950

Eco Specifications

System Model			K030/ EM4HAG	K062/ EM8HAG*6	K080/ EM10HAG*6	K100A/ EM14HAG*6	K125A/ EM18HAG*6	K125A/ EM30HAG*6	K100LS/ EM16HAG*6	K125LS/ EM20HAG*6	K125LS/ EM30HAG*6	K200/ EM24HAG*6	K200/ EM50HAG*6	K350/ EM36HAG*6	K350/ EM50HAG*6
System Specifications	Frequency Range (Hz)		0–3000	0–2500	0–2500	0–2500	0–2500	0–2500	0–2000	0–2000	0–2000	0–2000	0–2000	0–2000	0–2000
	Rated Force	Sine (kN)	30.8	61.7	80	100	125	125	100	125	125	200	200	350	350
		Random (kN rms)*1	21.5	61.7	80	100	125	125	100	125	125	200	200	315	315
		Shock (kN)	61.6	123.4	160	200	250	375	200	250	375	400	1000	700	900
		High Velocity Shock (kN)*6	-	-	110	130	165	245	130	165	245	260	-	700	-
	Maximum Acc.	Sine (m/s^2)	1000	1000	1000	1000	1000	1000	1000	1000	1000	1000	1000	1000	1000
		Random (m/s^2 rms)	557	700	700	700	700	700	700	700	700	700	700	700	700
		Shock (m/s^2 peak)	2000	2000	2000	2000	2000	2000	2000	2000	2000	2000	2000	2000	2000
		High Velocity Shock (m/s^2 peak)*6	-	-	1833	1625	2000	2000	1300	1650	2000	1300	-	2000	-
	Maximum Vel.	Sine (m/s)*3	1.8	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0
		Shock (m/s peak)	1.8	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.4	2.4	3.5	3.5
		High Velocity Shock (m/s peak)*6	-	-	3.5	3.5	3.5	3.5	3.5	3.5	3.5	3.5	-	3.5	-
	Maximum Disp.	Sine (mmp-p)	51	51	51	51	51	51	100	100	100	76.2	76.2	76.2	76.2
	Maximum Travel (mmp-p)		58	60	59	62	62	62	116	116	116	86	86	94	94
	Maximum Load (kg)		500	1000	1000	2000	2000	2000	2000	2000	2000	2000	2000	3000	3000
	Power Requirements (kVA)*2		49	87	100	150	170	170	170	190	190	300	300	325	325
	Breaker Capacity (A)*4		100	175	175	300	350	350	300	350	350	-	-	-	-
Vibration Generator	Model		K030	K060	K080	K125A	K125A	K125A	K125LS	K125LS	K125LS	K200	K200	K350	K350
	Armature Mass (kg)		27	40	60	80	80	80	100	100	100	200	200	350	350
	Armature Diameter (φmm)		320	400	446	560	560	560	560	560	560	650	650	760	760
	Allowable Eccentric Moment (N•m)		980	980	1550	2450	2450	2450	2450	2450	2450	4900	4900	4900	4900
	Dimensions (mm) W×H×D		1100×1090×824	1380×1085×1000	1595×1200×1050	1776×1373×1300	1776×1373×1300	1776×1373×1300	1990×1546×1370	1990×1546×1370	1990×1546×1370	2465×1908×1740	2465×1908×1740	3020×2306×2080	3020×2306×2080
	Shaker Body Diameter (φmm)		760	900	1000	1100	1100	1100	1100	1100	1100	1260	1260	1630	1630
	Mass (kg)		3000	3700	5000	7000	7000	7000	8000	8000	8000	19000	19000	40000	40000
Power Amplifier	Model		2BGH4-K030	2BGH8-K060	2BGH10-K080	2BGH14-K125A	2BGH18-K125A	2BGH30-K125A	2BGH16-K125LS	2BGH20-K125LS	2BGH30-K125LS	2BGJ24-K200	2BGJ50-K200	2BGH36-K350	2BGH50-K350
	Maximum Output (kVA)		33	60	100	98	124	124	124	155	155	320	300	400	400
	Dimensions (mm) W×H×D		1160×1950×850	1160×1950×850	1160×1950×850	1740×1950×850	1740×1950×850	2320×1950×850	1740×1950×850	1740×1950×850	2320×1950×850	2900×1950×850	4060×1950×850	4060×1950×850	4060×1950×850
	Mass (kg)		1300	1350	1500	2500	2600	3550	2650	3350	3550	5000	6000	5450	7000
	Vibration Controller		See Vibration Controller K2												
Cooling	Cooling Method		Shaker: Water cooling/Power Amplifier: Air Cooling												
	Primary Cooling Water (ℓ/min)		195	260	390	390*5	390*5	390*5	390*5	390*5	390*5	650*5	650*5	650*5	650*5
	Heat Exchanger	Dimensions (mm) W×H×D	580×1700×850	580×1700×850	580×1700×850	580×1700×850	580×1700×850	580×1700×850	580×1700×850	580×1700×850	580×1700×850	1050×1900×800	1050×1900×800	1200×1950×1400	1200×1950×1400
		Mass (kg)	400	400	400	400	400	400	400	400	400	600	600	950	950

*1 Random force ratings are specified in accordance with ISO5344 conditions. Please contact IMV or your local distributor with specific test requirements.
*2 Power supply: 3-phase 380/400/415/440 V, 50/60 Hz. A transformer is required for other supply voltages. *3 If the tests (Sweep or Spot) include high velocity, the maximum velocity value should be reduced to 1.4 m/s.
*4 Breaker capacity for 400 V *5 Bypass circuit is needed. Please contact IMV or your local distributor for further information.
*6 An export license is required for exporting the shaker system of over 50 kN sine force.
*"HAG" type is scheduled to be released in April, 2022. "HAM" or "AM" type will be applied until then.
*The specification shows the maximum system performance. For long-duration tests, system must be de-rated up to 70%.
Continuous use at maximum levels may cause failure. Please contact IMV if your system operates at more than 70%.
*For random vibration tests, please set the test definition of the peak value of acceleration waveform to operate at less than the maximum acceleration of shock.
*Frequency range values vary according to the sensor and vibration controller.
*Armature mass and acceleration may change when a chamber is added.
*Hydraulic unit for lower hydraulic bearing is attached for K200 and K350. Please contact IMV or your local distributor for further information.

m-series

Low Acoustic Noise and Compact Range

m030/MA1

Silent model suitable for abnormal noise inspection

Compact and silent design, but also powerful enough for full-scale tests.

[Silent design employing a built-in cooling fan]

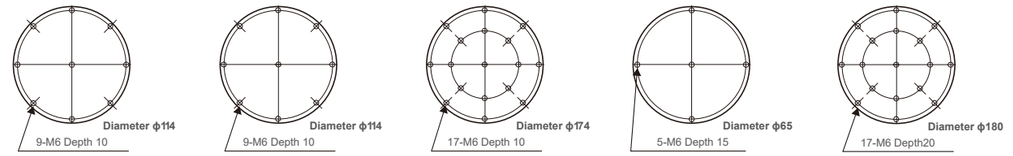
DC-powered cooling fan is built into the shaker. Natural air-cooling is also used when the cooling fan is stopped for silent operation (with a reduction in performance).

Specifications

System Model			m030/MA1-CE	m060/MA1-CE	m120/MA1-CE	m030H/MA1	m130LS/MA1-CE
System Specifications	Frequency Range (Hz)		0 – 3000	0 – 3000	0 – 2000	1000 – 10000	2 – 1000
	Rated force	Sine (N)	300	600	1200	380	1300
		Random (N rms)	210	420	840	266	650
		Shock (N)	300	600	1200	380	1300
	Maximum Acc.	No Load (m/s²)	500	500	500	200	130
		0.5kg Load (m/s²)	272	352	413	158	123
		1.0kg Load (m/s²)	187	272	352	131	118
	Maximum Velocity (m/s)		1.6	1.6	1.6	— *1	1.0
	Maximum Displacement (mmp-p)		26	30	30	— *1	51
	Maximum Load (kg)		15	15	120	15	100
	Power Requirements (kVA)*2		0.4	0.7	1.1	0.5	1.0
Vibration Generator	Model		m030-CE	m060-CE	m120-CE	m030H	m130LS-CE
	Armature Support Method		Diaphragm spring	Diaphragm spring	Air Suspension	Rubber spring	Air Suspension
	Armature Mass (kg)		0.6	1.2	2.4	1.9	10
	Armature Diameter (φmm)		114	114	174	65	180
	Dimensions (mm)		φ190 × H240	φ230 × H281	φ320 × H327*3	φ190 × H275	W410 × H592 × D460
	Mass (kg)		22	40	110	30	250
Power Amplifier	Model		MA1-CE	MA1-CE	MA1-CE	MA1-CE	MA1-CE
	Maximum Output (kVA)		1.0	1.0	1.0	1.0	1.0
	Dimensions (mm) W × H × D		430 × 149 × 430	430 × 149 × 430	430 × 149 × 430	430 × 149 × 430	430 × 149 × 430
	Mass (kg)		25	25	25	25	25
	Cooling Method		Air cooling				
Cooling	Blower		Housed in vibration generator				

*1 The displacement at the lower limit of frequency (1000 Hz) and maximum acceleration (200 m/s²) is so small that there is no certified value.
*2 Power supply: single-phase AC100 V/200 V or AC110 V/220 V or AC120 V/240 V ±10% 50/60 Hz. A transformer is required for other supply voltages.
*3 Insulation pad (W410 x H45 x D410 mm) is standard equipment.
*The specification shows the maximum system performance. For long-duration tests, system must be de-rated up to 70%. Continuous use at maximum levels may cause failure. Please contact IMV if your system operates at more than 70%.
*Frequency range values vary according to the sensor and vibration controller.

Table Insert Pattern (Unit: mm)



Accessories

A pair of carrying handles

Easily carried safely by one or two operators.
*Removable m030 and m060 only

Air pump

The vibration table height is adjusted to compensate for payload weight using an air pump.

Option

Head expander

Model	Dimensions (mm)	Mass (kg)	Maximum frequency (Hz)	m030	m060	m120
TBV-125-□-A	125 × 125 × t 20	0.9	2000	○	○	
TBV-200-□-A	200 × 200 × t 20	2.5	1500	○*	○	○
TBV-315-□-A	315 × 315 × t 30	8.5	1000		○*	○
*TBV-400-□-A	400 × 400 × t 35	14.4	600			○*

"-A" at the end of model number shows that material is aluminum alloy.
Add the vibration generator type where "□" is shown.
*Asupplementary guidance system using linear bearings is used with the vibration generator when combined with the head expander.
Armature mass is increased due to the addition of the guide support.

Head expander

Supplementary guidance system (GDP)

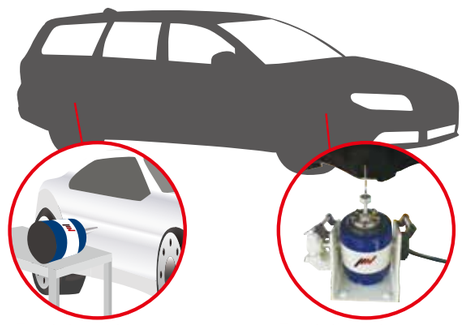
Slip table

Model	Dimensions (mm)	Maximum frequency (Hz)	Mass (kg)			
			m030	m060	m120	m130LS
TBH-200	200 × 200	500	4	4	5.5	-
TBH-315	315 × 315	500	7.5	7.5	9	-
TBH-400	400 × 400	500	-	12.3	14	-
TBH-500	500 × 500	500	-	-	-	28

*The material of slip plate is aluminum alloy.

Slip table

Excitation at any selected point



Excitation at body

Excitation at drive shaft

Modal analysis can be done by applying vibration to the car body, etc.

Emergency stop switch

It is possible to stop the system in an emergency.

Moving device

Eliminates the hassle of moving the machine and enables tests to be performed in any available space.

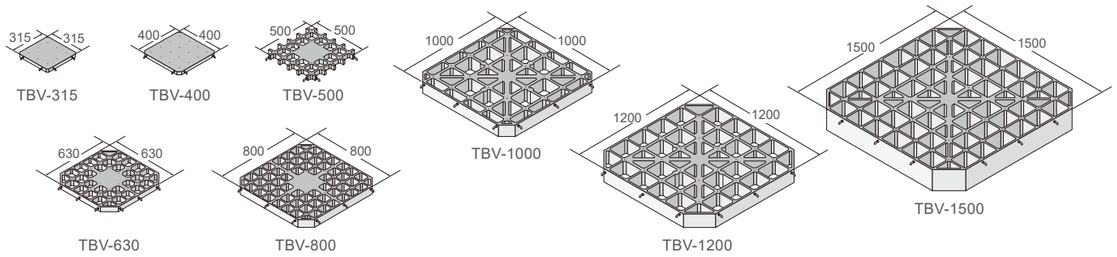
CE UKCA

Optional Units

Head expanders and cubic fixtures

Head expanders

Where the size of the specimen exceeds the dimensions of the armature a head expander should be used. Generally, the maximum usable frequency is reduced as the size of specimen increases. The head expander should be selected based on specimen size and maximum test frequency required. Properties of the standard range of head expanders is shown in the table.

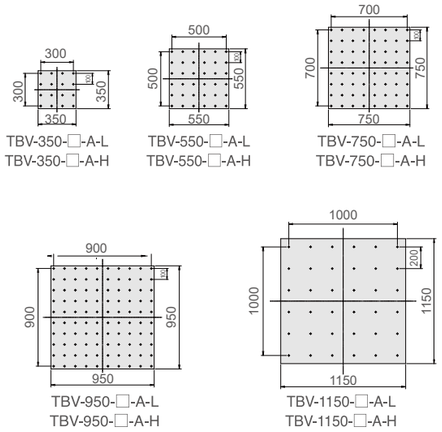


Model	Dimensions (mm)	Mass (kg)	Maximum frequency (Hz)	A-series						i-series	
				A11	A22	A30	A45	A65	A74	i210	i220
TBV-125-□-A	125 × 125 t 20	0.9	2000	-	-	-	-	-	-	○	-
TBV-125-□-M		0.6		-	-	-	-	-	-	○	-
TBV-315-□-A	315 × 315 t 30	8.5	1000	○	○	○	-	-	-	○	○
TBV-315-□-M		5.8		○	○	○	-	-	-	○	○
TBV-400-□-A	400 × 400 t 30	13	600	○	○	○	-	-	-	○	○
TBV-400-□-M		9		○	○	○	-	-	-	○	○
TBV-500-□-A	500 × 500 t 40	15	500	○	○	○	○	○	○	○	○
TBV-500-□-M		10.4		○	○	○	○	○	○	○	○
TBV-630-□-A	630 × 630 t 45	19	360	○	○	○	○	○	○	○	○
TBV-630-□-M		12.5		○	○	○	○	○	○	○	○
TBV-800-□-A	800 × 800 t 70	45	350	○	○	○	○	○	○	-	○
TBV-800-□-M		30		○	○	○	○	○	○	-	○
TBV-1000-□-A	1000 × 1000 t 110	110	350	○	○	○	○	○	○	-	-
TBV-1000-□-M		78		○	○	○	○	○	○	-	-
TBV-1200-□-A	1200 × 1200 t 125	180	200	-	○	○	○	○	○	-	-
TBV-1500-□-A	1500 × 1500 t 200	300	200	-	-	-	○	○	○	-	-

Model	Dimensions (mm)	Mass (kg)	Maximum frequency (Hz)	J-series				K-series						
				J230	J240	J250	J260	K030	K060	K080	K125	K125LS	K200	K350
TBV-125-□-A	125×125 t 20	0.9	2000	-	-	-	-	-	-	-	-	-	-	-
TBV-125-□-M		0.6		-	-	-	-	-	-	-	-	-	-	-
TBV-315-□-A	315×315 t 30	8.5	1000	○	○	-	-	-	-	-	-	-	-	-
TBV-315-□-M		5.8		○	○	-	-	-	-	-	-	-	-	-
TBV-400-□-A	400×400 t 30	13	600	○	○	-	-	○	-	-	-	-	-	-
TBV-400-□-M		9		○	○	-	-	○	-	-	-	-	-	-
TBV-500-□-A	500×500 t 40	15	500	○	○	○	○	○	○	○	-	-	-	-
TBV-500-□-M		10.4		○	○	○	○	○	○	○	-	-	-	-
TBV-630-□-A	630×630 t 45	19	360	○	○	○	○	○	○	○	○	○	-	-
TBV-630-□-M		12.5		○	○	○	○	○	○	○	○	○	-	-
TBV-800-□-A	800×800 t 70	45	350	○	○	○	○	○	○	○	○	○	○	○
TBV-800-□-M		30		○	○	○	○	○	○	○	○	○	○	○
TBV-1000-□-A	1000×1000 t 110	110	350	○	○	○	○	○	○	○	○	○	○	○
TBV-1000-□-M		78		○	○	○	○	○	○	○	○	○	○	○
TBV-1200-□-A	1200 × 1200 t 125	180	200	-	○	○	○	○	○	○	○	○	○	○
TBV-1500-□-A	1500 × 1500 t 200	300	200	-	-	○	○	○	○	○	○	○	○	○

Model names ending with “A” indicate aluminum body and “M” indicate magnesium alloy. Add the vibration generator type where “□” is shown.
*The data shown refers to the IMV standard range. Custom designs can also be supplied.

Head expander (flat surface type)



Model	Dimensions (mm)	Mass (kg)	Maximum frequency (Hz)	Specimen mounting screw	Screw pitch
TBV-350-□-A-L	350×350×t 33	6	750	M10 Depth25	□100mmPitch
TBV-350-□-A-H	350×350×t 65	11	1500	M10 Depth25	□100mmPitch
TBV-550-□-A-L	550×550×t 30	17	300	M10 Depth25	□100mmPitch
TBV-550-□-A-H	550×550×t 60	30	600	M10 Depth25	□100mmPitch
TBV-750-□-A-L	750×750×t 38	30	200	M10 Depth25	□100mmPitch
TBV-750-□-A-H	750×750×t 75	55	400	M10 Depth25	□100mmPitch
TBV-950-□-A-L	950×950×t 45	45	150	M10 Depth25	□100mmPitch
TBV-950-□-A-H	950×950×t 90	80	300	M10 Depth25	□100mmPitch
TBV-1150-□-A-L	1150×1150×t 60	90	120	M10 Depth25	□200mmPitch
TBV-1150-□-A-H	1150×1150×t 120	160	240	M10 Depth25	□200mmPitch

Model names ending with “A” indicate aluminum body.
Add the vibration generator type where “□” is shown.
Please contact us for more information.

Options for use with vertical tables

Guide system, additional air spring

The following option increases the allowable overturning moment of the head expander.

- Additional guide system
  Enabling larger or off-centre specimens to be tested.
- Additional air spring
  Providing additional load support to accommodate higher specimen & fixture mass.

*Some models do not support the options above

Vibration generator

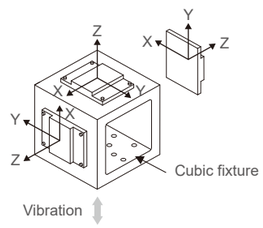
High-frequency model

A head-expander having exceptionally low mass and special dual conical shape giving excellent damping.

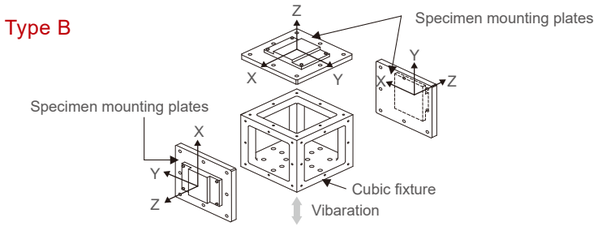
Cubic fixture

The specimen can be fastened to the top or the side face of the cubic fixture where testing in each axis is required.
Two types of cubic fixture are available. Type A has fixing holes on each face, Type B has specimen mounting plates which attach to the cubic frame.

Type A



Type B



Cubic fixture (Type A)				specimen mounting plates	
Model	Dimensions (mm)	Mass (kg)	Maximum frequency (Hz)	Model	Mass (kg)
TCJ-A150-□-A	150×150×150	5.5	2000	TCJ-B150-P-A	1.5
TCJ-A150-□-M		4		TCJ-B150-P-M	1.1
TCJ-A160-□-A	160×160×160	6.5	2000	TCJ-B160-P-A	1.7
TCJ-A160-□-M		4.6		TCJ-B160-P-M	1.3
TCJ-A200-□-A	200×200×200	8	1000	TCJ-B200-P-A	3.5
TCJ-A200-□-M		5.6		TCJ-B200-P-M	2.5
TCJ-A250-□-A	250×250×250	13.5	650	TCJ-B250-P-A	4.5
TCJ-A250-□-M		9.5		TCJ-B250-P-M	3.2
TCJ-A300-□-A	300×300×300	20	400	TCJ-B300-P-A	6.5
TCJ-A300-□-M		14		TCJ-B300-P-M	4.5

Cubic fixture (Type B)				specimen mounting plates	
Model	Dimensions (mm)	Mass (kg)	Maximum frequency (Hz)	Model	Mass (kg)
TCJ-B150-□-A	150×150×150	3.5	2000	TCJ-B150-P-A	1.5
TCJ-B150-□-M		2.5		TCJ-B150-P-M	1.1
TCJ-B160-□-A	160×160×160	4	2000	TCJ-B160-P-A	1.7
TCJ-B160-□-M		2.8		TCJ-B160-P-M	1.3
TCJ-B200-□-A	200×200×200	10	2000	TCJ-B200-P-A	3.5
TCJ-B200-□-M		7		TCJ-B200-P-M	2.5
TCJ-B250-□-A	250×250×250	20	1000	TCJ-B250-P-A	4.5
TCJ-B250-□-M		14		TCJ-B250-P-M	3.2
TCJ-B300-□-A	300×300×300	20	600	TCJ-B300-P-A	6.5
TCJ-B300-□-M		14		TCJ-B300-P-M	4.5

Model names ending with “A” indicate aluminum body and “M” indicate magnesium alloy. Add the vibration generator type where “□” is shown.

Optional Units

Slip table

Slip table

A slip table is required for testing a specimen along its horizontal axis, or when a heavy specimen is to be tested.
Slip tables are designed to achieve low friction in the driven axis, while supporting heavy loads and introducing minimal waveform distortion.



Type and features of slip table

MB: Mechanical Bearing

Mechanical bearing employs the linear motion guide which incorporates a component with a linear rolling motion into practical use. It significantly contributes to high performance of table which are high-rigidity, high load and long stroke motion. Another strong feature of the mechanical bearing is easy to operate. Since it is light weighted and no need for a hydraulic unit.

Model	TBH-550-□-A-MB		
Table Size (mm)	550 × 550		
Moment (N•m)	9300		
Maximum Load (kg)	1000		
Vibration Generator	Moving Mass* (kg)	Frequency (Hz)	Table Thickness (mm)
A11	46	2000	30
A22	47		

Model	TBH-550-□-A-MB			TBH-750-□-A-MB			TBH-950-□-A-MB			TBH-1150-□-A-MB		
Table Size (mm)	550 × 550			750 × 750			950 × 950			1150 × 1150		
Moment (N•m)	9300			12700			19700			51500		
Maximum Load (kg)	1000			2000			2000			2000		
Vibration Generator	Moving Mass* (kg)	Frequency (Hz)	Table Thickness (mm)	Moving Mass* (kg)	Frequency (Hz)	Table Thickness (mm)	Moving Mass* (kg)	Frequency (Hz)	Table Thickness (mm)	Moving Mass* (kg)	Frequency (Hz)	Table Thickness (mm)
A30	47	2000	30	75	2000	30	106	2000	30	151	2000	40
A45	54			87			114			160		
A65/A74		2000*1			2000*1			2000*1			2000*1	

*1 Above 1600 Hz, the force rolls-off at a rate of -6db/oct.
*The weight is referring the plate made of aluminum.
*□ is the model number of the vibration generator.
*Please contact us about the table size over 1150 × 1300.

ST: Oil Film Type

It is supported on oil film. Constantly create oil film at reverse side of the table letting the table slide with low friction. Pump oil unit is located in the slip table base. Since moving mass is small, it becomes one of the most standard slip table with substantial sales record.

Model	TBH-500-□-A-ST			TBH-630-□-A-ST			TBH-800-□-A-ST			TBH-1000-□-A-ST		
Table Size (mm)	500 × 500			630 × 630			800 × 800			1000 × 1000		
Pitch Moment (N•m)	200			400			800			1300		
Maximum Load (kg)	200			300			400			500		
Vibration Generator	Moving Mass* (kg)	Frequency (Hz)	Thickness (mm)	Moving Mass* (kg)	Frequency (Hz)	Thickness (mm)	Moving Mass* (kg)	Frequency (Hz)	Thickness (mm)	Moving Mass* (kg)	Frequency (Hz)	Thickness (mm)
i210	33	2500	30	45	2000	30	-	-	-	-	-	-
i220							65	2000	30	100	1250	30
K030		2000										
K060	60		50	80		50	115		50	170		50
K080	-	-	-									

*The material of slip plate is aluminum alloy. It is possible to change to magnesium. Please contact us for more information.
*□ is the model number of the vibration generator.

TT-L: Hydrostatic Bearing (Low Pressure)/TT-H: Hydrostatic Bearing (High Pressure)

Locating multiple hydrostatic bearing on high rigid base to support slip table. Special purpose designed hydrostatic bearing realizes high load and allowable eccentric moment.

TT-L: Hydrostatic Bearing (Low Pressure)

Model	TBH-500-□-A-TTL			TBH-630-□-A-TTL			TBH-800-□-A-TTL			TBH-1000-□-A-TTL			TBH-1200-□-A-TTL			TBH-1500-□-A-TTL			TBH-1800-□-A-TTL			TBH-2000-□-A-TTL		
Table Size (mm)	500 × 500			630 × 630			800 × 800			1000 × 1000			1200 × 1200			1500 × 1500			1800 × 1800			2000 × 2000		
Pitch Moment (N•m)	1100			1100			2200			2200			4600			6500			10000			10000		
Maximum Load (kg)	700			1000			1000			1500			2000			2000			2500			2500		
Vibration Generator	Moving Mass* (kg)	Frequency (Hz)	Thickness (mm)	Moving Mass* (kg)	Frequency (Hz)	Thickness (mm)	Moving Mass* (kg)	Frequency (Hz)	Thickness (mm)	Moving Mass* (kg)	Frequency (Hz)	Thickness (mm)	Moving Mass* (kg)	Frequency (Hz)	Thickness (mm)	Moving Mass* (kg)	Frequency (Hz)	Thickness (mm)	Moving Mass* (kg)	Frequency (Hz)	Thickness (mm)	Moving Mass* (kg)	Frequency (Hz)	Thickness (mm)
i210	40	2000	30	53	2000	30	75	1600	30	105	1000	30	280	900	50	450	800	50	650	600	50	800	500	50
i220	43			55			78			108														
J230	50	1600		63	1600		85	1250		118														
J240																								
J250	70		40	85		40	115		40	155		40												
J260																								

*The material of slip plate is aluminum alloy. It is possible to change to magnesium. Please contact us for more information. *□ is the model number of the vibration generator.

Model	TBH-550-□-A-TTL			TBH-750-□-A-TTL			TBH-950-□-A-TTL		
Table Size (mm)	550 × 550			750 × 750			950 × 950		
Pitch Moment (N•m)	1100			2200			2200		
Maximum Load (kg)	1000			1500			1500		
Vibration Generator	Moving Mass* (kg)	Frequency (Hz)	Thickness (mm)	Moving Mass* (kg)	Frequency (Hz)	Thickness (mm)	Moving Mass* (kg)	Frequency (Hz)	Thickness (mm)
A11	52	2000	30	-	-	-	-	-	-
A22	53								
A30				78	1600	30	105	1000	30
A45	64						115		
A65/A74		2000*		89					

*Above 1600 Hz, the force rolls-off at a rate of -6db/oct.
*□ is the model number of the vibration generator.

TT-H: Hydrostatic Bearing (High Pressure)

Model	TBH-500-□-A-TTH			TBH-630-□-A-TTH			TBH-800-□-A-TTH			TBH-1000-□-A-TTH			TBH-1200-□-A-TTH			TBH-1500-□-A-TTH			TBH-1800-□-A-TTH			TBH-2000-□-A-TTH		
Table Size (mm)	500 × 500			630 × 630			800 × 800			1000 × 1000			1200 × 1200			1500 × 1500			1800 × 1800			2000 × 2000		
Pitch Moment (N•m)	4000			4000			7700			7700			16000			22000			48000			48000		
Maximum Load (kg)	800			1200			1600			2000			2000			2000			3000			3000		
Vibration Generator	Moving Mass* (kg)	Frequency (Hz)	Thickness (mm)	Moving Mass* (kg)	Frequency (Hz)	Thickness (mm)	Moving Mass* (kg)	Frequency (Hz)	Thickness (mm)	Moving Mass* (kg)	Frequency (Hz)	Thickness (mm)	Moving Mass* (kg)	Frequency (Hz)	Thickness (mm)	Moving Mass* (kg)	Frequency (Hz)	Thickness (mm)	Moving Mass* (kg)	Frequency (Hz)	Thickness (mm)	Moving Mass* (kg)	Frequency (Hz)	Thickness (mm)
i210	60	2000	50	70	2000	50	115	2000	50	165	1250	50	280	900	50	450	800	50	650	600	50	800	500	50
i220	63			83			118			168														
J230	68	1600		88	1600		125	1250		175	1000													
J240	70			90			130			178														
J250	83			100			143			188														
J260																								
K030	68	2000		88	2000		123	2000		173	1250													
K060	93			108			145			193														
K080	78			95			133			180														
K125	103			118			155			205														
K125LS	113	1600		128	1600		170	1250		220	1000													

*The material of slip plate is aluminum alloy. It is possible to change to magnesium. Please contact us for more information. *□ is the model number of the vibration generator.

Model	TBH-550-□-A-TTH			TBH-750-□-A-TTH			TBH-950-□-A-TTH		
Table Size (mm)	550 × 550			750 × 750			950 × 950		
Pitch Moment (N•m)	4000			7700			7700		
Maximum Load (kg)	1200			2000			2000		
Vibration Generator	Moving Mass* (kg)	Frequency (Hz)	Thickness (mm)	Moving Mass* (kg)	Frequency (Hz)	Thickness (mm)	Moving Mass* (kg)	Frequency (Hz)	Thickness (mm)
A11	52	2000	30	-	-	-	-	-	-
A22	53								
A30				78	1600	30	105	1000	30
A45	66			89			115		
A65/A74		2000*							

*Above 1600 Hz, the force rolls-off at a rate of -6db/oct.
*□ is the model number of the vibration generator.

Optional Units

Slip table

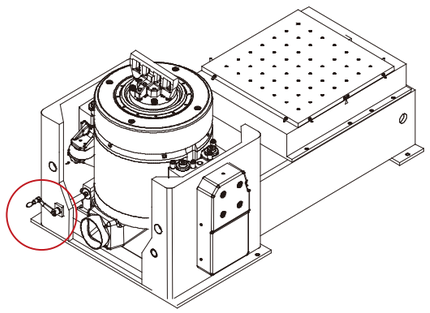
T-Film bearing range

The T-Film bearing from Team Corporation is probably the most advanced design of linear bearing available to the vibration test industry.
The slip table employs a number of bearings, each consisting of a U.S. patented bearing element and hydro static oil film.
T-Film bearings provide excellent vibration waveform linearity and are considered to be the best solution for the aerospace industry and research establishments.

Option for slip table

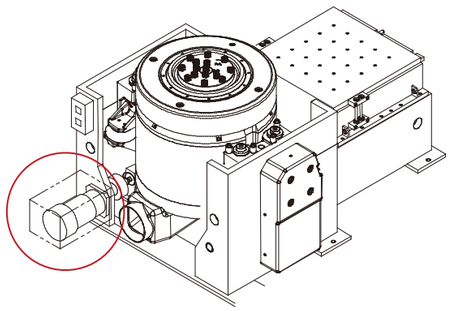
Rotation reduction gearing

A reduction gearing unit enabling easier reconfiguration of the vibration generator.
*i210 doesn't have this option.



Motor drive rotation

Powered rotation of the vibration generator.
The motor-driven rotation can be optionally installed on systems equipped with reduction gearing.



HBT (High Pressure Slip Tables)

This concept combines a standard oil-film slip table assembly with 3,000-psi hydrostatic bearings to provide high dynamic moment restraint while preserving the damping characteristics of an oil film.

Features

- Light Weight Magnesium slip plate as standard
- Precision ground granite base provides a low friction surface and high damping.
- Hydrostatic bearings offer high Pitch, Roll and Yaw moments.
- Low cross axis performance

Options Include

Gun drilled slip plate for testing with Climatic Chamber, Clean Room option for Space applications

Specification

	HBT600	HBT700	HBT900	HBT1000	HBT1200 7bgs	HBT1500 7bgs
Maximum Payload (kg)	5000	5750	7250	8000	10000	12000
Slip Plate Working Surface - square (mm)	600	700	900	1000	1200	1500
Slip Plate Material	Magnesium	Magnesium	Magnesium	Magnesium	Magnesium	Magnesium
Slip Plate Thickness (mm)	50	50	50	50	50	50
Slip Plate Grid Pattern (mm)	100 mm Grid	100 mm Grid	100 mm Grid	100 mm Grid	100 mm Grid	100 mm Grid
Slip Plate Mass (kg)	37	50	84	96	140	224
Number of Hydrostatic Bearings	2	2	2	2	7	7
Mass per Hydrostatic Bearings (kg)	5	5	5	5	5	5
Driver Bar Weight including Bolts	Please refer to the table below					
Overturning Moment Pitch (kNm)	23.6	31.0	50.3	62.8	201.2	296.6
Overturning Moment Roll (kNm)	24.7	30.7	45.7	54.8	156.5	221.8
Overturning Moment Yaw(kNm)	19.0	23.6	34.7	41.4	54.7	74.7

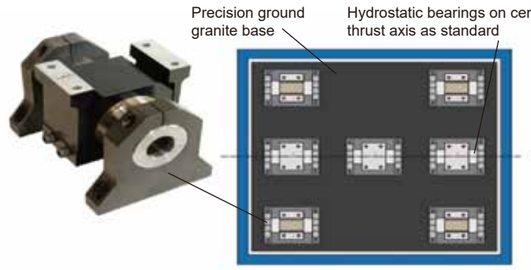
Driver Bar Weights

Vibratorion Generator Model	A20, A30, J240	A45, A74, J250, J60, K060, K080	K100LS, K125LS	K200
Driver Bar Weight including Bolts (kg)	7	17.5	31	37.5
Driver Bar to fit Armature Diameter (mm)	290	446	560	650
Insert Thread Size	M10	M10	M16	M16

Special Solutions

1. Multi Bearing Configuration

The HBT tables can be design to meet customer requirements. Adding additional bearing to increase the load capacity and overturning moment performance of the slip table.



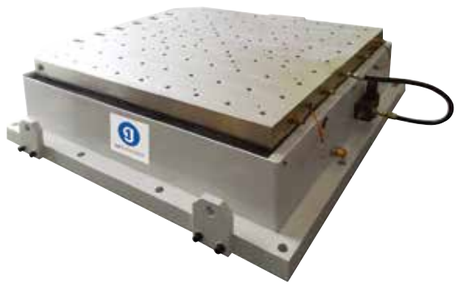
Additional hydrostatic bearings
Additional hydrostatic journal bearings either side of the centre thrust axis can be installed to increase overturning restraint. These additional bearings are so designed to allow for thermal expansion of the slip plate (2 degrees of freedom).

2. HBT Interchangeable Slip Plates

The interchangeable slip plates solution allows the Customer to adapt the size and moving mass of the table to match the size of the payload. This allows the optimisation of the used force and energy consumption. The interchangeable HBT slip table allows the Customer to have 2 shakers in 1.

Features

- Dual Magnesium Interchangeable Plates
- Multi bearing configuration
- Removable bearing and granite block protective covers
- Quick and easy plate change.



Optional Units

Slip table

VST(Vacuum Slip Table)

New concept slip table guided by balancing oil pressure and vacuum force.

Features

- Long stroke up to 160 mm
- Interchangeable table fits customer needs (option)
- High damping ratio
- High moments
- Minimum alignment operation
- Low maintenance

CENTROTECNICA S.r.l.

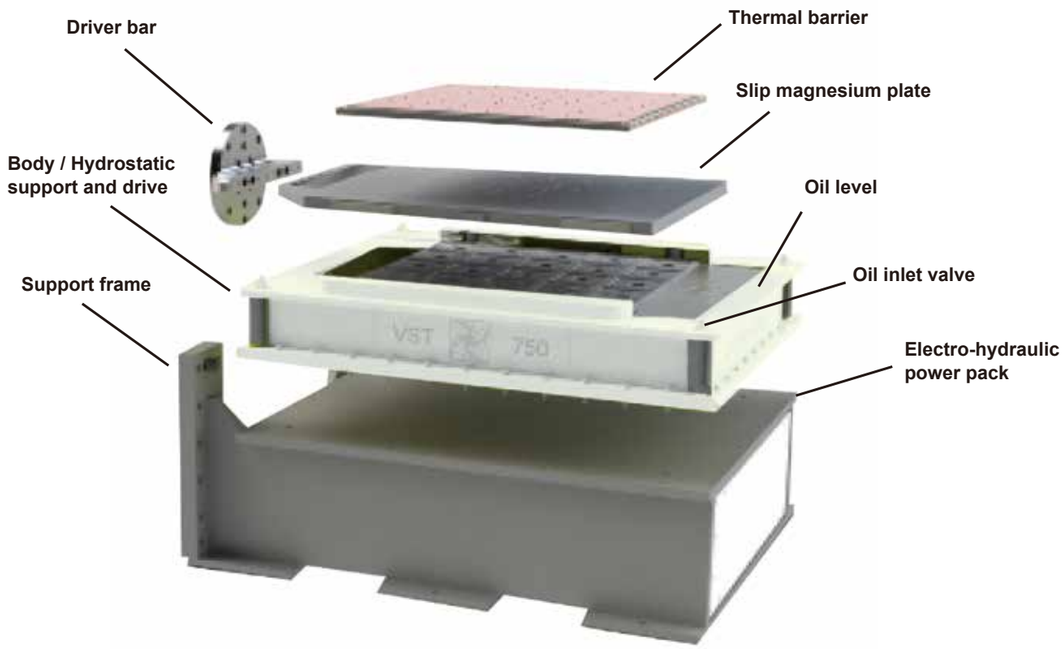
Specification

VST (Vacuum Slip Table)

Table Size		600 x 600	750 x 750	900 x 900	1050 x 1050	1200 x 1200	1500 x 1500
Weight (kg)	Magnesium	35	50	67	88	111	167
Moments (kNm)	Pitch	7.7	15	25.9	41.2	61.4	120
	Roll	7.7	15	25.9	41.2	61.4	120
	Yaw Continuous	2.8	3.7	4.7	5.6	6.5	8.4
	Yaw Ultimate	23.4	31.2	39	46.8	54.6	70.2
Maximum Displacement (mm)		160	160	160	160	160	160
Maximum Payload (kg)		640	1000	1450	1950	2550	4000
Maximum Frequency (Hz)		2000	2000	2000	2000	2000	2000
First Resonance (Hz)		1250	1050	950	830	730	600
Standard Insert Pattern	100 mm Grid	36	64	81	121	144	225
Driver Bar Weight (kg) *	Aluminium	15	15	15	15	15	15

* TBC according to the armature

VST in details

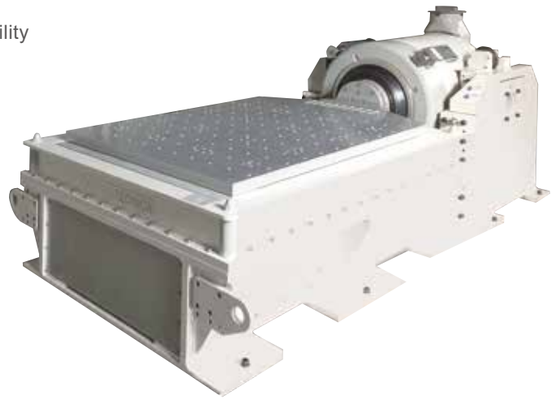


Optional Units

Slip table

RT(Rail Table)

The main innovation consists in the use of recirculating balls guideways and a particular damping technology based on the “constrained layer” principle.
The innovative system is characterized by high reliability and excellent performances, the result of a long direct field experience.



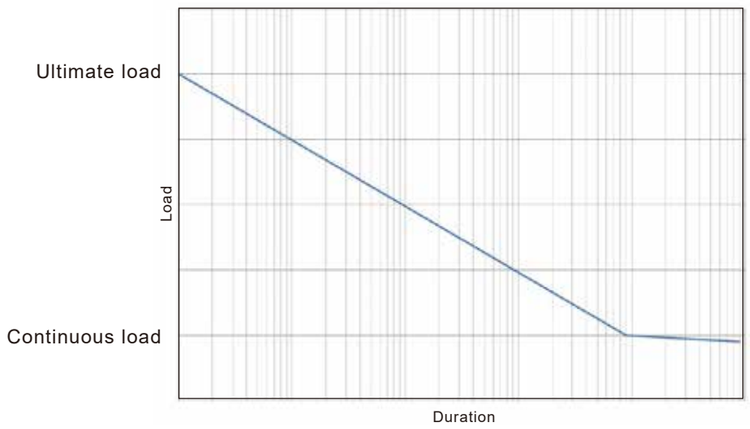
Features

- Easily to use
- No oil
- No electrical power
- No compressed air
- Long stroke
- Robust and longlasting
- Easily to repair and maintain
- Very good dynamic performances
- Oxidation resistance

Bearing lasting time

The high technical level of the Rail Table led to an extension of the working time between each maintenance.
Before the test start, the customer could easily calculate the table bearable test load and, by comparing the “continuous” and “ultimate” load values, asses the wear level which the test will cause to the table and consequently the economic impact of the maintenance.

Important : the maintenance is a very simple operation since it consists in the mere substitution of the bearings.

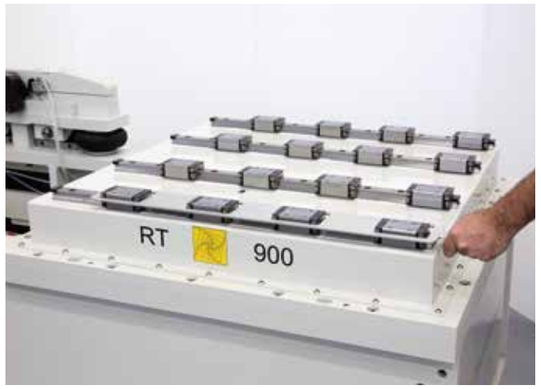


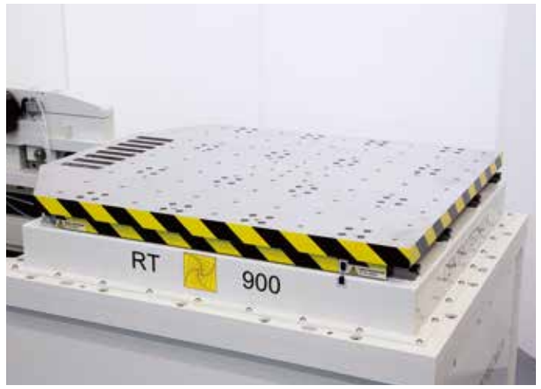
Specification

RT (Rail Table)

Table Size		450 × 450	600 × 600	750 × 750	900 × 900	1050 × 1050	1200 × 1200	1500 × 1500
Weight (kg)	Aluminium	30	50	68	96	125	160	230
	Magnesium	23	40	53	75	98	125	175
Moments (kNm)	Pitch Continuous	6.3	16.9	24.3	56.4	69.6	82.8	122.9
	Pitch Ultimate	15.7	42.25	60.75	141	174	207	307.25
	Roll Continuous	9.7	24.8	29.7	70.3	71.6	89.9	144.1
	Roll Ultimate	24.5	62	74.25	175.75	179	224.75	360.25
	Yaw Continuous	6.3	16.9	24.3	56.4	69.6	82.8	122.9
	Yaw Ultimate	15.7	42.25	60.75	141	174	207	307.25
Maximum Displacement (mm)		160	160	160	160	160	160	160
Maximum Payload (ton)		3.3	7.4	7.4	13.2	13.2	13.2	16.5
Maximum Frequency (Hz)		2000	2000	2000	2000	2000	2000	2000
First Resonance (Hz)		1400	1250	1050	950	830	750	700
Standard Insert Pattern	100 mm Grid	25	36	64	81	121	121	225
Driver Bar Weight (kg) *	Aluminium	15	15	15	15	15	15	15
Mass of Thermal Barrier (kg)		9	13.7	24	31	42	55	85.5

* TBC according to the armature



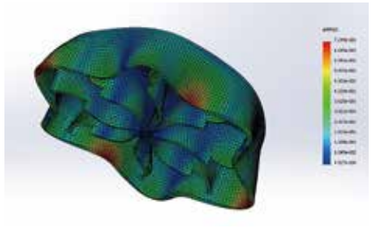


Optional Units

Fixture, Vibration Isolation, Reinforcement

Fixture

IMV has a range of fixtures, such as cube- and 'L'-shaped types, to suit most applications.
Custom fixtures are supplied, designed and analysed using finite-element modeling to ensure best performance.

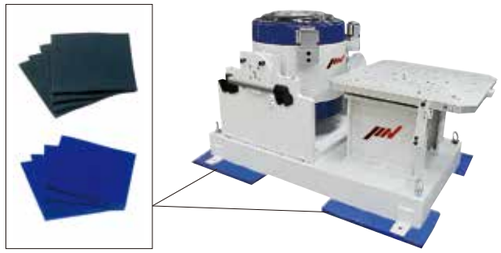


Vibration Isolation

Additional isolation mounts are available to reduce the effects of vibration on the floor and adjacent equipment.

Insulation pad

These are simple to install by placing under the vibration generator.



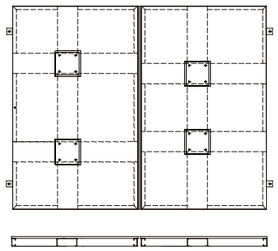
Air spring

Air springs placed under each corner of the frame support the vibration generator and are an excellent way to isolate vibration above about 5 Hz.

Reinforcement

Load-spreader base

The weight of the vibration generator can be distributed over a larger area where the maximum allowable floor loading is limited.



Optional Units

Soundproof enclosure, cooling ducting

Soundproof enclosure

A soundproof enclosure for the cooling blower reduces noise in installations where the blower cannot be located outside the work area.

inside

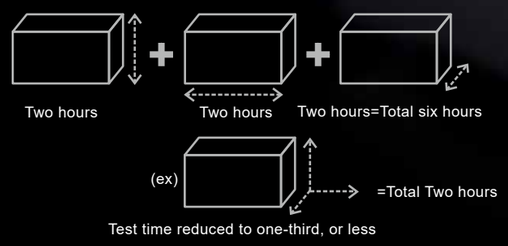
Cooling ducting

The standard arrangement for air-cooled systems is to install the blower outside the work area.
Ducting the input air from outside eliminates the changes in ambient pressure and temperature caused by the cooling air flow.

Vibration Test Systems
Multi-axis systems

Reduced test time

Testing in three-axis simultaneously instead of sequentially can reduce overall test time by eliminating the time taken to reconfigure the system, and time to run tests in each axis.



Reproduction of failure modes

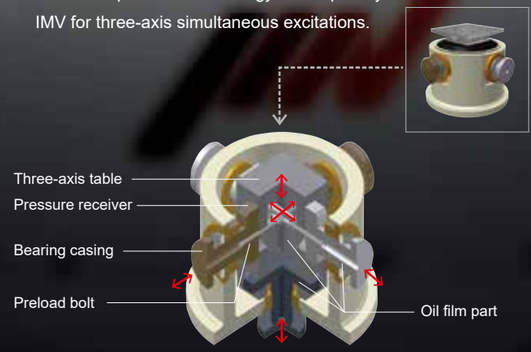
Three-axis simultaneous vibration testing reproduces real environments more accurately than sequential single-axis tests can.

A single-axis system does not achieve realistic simulation of real-world vibration.

Simultaneous three-axis testing reproduces the stress placed on specimens by complex resonances which may not be detected in single-axis testing.

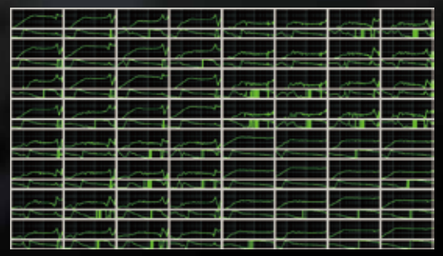
ICCU (Integrated Cross Coupling Bearing Unit)

ICCU is a patented technology developed by IMV for three-axis simultaneous excitations.



Highly accurate multi-axis multi-point control

High-precision multi-axis, multi-point control which can compensate for rotational moments generated by the specimen and fixture and accurately reproduce the vibration measured in the field.



DC-series

2-Axis Changeover Systems

DC-2000-5H

Specifications

System Model			DC-1000-4H	DC-1000-6H	DC-1000-8H	DC-1000-10M	DC-2000-5H	DC-2000-8M	DC-2000-10M	DC-2000-15M	DC-3000-5H	DC-3000-8M
System Specifications	Table Size (mm)		□400	□600	□800	□1000	□500	□800	□1000	□1500	□500	□800
	Rated Force	Sine (kN)	9.8	9.8	9.8	9.8	19.6	19.6	19.6	19.6	29.4	29.4
		Random (kN)	4.9	4.9	4.9	4.9	9.8	9.8	9.8	9.8	14.7	14.7
		Shock (kN)	14.7	14.7	14.7	14.7	29.4	29.4	29.4	29.4	44.1	44.1
	Maximum Acceleration (m/s²)		108	75	54	32	150	81	67	28	196	140
	Maximum Velocity (m/s)		1.0	1.0	1.0	1.0	1.0	1.0	1.0	0.9	1.0	1.0
	Maximum Displacement (mmp-p)		51	51	51	51	51	51	51	51	51	51
	Armature Mass (kg)		90	130	180	300	130	240	290	680	150	210
	Maximum Frequency	Horizontal (Hz)	1000	800	700	350	800	500	350	250	800	500
		Vertical (Hz)	1000	1000	700	500	800	800	500	350	800	800
	Maximum Load (kg)		100	100	200	200	200	300	500	500	200	300
	Power Requirements (kVA)		25	25	25	25	43	43	43	43	52	52
	Primary Cooling Water (ℓ/min)		–	–	–	–	–	–	–	–	–	–

System Model			DC-3000-10M	DC-3000-15M	DC-5000-6H	DC-5000-8H	DC-5000-10M	DC-5000-15M	DC-6000-6H	DC-6000-8H	DC-6000-10M	DC-6000-15M
System Specifications	Table Size (mm)		□1000	□1500	□600	□800	□1000	□1500	□600	□800	□1000	□1500
	Rated Force	Sine (kN)	29.4	29.4	49	49	49	49	61.7	61.7	61.7	61.7
		Random (kN)	14.7	14.7	29.4	29.4	24.5	24.5	37	37	30.8	30.8
		Shock (kN)	44.1	44.1	73.5	73.5	58.8	58.8	92.5	92.5	74	74
	Maximum Acceleration (m/s²)		91	47	350	204	163	59	385	268	102	75
	Maximum Velocity (m/s)		1.0	0.9	1.0	1.0	0.9	0.9	1.0	1.0	0.9	0.9
	Maximum Displacement (mmp-p)		51	51	51	51	51	51	51	51	51	51
	Armature Mass (kg)		320	620	140	240	300	820	160	230	600	820
	Maximum Frequency	Horizontal (Hz)	350	250	800	700	350	250	800	700	350	250
		Vertical(Hz)	500	350	1000	800	500	350	1000	800	500	350
	Maximum Load (kg)		500	500	300	300	500	700	300	300	500	700
	Power Requirements (kVA)		52	52	75	75	73	73	93	93	91	91
	Primary Cooling Water (ℓ/min)		–	–	195	195	190	190	230	230	225	225

*Depending on the reference PSD or other operating conditions such as the specimen, one part of the controlled response may deviate from the reference PSD.
*The above is just an example. Specifications may be changed depending on test conditions. Please contact us for more information.

CE UKCA

TC-series

3-Axis Changeover Systems

TC-3000-6H

Specifications

System Model			TC-1000-4H	TC-1000-6H	TC-1000-8H	TC-1000-10M	TC-2000-5H	TC-2000-8M	TC-2000-10M	TC-2000-15M	TC-3000-5H	TC-3000-8M
System Specifications	Table Size (mm)		□400	□600	□800	□1000	□500	□800	□1000	□1500	□500	□800
	Rated Force	Sine (kN)	9.8	9.8	9.8	9.8	19.6	19.6	19.6	19.6	29.4	29.4
		Random (kN)	4.9	4.9	4.9	4.9	9.8	9.8	9.8	9.8	14.7	14.7
		Shock (kN)	14.7	14.7	14.7	14.7	29.4	29.4	29.4	29.4	44.1	44.1
	Maximum Acceleration (m/s²)		98	65	42	33	163	98	65	30	196	113
	Maximum Velocity (m/s)		1.0	1.0	1.0	1.0	1.0	1.0	1.0	0.9	1.0	1.0
	Maximum Displacement (mmp-p)		51	51	51	51	51	51	51	51	51	51
	Armature Mass (kg)		100	150	230	290	120	200	300	640	150	260
	Maximum Frequency	Horizontal (Hz)	1000	800	700	350	800	500	350	250	800	500
		Vertical (Hz)	1000	1000	700	500	800	800	500	350	800	800
	Maximum Load (kg)		100	100	200	200	200	300	500	500	200	300
	Power Requirements (kVA)		27	27	27	27	43	43	43	43	52	52
	Primary Cooling Water (ℓ/min)		–	–	–	–	–	–	–	–	–	–

System Model			TC-3000-10M	TC-3000-15M	TC-5000-6H	TC-5000-8H	TC-5000-10M	TC-5000-15M	TC-6000-6H	TC-6000-8H	TC-6000-10M	TC-6000-15M
System Specifications	Table Size (mm)		□1000	□1500	□600	□800	□1000	□1500	□600	□800	□1000	□1500
	Rated Force	Sine (kN)	29.4	29.4	49	49	49	49	61.7	61.7	61.7	61.7
		Random (kN)	14.7	14.7	29.4	29.4	24.5	24.5	37	37	30.8	30.8
		Shock (kN)	44.1	44.1	73.5	73.5	58.8	58.8	92.5	92.5	74	74
	Maximum Acceleration (m/s²)		73	43	306	222	158	67	342	257	199	84
	Maximum Velocity (m/s)		1.0	0.9	1.0	1.0	0.9	0.9	1.0	1.0	0.9	0.9
	Maximum Displacement (mmp-p)		51	51	51	51	51	51	51	51	51	51
	Armature Mass (kg)		400	680	160	220	310	730	180	240	310	730
	Maximum Frequency	Horizontal (Hz)	350	250	800	700	350	250	800	700	350	250
		Vertical (Hz)	500	350	1000	800	500	350	1000	800	500	350
	Maximum Load (kg)		500	500	300	300	500	700	300	300	500	700
	Power Requirements (kVA)		52	52	77	77	75	75	93	93	91	91
	Primary Cooling Water (ℓ/min)		–	–	195	195	190	190	230	230	225	225

*Depending on the reference PSD or other operating conditions such as the specimen, one part of the controlled response may deviate from the reference PSD.
*The above is just an example. Specifications may be changed depending on test conditions. Please contact us for more information.

CE UKCA

DS-series

2-Axis Simultaneous Systems

DS-2000-4H

Specifications

System Model		DS-1000-4H	DS-1000-6H	DS-1000-8H	DS-1000-10M	DS-2000-5H	DS-2000-8M	DS-2000-10M	DS-2000-15M	DS-3000-5H	DS-3000-8M
System Specifications	Table Size (mm)	□400	□600	□800	□1000	□500	□800	□1000	□1500	□500	□800
	Rated Force Sine (kN)	9.8	9.8	9.8	9.8	19.6	19.6	19.6	19.6	29.4	29.4
	Rated Force Random (kN)	4.9	4.9	4.9	4.9	9.8	9.8	9.8	9.8	14.7	14.7
	Rated Force Shock (kN)	14.7	14.7	14.7	14.7	29.4	29.4	29.4	29.4	44.1	44.1
	Maximum Acceleration (m/s²)	108	75	54	32	150	81	67	28	196	140
	Maximum Velocity (m/s)	1.0	1.0	1.0	1.0	1.0	1.0	1.0	0.9	1.0	1.0
	Maximum Displacement (mmp-p)	51	51	51	51	51	51	51	51	51	51
	Armature Mass (kg)	90	130	180	300	130	240	290	680	150	210
	Maximum Frequency Horizontal (Hz)	1000	800	700	350	800	500	350	250	800	500
	Maximum Frequency Vertical (Hz)	1000	1000	700	500	800	800	500	350	800	800
	Maximum Load (kg)	100	100	200	200	200	300	500	500	200	300
	Power Requirements (kVA)	30	30	30	30	66	66	66	66	76	76
	Primary Cooling Water (ℓ /min)	–	–	–	–	–	–	–	–	–	–

System Model		DS-3000-10M	DS-3000-15M	DS-5000-6H	DS-5000-8H	DS-5000-10M	DS-5000-15M	DS-6000-6H	DS-6000-8H	DS-6000-10M	DS-6000-15M
System Specifications	Table Size (mm)	□1000	□1500	□600	□800	□1000	□1500	□600	□800	□1000	□1500
	Rated Force Sine (kN)	29.4	29.4	49	49	49	49	61.7	61.7	61.7	61.7
	Rated Force Random (kN)	14.7	14.7	29.4	29.4	24.5	24.5	37	37	30.8	30.8
	Rated Force Shock (kN)	44.1	44.1	73.5	73.5	58.8	58.8	92.5	92.5	74	74
	Maximum Acceleration (m/s²)	91	47	350	204	163	59	385	268	102	75
	Maximum Velocity (m/s)	1.0	0.9	1.0	1.0	0.9	0.9	1.0	1.0	0.9	0.9
	Maximum Displacement (mmp-p)	51	51	51	51	51	51	51	51	51	51
	Armature Mass (kg)	320	620	140	240	300	820	160	230	600	820
	Maximum Frequency Horizontal (Hz)	350	250	800	700	350	250	800	700	350	250
	Maximum Frequency Vertical (Hz)	500	350	1000	800	500	350	1000	800	500	350
	Maximum Load (kg)	500	500	300	300	500	700	300	300	500	700
	Power Requirements (kVA)	76	76	104	104	106	106	126	126	128	128
	Primary Cooling Water (ℓ /min)	–	–	370	370	360	360	440	440	430	430

*Depending on the reference PSD or other operating conditions such as the specimen, one part of the controlled response may deviate from the reference PSD.
*The above is just an example. Specifications may be changed depending on test conditions. Please contact us for more information.

CE UKCA

TS-series

3-Axis Simultaneous Systems

TS-1000-4H

Specifications

System Model		TS-1000-4H	TS-1000-6H	TS-1000-8H	TS-1000-10M	TS-2000-5H	TS-2000-8M	TS-2000-10M	TS-2000-15M	TS-3000-5H	TS-3000-8M
System Specifications	Table Size (mm)	□400	□600	□800	□1000	□500	□800	□1000	□1500	□500	□800
	Rated Force Sine (kN)	9.8	9.8	9.8	9.8	19.6	19.6	19.6	19.6	29.4	29.4
	Rated Force Random (kN)	4.9	4.9	4.9	4.9	9.8	9.8	9.8	9.8	14.7	14.7
	Rated Force Shock (kN)	14.7	14.7	14.7	14.7	29.4	29.4	29.4	29.4	44.1	44.1
	Maximum Acceleration (m/s²)	98	65	42	33	163	98	65	30	196	113
	Maximum Velocity (m/s)	1.0	1.0	1.0	1.0	1.0	1.0	1.0	0.9	1.0	1.0
	Maximum Displacement (mmp-p)	51	51	51	51	51	51	51	51	51	51
	Armature Mass (kg)	100	150	230	290	120	200	300	640	150	260
	Maximum Frequency Horizontal (Hz)	1000	800	700	350	800	500	350	250	800	500
	Maximum Frequency Vertical (Hz)	1000	1000	700	500	800	800	500	350	800	800
	Maximum Load (kg)	100	100	200	200	200	300	500	500	200	300
	Power Requirements (kVA)	41	41	41	41	94	94	94	94	110	110
	Primary Cooling Water (ℓ /min)	–	–	–	–	–	–	–	–	–	–

System Model		TS-3000-10M	TS-3000-15M	TS-5000-6H	TS-5000-8H	TS-5000-10M	TS-5000-15M	TS-6000-6H	TS-6000-8H	TS-6000-10M	TS-6000-15M
System Specifications	Table Size (mm)	□1000	□1500	□600	□800	□1000	□1500	□600	□800	□1000	□1500
	Rated Force Sine (kN)	29.4	29.4	49	49	49	49	61.7	61.7	61.7	61.7
	Rated Force Random (kN)	14.7	14.7	29.4	29.4	24.5	24.5	37	37	30.8	30.8
	Rated Force Shock (kN)	44.1	44.1	73.5	73.5	58.8	58.8	92.5	92.5	74	74
	Maximum Acceleration (m/s²)	73	43	306	222	158	67	342	257	199	84
	Maximum Velocity (m/s)	1.0	0.9	1.0	1.0	0.9	0.9	1.0	1.0	0.9	0.9
	Maximum Displacement (mmp-p)	51	51	51	51	51	51	51	51	51	51
	Armature Mass (kg)	400	680	160	220	310	730	180	240	310	730
	Maximum Frequency Horizontal (Hz)	350	250	800	700	350	250	800	700	350	250
	Maximum Frequency Vertical (Hz)	500	350	1000	800	500	350	1000	800	500	350
	Maximum Load(kg)	500	500	300	300	500	700	300	300	500	700
	Power Requirements (kVA)	110	110	149	149	153	153	182	182	182	186
	Primary Cooling Water (ℓ /min)	–	–	550	550	530	530	650	650	640	640

*Depending on the reference PSD or other operating conditions such as the specimen, one part of the controlled response may deviate from the reference PSD.
*The above is just an example. Specifications may be changed depending on test conditions. Please contact us for more information.

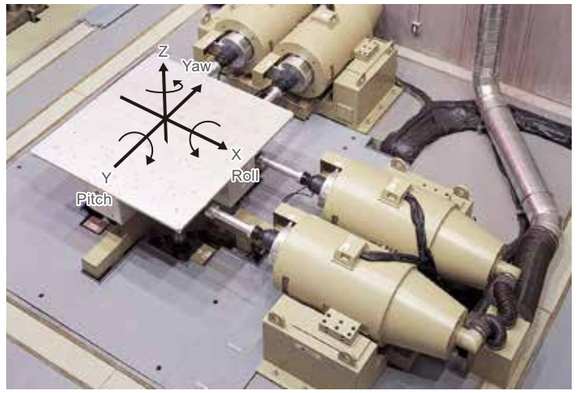
CE UKCA

TTS-series

6 Degrees of Freedom Systems

6 degrees of freedom systems

At least 6 vibration shakers are located in 3D space with integrated control and can create 6 degrees of freedom motion (3 translation degrees of freedom and 3 rotating degrees).
In addition to X, Y, Z axis motion, rotational motion, Roll, Pitch and Yaw is also possible utilising spherical bearings.
Using electro dynamic vibration generators, IMV systems can reproduce waveforms which have components in a wide frequency range with a high degree of accuracy. System maintenance is easy. Systems comprise at least six vibration generators to act along orthogonal axes and also to generate the roll, pitch and yaw components of vibration. A spherical bearing is used to allow the rotational motion. By using electrodynamic vibration generators the system can operate over a wide frequency range with a high degree of accuracy. System maintenance is straight-forward.



Ride comfort evaluation system

The addition of rotational motion to a three-axis system enables 6 degree-of freedom testing, as is required for vehicle seat evaluation, for example.

Excitation direction	X axis	Y axis	Z axis
Rated Force (kN)	3.9	7.8	16
Maximum displacement (mmp-p)	150	150	100
Frequency Range (Hz)	1 - 100		
Table Size (mm)	1800×1800		
Vibration Generator	1	2	4

(Per 1 system)

Check the movie on You Tube

Large-scale 6 DOF vibration test system

A total of 10 vibration generators (6 vertical and 4 horizontal) and a 4000 mm by 3500 mm large size table allow the simultaneous 6 DOF vibration testing. This versatile platform is ideal for testing large items such as railway carriage components.

Excitation direction	X axis	Y axis	Z axis
Rated Force (kN)	80	48	96
Maximum displacement (mmp-p)	51		
Frequency Range (Hz)	2 - 150		
Table Size (mm)	4000×3500		
Vibration Generator	2	2	6

(Per 1 system)

6 DOF simultaneous squeak and rattle test system for vehicle seats

Air-cooled vibration test system for the evaluation of squeak and rattle noise from an instrument panel or other car interior assemblies.

Excitation direction	X axis	Y axis	Z axis
Rated Force (N)	1600	1600	3200
Maximum displacement (mmp-p)	30		
Frequency Range (Hz)	5 - 100		
Table Size (mm)	1500×3500		
Vibration Generator	2	2	4

(Per 1 system)

Vibration Controller K2+

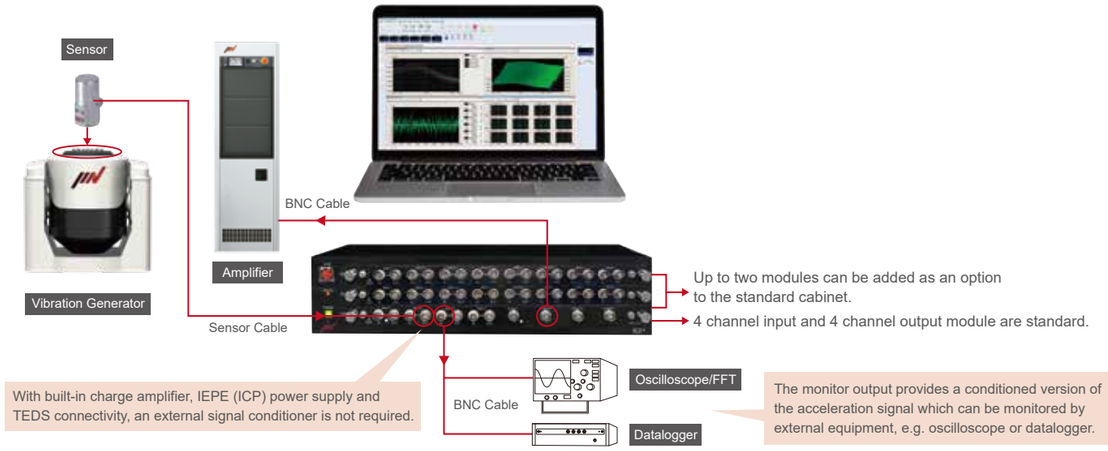
Common hardware supports all types of vibration test.

The K2+ controller provides the precision and repeatability required to test with confidence during both product development and series production. The K2+ hardware and software has been developed in-house, giving IMV full design control of this important part of a vibration system.

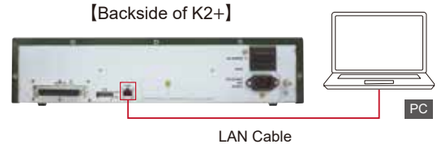
The K2+ system offers enhanced functions and operability based on the most advanced technologies and incorporating feedback from our customers.

Vibration Controller
K2+

System Composition



【Backside of K2+】



Hardware Specifications

Main Enclosure	
Number of Slots	3
AC Power	Single-phase AC, 100 V-240 V (auto-selected)
External Communication	Contact I/O (for emergency stop)
Ambient Conditions	0-40°C, below 85% RH, non-condensing
Dimensions	W430 × H100 × D383 mm (not including projecting parts)
Mass	Approximately 7.0 kg

Minimum Specifications of PC
- One LAN port Gigabyte ethernet port and Gigabyte ethernet cable
- Microsoft Windows 10 Pro (64 bit) or Windows 10 IoT Enterprise (64 bit)*.
- Memory required (for 8 input channels)
  4 GB or more
- One USB port (necessary for protect device)
- Resolution of monitor and PC required 1280 x 1024 or more

* Recommended OS and memory vary depending on software, options, number of I/O channels, etc.

*Please note that optional software “Program K2+” used for vibration controller K2+ also requires Japanese government export license (E/L).

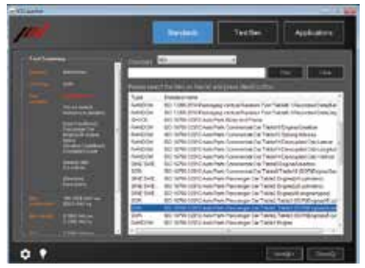
			4-channel Input and 4-channel Output Module (standard)	8-channel Input Module (option)
Input Section	Number of Channels		4	8
	Input Connector		BNC	
	Input Signal		Charge, Voltage, IEPE	
	Charge Amplifier Sensitivity		1.0 mV/pC or 10 mV/pC	
	Charge Amplifier Cut-off		0.32 Hz	
	Maximum Input	Charge Input	±10000 pC or ±1000 pC	
		Voltage Input	±10000 mV	
		IEPE input	±10000 mV	
	Sampling Frequency		102.4 kHz maximum	
	Voltage Input Coupling		AC or DC	
	AC Coupling Cut-off		0.1 Hz	
	CCLD Amplifier (IEPE)		+24 VDC, 3.5 mA	
	TEDS (IEPE)		Version 0.9, Version 1.0	
	A/D Converter	Type	ΔΣ	
		Resolution	32 bit	
		Dynamic range	121 dB	
		Digital filter	Pass-band ripple: +0.001, -0.06 dB, Stop-band attenuation: 85 dB	
Output Section	Number of Channels		4 (One channel is reserved for drive output)	
	Output Connector		BNC	
	Output Signal		Voltage	
	Maximum Output		±10000 mV	
	Sampling Frequency		102.4 kHz maximum	
	D/A Converter	Type	ΔΣ	
		Resolution	32 bit	
		Dynamic range	120 dB	
		Digital filter	Pass-band ripple: ±0.005 dB Stop-band attenuation: 100 dB	

Intuitive Operation

Launcher

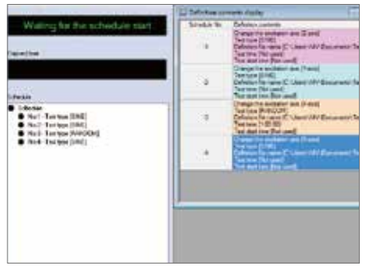
Easily-recognised icons are used for file management.

Test Standard * Standard for A-series and K-series



A test file will be automatically generated upon selection of the test conditions defined by the test standards.
*Please refer to the following for the test standards.

Scheduler



Several different tests types are executed automatically and in sequence according to the pre-defined schedule.

Optional Test Standard

The main test standards stored in the Launcher software (Ver 22.2.0.0 onwards) are as follows as of December 2022. The Launcher software is an option for the K2.

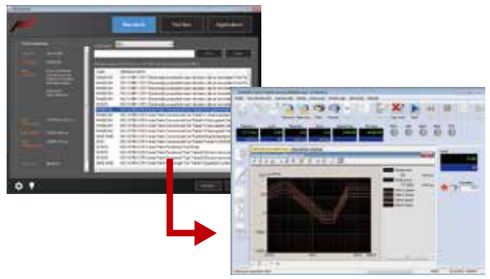
JIS C 60068	Sine, Random, Shock
JIS D 1601	Automotive parts simulated long-life test
JIS E 4031	Railway vehicle parts functional test, Simulated long-life test
JIS Z 0200	Transportation test
JIS Z 0232	Transportation test（Random）
JASO D 014	Automotive parts functional test
ASTM	Transportation test
UN	Lithium-ion battery test recommendated by UN
ISO16750	Automotive parts test
ISO12405	Electric vehicle
IEC60068	Sine, Random, Shock
IEC62660	Random, Shock for secondary lithium-ion cells of electric vehicles
ISTA	Transportation test
IEC61373	Railway vehicle parts functional test
ISO13355	Transportation test（Random）
ISO4180	Transportation test
ISO19453	Electric vehicle parts
JIS E 3014	Parts for railway signal
EIA 364	Electrical connector performance test

*Version upgrade will incur an additional cost.

Option

LAUNCHER

Test file will be automatically generated upon selection of the test conditions defined by the test standards. Then, the test can be carried out just by pressing the start button.



In-built "Quick Help" provides guidance on each operation.

SYSTEM MONITOR

Statuses for vibration generator, amplifier test proceeding, and specimen can be observed on a PC or tablet by either wired or wireless LAN. Solutions can be seen on the Web browser upon the occurrence of any error. Installation of additional software is not necessary for PC or tablet.

Home screen

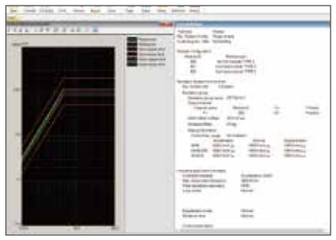
Home screen (error)

Eco screen

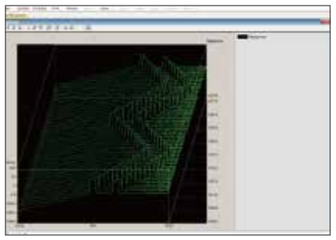
Camera screen

K2 DataViewer Free software

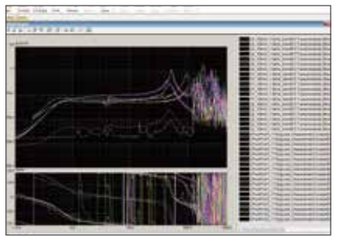
Software for displaying results in data files saved after SINE, RANDOM and SHOCK tests. It can be used for display of test conditions, graphed results, or for comparison between past test data (overlapping display) and generation of reports.



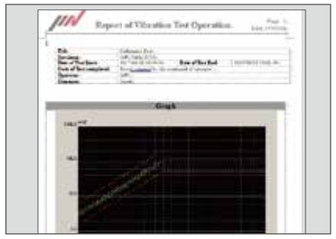
Test condition, graph of results



3D graph



Overlapping display



Report

System Requirements

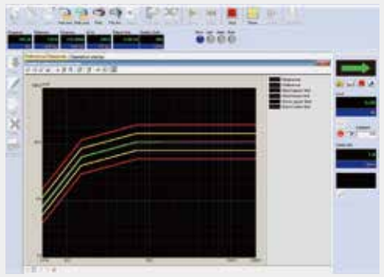
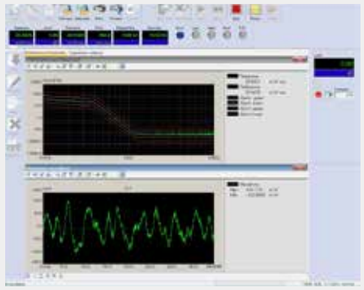
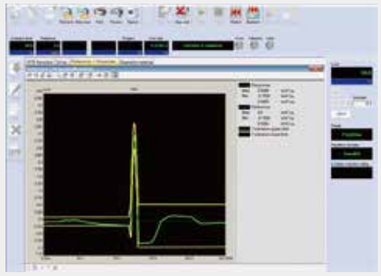
［Supported OS］
Windows 10（64bit）, Windows 7（32bit/64bit）

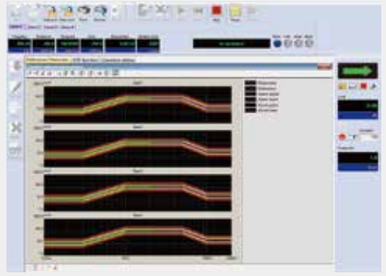
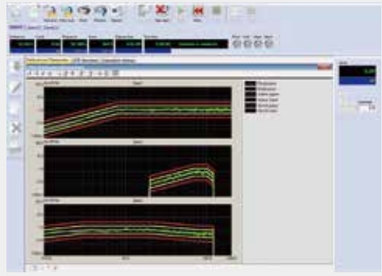
［Memory］
More than 512 MB of RAM is recommended

［Hard Disk］
More than 200 MB of free space is required

Application site

Software

Basic Software	Specifications	Optional software
SINE 	• **Control Algorithm** Continuous closed-loop control of true rms level • **Control Frequency Range** 0.1 - 20000 Hz • **Control Dynamic Range** More than 120 dB • **Operation Modes** 1) Continuous sweep, Spot, Manual 2) Closed-loop, Open-loop • **Measurement Method** Average, RMS, Tracking • **Multiple-Channel Control Modes** Average control, Maximum control, Minimum control • **Input Channels** Maximum 20 *Specifications may be affected by other conditions	• **R_DWELL: Resonance Dwell** Resonance is detected by measuring the phase difference between the control point and the response signal from a resonant part of the item under test. The test frequency is controlled in order to maintain resonance as the structure fatigues. After holding at the resonance for a pre-defined duration, sweeping can be resumed, until the next resonance is detected. • **A_DWELL: Amplitude Dwell** A transmissibility plot is taken from two points on the structure under test and resonances listed. A sine test can then be run at each resonant frequency, with tracking of the resonance by either amplitude or phase. • **LIMIT CONTROL** Response channels can be specified as limit control channels. If the level on a limit control channel would exceed its limit, the test level is reduced accordingly. • **Multi Sweep Sine** A traditional wide-band sine sweep is divided into several narrower-band sine sweeps, which when added together combine to cover the original wide band. Running the narrow band sweeps in parallel significantly reduces the test time required.
RANDOM 	• **Control Algorithm** Closed-loop control of PSD within each spectral line • **Control Frequency Range** Maximum 20000 Hz • **Number of Control Lines** Maximum 25600 lines • **Control Dynamic Range** More than 98 dB • **Loop Time** 200 ms (fmas = 2000 Hz, at L = 400 line) • **Multiple-Channel Control Modes** Average control, Maximum control, Minimum control • **Input Channels** Maximum 20 *Specifications may be affected by other conditions	• **SOR: Sine on Random** An SOR test is a vibration test composed by adding random vibration to sine vibration simultaneously. It is possible for sine vibration to be swept in this test. • **ROR: Random on Random** An ROR test is a vibration test composed by superimposing a stationary broadband random vibration with a narrow band random vibration that is swept according to given sweep conditions. • **EXTENDED ROR** The extended ROR makes it possible to execute an ROR test with greater freedom when defining separate NBR references. • **PSD LIMIT: PSD limit control** Response channels can be specified as limit control channels. If the PSD on a limit control channel is likely to exceed its limit, the test level is reduced over that range of frequencies to keep within the limit level. • **Soft-Clipping** A clipping function that can reduce the peak value of the output voltage without affecting control performance. • **Non-Gaussian** A vibration testing method which precisely reproduces non-Gaussian vibrations, for example transportation vibrations, with large spikes.
SHOCK 	• **Control Algorithm** Finite-length waveform controlled by feed forward method • **Control Frequency Range** Maximum 20000 Hz • **Number of Control Lines** Maximum 25600 lines • **Control Dynamic Range** More than 98 dB • **Type of Reference Waveform** Classical shock waveform (Half-sine, Haversine, Saw-tooth, Triangle, Trapezoid etc.), Sine beat waveform, Measured waveform etc. • **Input Channels** Maximum 20 *Specifications may be affected by other conditions	• **LONG WAVEFORM** The standard length of a reference waveform is 16 K points. This can be increased to 200 K points by adding the LONG WAVEFORM option. At a sampling frequency of 512 Hz for example, this produces approximately 6.5 minutes of waveform, compared to the standard length of approximately 30 seconds. • **MEGAPOINT** A further increase in waveform duration can be obtained by adding the MEGAPOINT option to the LONG WAVEFORM option. This increases the record length to 5000 K points, about 163 minutes at 512 Hz sampling rate. • **SRS: Shock Response Spectrum** SRS (Shock Response Spectrum) can execute a test in which the test conditions and evaluation are conducted not based on waveform itself, but on SRS analysis. With standard shock test selected, SRS analysis of response waveform is also possible.

Basic Software	Specifications	Optional Software
Multi SINE 	• **Control Algorithm (Three modes of control)** 1) Amplitude: Continuous closed-loop control of true rms level 2) Phase: Real-time waveform controlled by feed forward method 3) Monitoring and minimising of cross-axis component • **Control Frequency Range** 0.1 - 10000 Hz • **Frequency Resolution** Better than 10^{-4} of frequency • **Control Dynamic Range** More than 120 dB • **Operation Modes** 1) Continuous sweep, Spot test 2) Control and monitoring in various physical units • **Estimation Method** Average, RMS, Tracking • **Multiple-Channel Control Modes** Average control, Maximum control, Minimum control • **Input Channels** Maximum 20 (Maximum 20 chs for principal control channel) • **Output Channel** Maximum 12 *Specifications may be affected by other conditions	• **LIMIT CONTROL** If a response point is specified to be a limit control channel, the level of that response point will not exceed the level specified in the test.
Multi RANDOM 	• **Control Algorithm (Three modes of control)** 1) PSD of random signal closed loop control by spectrum density for each frequency segment 2) Real-time waveform controlled by feed forward method 3) Monitoring and minimising of cross-axis component • **Control Frequency Range** Maximum 10000 Hz • **Number of Control Lines** Maximum 3200 lines • **Control Dynamic Range** More than 98 dB • **Loop Time** 450 ms (3-input, 3-output control, 120 DOF, fmax = 2000 Hz, L = 200 line cross-talk information averaging times = 8 times/loop) • **Multiple-Channel Control Modes** Average control, Maximum control, Minimum control • **Input Channels** Maximum 20 (Maximum 20 chs for principal control channel) • **Output Channel** Maximum 12 *Specifications may be affected by other conditions	• **PSD LIMIT CONTROL** Response channels can be specified as limit control channels. If the PSD on a limit control channel is likely to exceed its limit, the test level is reduced over that range of frequencies to keep with the limit level. • **Non-Gaussian** A vibration testing method which precisely reproduces non-Gaussian vibrations, for example transportation vibrations, with large spikes.
Multi SHOCK 	• **Control Algorithm** Finite-length waveform controlled by feed forward method • **Control Frequency Range** Maximum 20000 Hz • **Number of Control Lines** Maximum 25600 lines • **Control Dynamic Range** More than 98 dB • **Type of Reference Waveform** Classical shock waveform (Half-sine, Haversine, Saw-tooth, Triangle, Trapezoid etc.), Sine beat waveform, Measured waveform etc. • **Length of Reference Waveform** Maximum 5000 k points • **Input Channels** Maximum 20 • **Output Channel** Maximum 12 *Specifications may be affected by other conditions	• **SRS: Shock Response Spectrum** SRS (Shock Response Spectrum) can execute a test in which the test conditions and evaluation are conducted not based on waveform itself, but on SRS analysis. With a standard shock test selected, SRS analysis of response waveform is also possible.

Common optional software	Outline		
CAPTURE: Analogue waveform signal data program	Provides analogue waveform signal capture. Saved data can then be used as a reference for SHOCK, BMAC waveform controls or Random vibration PSD control.	• Sampling Frequency • Data Length • Input Channel • Waveform edit/analysis function	51.2 kHz maximum Maximum 5000 k points Maximum 24 Filtering, Frequency transfer processing, PSD transfer, Transmissibility ratio between channels
SCHEDULER: Test scheduler	Pre-defined tests can be executed in sequence.		
TCP Communication Server	TCP communication server software that allows external applications to operate K2 applications and acquire vibration data and operating status by sending and receiving commands via TCP/IP.		

With IMV's approach to a more realistic reproduction of the vibration environment, IMV is focused on making products that are customised to the specific needs of our customers. IMV is proud of our tireless contributions to improving product safety and comfort for society as a whole through increasing product reliability as a ''solution partner'' for all industries.

Customised Products [Case Studies]

Customised Products
Automotive Parts

Case Studies

Electrodynamic multi-axis 4 poster system

Accurate waveform reproduction is achieved over a wide frequency range of up to 500 Hz by employing electrodynamic vibration generators.

Torsion vibration test system

By building compact shakers on top of a multi-axis test system and exciting both systems simultaneously, reproduction of 'real road' 6-DOF and torsion is achieved.

3-axis simultaneous vibration test system

Test systems for the automotive tire industry, used for evaluating the transfer characteristics of a tire at varying air volumes and ride comfort.

Low cross-axis motion vibration test system

Ensures low cross-axis motion, equipped with a mechanism that matches the center of gravity of the assembly of specimen + fixture (+ slip table) to the excitation axis through vertical motion of the table-support bearing assembly.

Customised Products

Automotive Parts

Case Studies

6-DOF vibration test system

Evaluate road noise generated by a car by placing the test system under the wheel of the car and generating vibration of 6-DOF nature into one wheel.

200 mm peak-to-peak displacement vibration test system

This system is particularly suited for applications requiring high velocity at low frequencies. It has a high over-turning moment due to a lateral load reinforcement guide, allowing tests of specimens with a large offset center of gravity.

6-DOF large vibration test system

A reproduction of ultimate vibration realism for testing the ride comfort of car seats with a 6-DOF vibration test system.

6-DOF simultaneous squeak-and-rattle test system for instrument panels

A 6-DOF vibration test system with 8 compact, silent shakers for squeak-and-rattle acoustic noise evaluation of instrument panels.

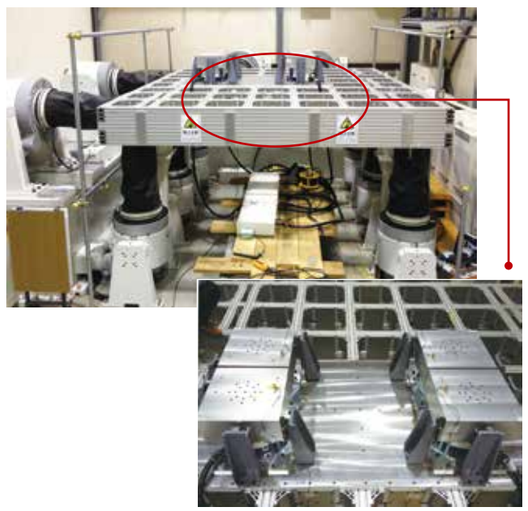
Rotation adjustment

Diagonal excitation vibration test system

Diagonal excitation for two-wheeled vehicles. Angle of rotation for the vibration generator can be adjusted in 1 degree increments.

Vibration test system for large battery pack testing

The K200 or K350 with upgraded Shock Force up to 1MN, are designed to be integrate with a 3 x 3 meter interchangeable size slip and modular guided Head Expander for testing large Battery Packs for Automotive and other applications. This system can be integrated as direct coupling with a climatic vibration chamber.



Torsion test system (6 DOF + Torsion vibration test system)

A 6 DOF vibration test with measured running data is possible. Torsion on a car body can be simulated while the car is running.

Exhaust system durability testing

Durability testing with hot air and vibration. Air temperature range is from 200 °C to 900°C and air flow from 2 to 10 m³/min is channeled into the exhaust system from a hot air generator.

Customised Products

Automotive Parts

Case Studies

Dynamic spring constant measuring system

Highly accurate testing and analysis are possible over a wide frequency range from 1 Hz up to 2000 Hz.

Low-acoustic-noise 3-axis vibration test system

Simulation testing using actual measured data or more traditional random testing is possible in 3-axis simultaneous excitation. When combining the shaker system with a half-anechoic room, 3D squeak-and-rattle testing is possible in an environment with a background noise level of less than 30 dB.

Low-acoustic-noise 3-axis vibration test system + guide rail

A vibration system can be set up to move along guide rails. The system can be combined with other test equipment if necessary, for example a temperature chamber.

Vertical/Horizontal changeover chamber combined a vibration test system

Used for durability testing of on-board battery chargers and inverters/DC-DC converters for electric cars. Vertical and horizontal excitation, both combined with a chamber, is possible.

2-axis climatic chamber combined vibration test system

A double-sided door makes it easy to reach the specimen. This system is equipped with a temperature alarm meter for surface temperature monitoring and CO2 automatic fire extinguisher. Sine: 1,000 Hz, Random: 2,000 Hz

Ultra-high temperature (900ºC) chamber combined with single-axis vibration test system

Applicable to temperature and humidity environmental testing for products which may be exposed to ultra-high temperature of up to 900 ºC. Employs the virtual point control method to control acceleration of the specimen in the chamber without accelerometers mounted.

3-axis simultaneous vibration test system

Simultaneous 3-axis vibration test system designed for earthquake resistance tests and earthquake regeneration. Vibrations in three directions can be simultaneously applied to the specimen.

Compact chamber combined with vibration test system

Function tests and durability tests of parts exposed to sudden temperature change are possible.

Customised Products

Electronic Parts

Case Studies

Sensor calibration vibration test system

Pure single-axis vibration which is very hard to generate with a conventional single-axis system. 4 vibration generators are located orthogonally to the major axis to cancel unwanted cross-axis acceleration.

High-frequency vibration test system

Combining 4 low-noise compact vibration test systems with a chamber and using multi-point control, vibration excitation combined with a climatic test is achieved from 2 kHz up to 10 kHz.

Environmental test system

Large area heat resistance glass (-40 ˚C to 110 ˚C) is provided for checking the specimen inside the chamber during a combined test. To reduce the required installation space, a guide rail system is used with the vibration test system and horizontal slip table.

Crimping terminal evaluation system

Setting time is reduced with a dedicated fixture for various sizes of crimping terminal. 8 to 20 samples can be evaluated at one time.

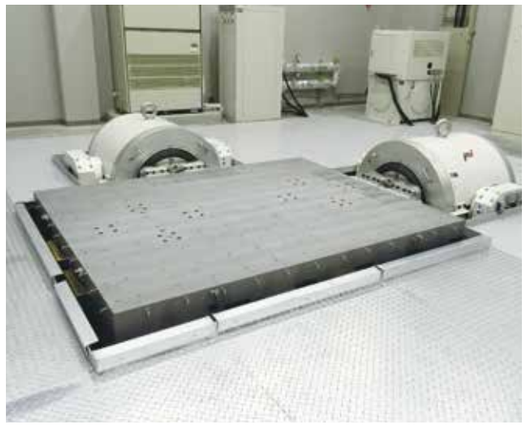
Customised Products

Transportation Test

Case Studies

Underslung 6-DOF vibration test system (Railway testing)

A combination of 10 vibration generators (6 vertical and 4 horizontal) and a 4,000 mm by 3,500 mm large-scale moving table allowing simultaneous, multi-point vibration testing. This versatile vibration platform is ideal for testing large items such as railway carriage parts and fuel cells.



3-axis large vibration test system for transportation simulation

Vibration test system for very large specimens. Moving table size is 3,000 mm × 2,000 mm composed of 2 off 125 kN shakers for the X and Y axes and 2 off 60 kN shakers for the Z axis.

3-axis simultaneous vibration test system

Watch the YouTube video

Simultaneous, multi-axis vibration data acquisition with IMV's vibration measurement unit built in to a railway container. Data is subsequently used for a real waveform 3-axis simultaneous vibration test.

2-axis large vibration test system

Table size 2000 x 2500 mm, Maximum load 2000 kg
Transportation test for large specimens or vibration durability test

Customised Products

Construction Machinery

Case Studies

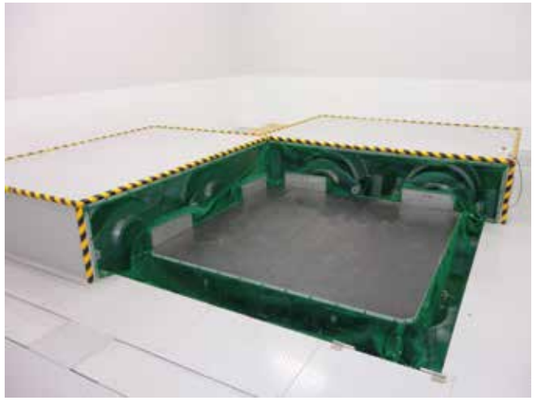
GDP
(Guide system with air spring load support)

Energy-saving vibration test system with large slip table

Maximum load is 2,000 kg. (when used with the lateral load reinforcement guide or slip table) The built-in automatic ECO function optimises power consumption across all vibration test types.

3-axis changeover vibration test system

Once the specimen and fixture are set, it is possible to switch the X/Y/Z axis excitation automatically. No time is spent remounting specimens or assemblies. Tests can be easily continued withouttime loss.



6-DOF vibration test systems

Durability testing with real measured waveforms for excavator cabins or heavy machinery tanks. The system reproduces vibration in X, Y, Z axes as well as roll, pitch and yaw.

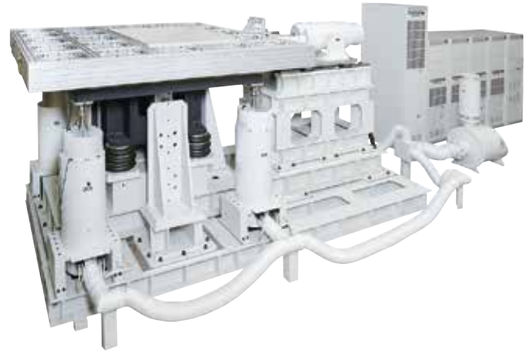
Large vibration test system for high-frequency testing (up to 5000 Hz)

For high-frequency tests with large specimens. The slip table can be replaced according to the size of the specimen and each table can be used for high-frequency testing.

Customised Products

Earthquake Resistance

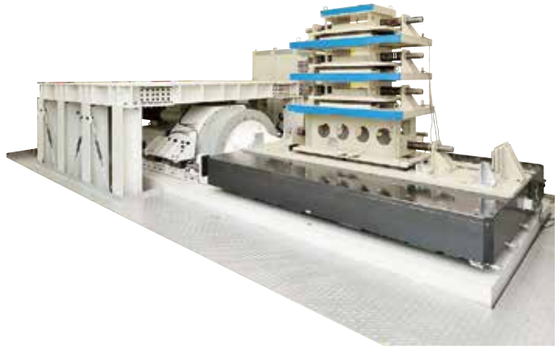
Case Studies



Large-scale earthquake-resistance vibration test systems

Watch the YouTube video

The unique hybrid method achieves accurate reproduction of both large-displacement and high-frequency waveforms by utilising the benefits from an electrodynamic shaker and an AC servomotor.



Large-scale earthquake-resistance vibration test systems

Watch the YouTube video

An industry first, hybrid technology low-frequency vibration test system which simulates highly accurate waveforms including high- and low-frequency components simultaneously with an electrodynamic vibration generator and AC servomotor.

Large 2-axis simultaneous, multi-point excitation vibration test system

Large vibration test system with a table size of 4500 mm × 4500 mm. Rated displacement: 400 mm peak-to-peak horizontal, 200 mm peak-to-peak vertical. Maximum load of 20 ton.

Earthquake resistance vibration test system for seismic switches

Hydraulic bearing (Type TT) makes it possible to achieve a waveform reproduction error ratio within 2% using only 2 or 3 drive signal updates.
Maximum displacement: 150 mmp-p Frequency range: 0.5–20 Hz

Customised Products

Aerospace

Case Studies

350 kN large water-cooled vibration test system

Watch the YouTube video

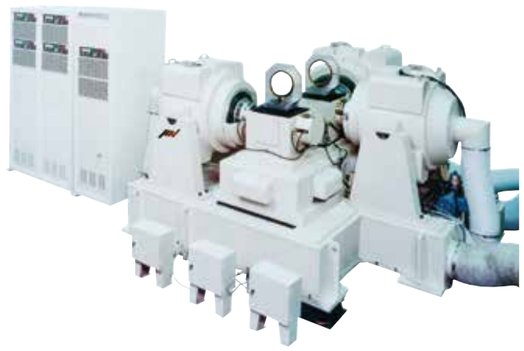
K350 is designed to test large satellite systems at high acceleration and frequency, with continuous displacement up to 3'' – necessary for quasi static testing. It features a 2000 mm vibration table with a maximum load capacity of more than 10,000 kg.

Vibration test systems for clean rooms

The air inlet of all air-cooled shakers can be ducted from outside of the clean room using a concentrated suction top cover. This allows using air cooled shakers even in clean room conditions for space testing.

Large-scale 200 kN vibration test systems for the aerospace industry

With low displacement requirements for the aerospace industry, this system is fitted with a TEAM slip table using the T-Film bearing.High over-turning moment and low cross-axis acceleration are features of this system in both vertical and horizontal operation.



Multi-point, multi-axis vibration test system

Multi-point vibration test system with three-axis simultaneous excitation. The system has the capability to carry out tests of very long specimens over a high frequency range.

Customised Products

Other Applications

Case Studies

Vibration test system for fatigue testing of copper plating

Especially developed for the fatigue testing of copper plating by customising a compact shaker from IMV's m-series. Simultaneous testing of 12 sheets of copper plate is possible with this compact system.

Compact vibration test system for sensor calibration

Adopted by JQA (Japan Quality Assurance Organization)

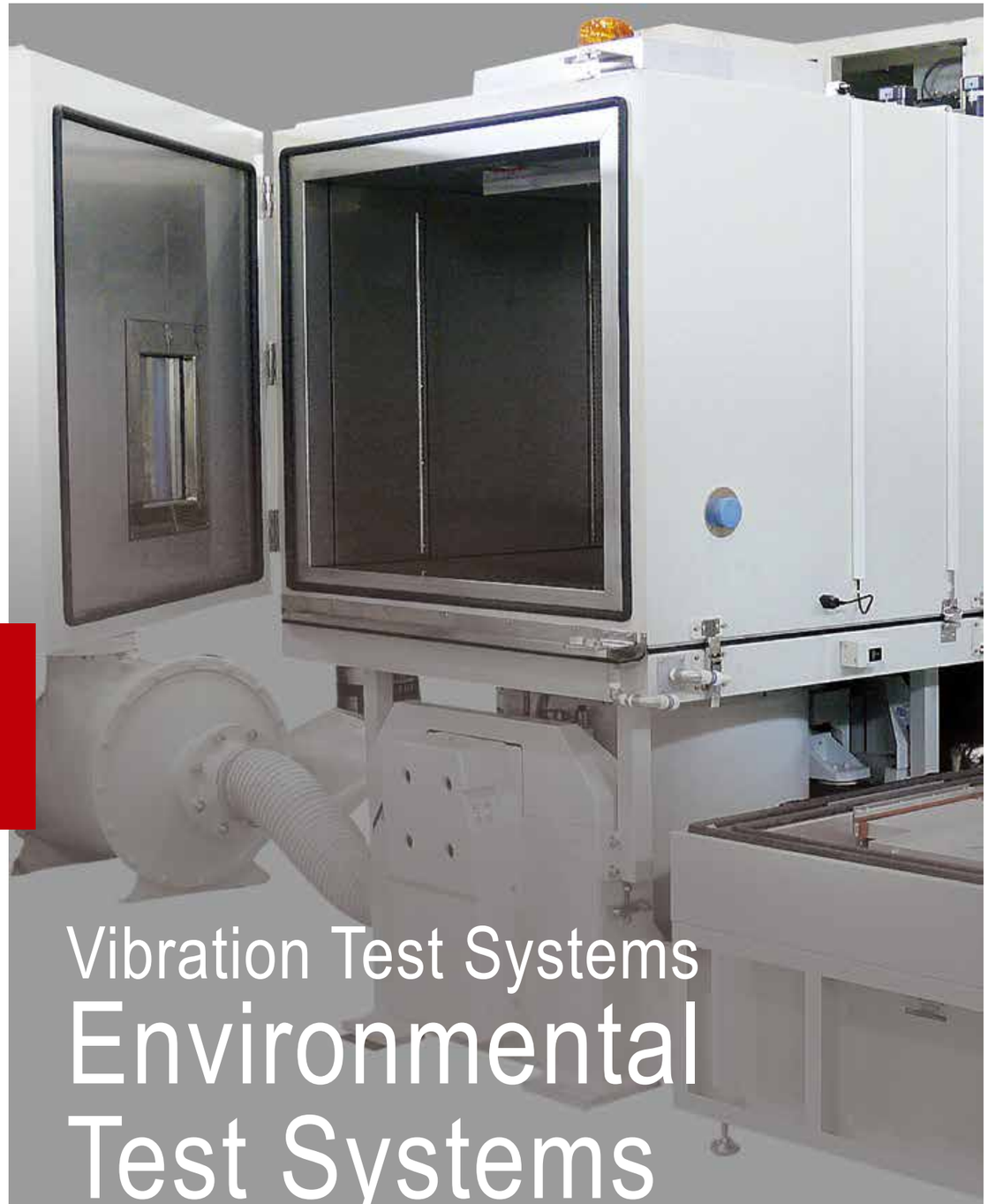
This system realizes low distortion in low-frequency and low-acceleration areas and is used as a calibrator at JQA and other public institutions.

Vibration test system with acid-resistant table

A standard specification slip table with alumite coating (as an example) is not suitable for vibration testing in the battery industry due to damage caused by leaking battery chemicals. A specially-formulated coating for the slip table is applied which is resistant to battery leaks.

Pressure-proof flexible duct

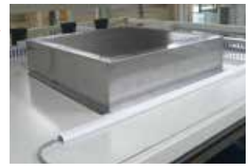
The neutral position of the horizontal slip table can be adjusted and the slip table displacement is controlled as well. This allows a specimen to be permanently and rigidly fixed on one side and mounted on the slip table on the other side.



Vibration Test Systems
Environmental Test Systems

Manufactured products can be exposed to both thermal and mechanical stresses.
These should not be considered separately, as the effects may be linked.
IMV can supply vibration-test systems combined with climatic chambers to provide complete vibration, temperature and humidity environmental testing. These systems can be custom-designed to meet your application.

Chamber for Vertical Excitation

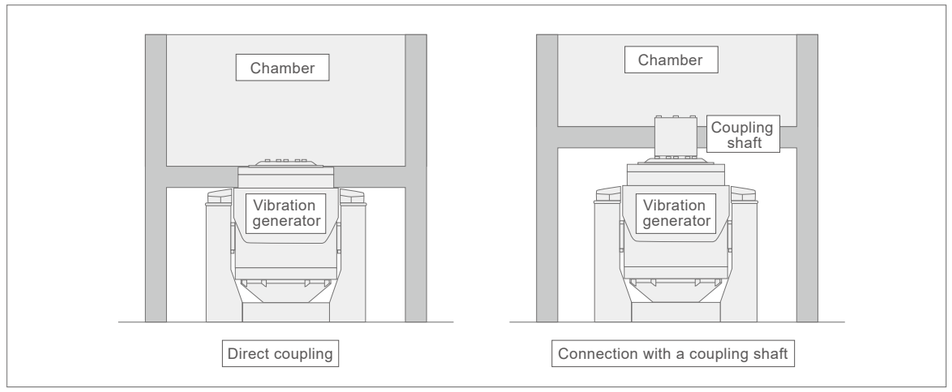


Inner pressure regulator:Reduce internal pressure fluctuation caused by vibration (Standard equipment)

Model : Syn-3HA-40-V

Internal dimensions	W1000×D1000×H1100 mm
Temperature range	-40 °C to +150 °C
Humidity range	20 % to 95 %RH
Temperature pull down time	+20 °C => -40 °C In 60 minutes (Curve gradient)
Temperature heat up time	-40 °C => +150 °C In 90 minutes (Curve gradient)

Docking image of combined systems



Model : Syn-6HW-30-V

Internal dimensions	W1800×D1900×H1500 mm
Temperature range	-30 °C to +80 °C
Humidity range	30 % to 95 %RH
Temperature pull down time	+45 °C => -30 °C In 35 minutes (Curve gradient)
Temperature heat up time	-30 °C => +80 °C In 25 minutes (Curve gradient)

Chamber for both Vertical and Horizontal Excitation

Horizontal slip table combined vibration test system.
Combining a rail support for horizontal move and a lift support for vertical move,
chamber combined test for both vertical and horizontal axis.

Vertical use

Horizontal use

Rail and lift support

Model : Syn-3HA-70-VH

Internal dimensions	W1000×D1000×H1000 mm
Temperature range	-70 ˚C to +180 ˚C
Humidity range	20 % to 98 %RH
Temperature pull down time	1 ˚C / minutes or more (Curve gradient)
Temperature heat up time	2 ˚C / minutes or more (Curve gradient)

Check the movie
on You Tube

Option for chambers for both vertical and horizontal excitation

Optional crane

Adding a dedicated crane provides safe and simple loading and unloading of test specimens.

Optional crane and observation door

The vertical base can be attached and detached using the optional crane with the head expander straying mounted on the vibration generator.
In addition, operator-friendly environment such as observation door and body suspension automatic adjustment mechanism etc. are equipped.

Side window

With a side window, chamber combined docking is possible with the specimen attached to the shaker for vertical excitation use.

Cable bear

Cables and water pipes put together with the cable bear provide safe work environment.

Chamber for Multi-Axis Excitation

Temperature, humidity chamber for multi-axis vibration test system.
Total test time can be reduced by eliminating the need to reconfigure for testing each axis.

2-axis

Model : Syn-4HA-40-M

Internal dimensions	W1200×D1200×H1000 mm
Temperature range	-40 ˚C to +150 ˚C
Humidity range	20 % to 98 %RH
Temperature pull down time	+20 ˚C => -40 ˚C In 80 minutes (Load condition:combined + aluminum 60 kg)
Temperature heat up time	-40 ˚C => +150 ˚C In 80 minutes (Load condition:combined + aluminum 60 kg)

3-axis

Model : Syn-3HA-40-M

Internal dimensions	W1000×D1000×H1000 mm
Temperature range	-70 ˚C to +180 ˚C
Humidity range	20 % to 98 %RH
Temperature pull down time	+20 ˚C => -70 ˚C In 40 minutes (Curve gradient)
Temperature heat up time	-70 ˚C => +180 ˚C In 40 minutes (Curve gradient)

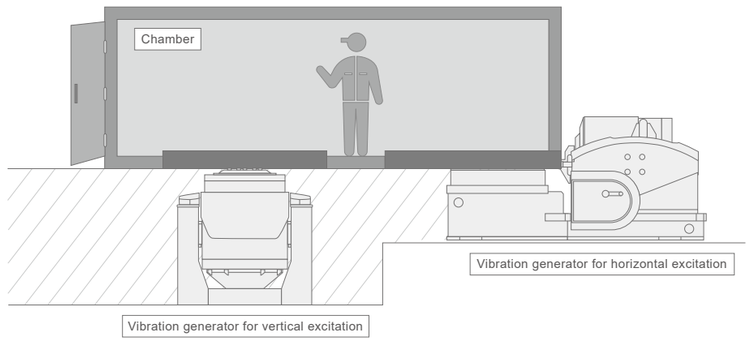
Prefabricated Chamber for Large Specimens

Large-sized specimen can be tested with a chamber combined test in both vertical and horizontal axis

Model : Syn-6HA-40-VH

Internal dimensions	W4000×D2000×H2500 mm
Temperature range	-40 ˚C to +120 ˚C
Humidity range	30 % to 95 %RH
Temperature pull down time	+20 ˚C => -40 ˚C In 120 minutes (Curve gradient)
Temperature heat up time	-40 ˚C => +150 ˚C In 150 minutes (Curve gradient)

Docking image of combined systems



Technical Guidance

For installation of vibration test systems

Basic units used for vibration test

There are four important units for a vibration test. Force [N], Acceleration [m/s^2], Velocity [m/s], and Displacement [mm peak-to-peak (p-p)]

The force “F” required to give an object of mass, “m” acceleration “A” is;

$F=mA$

	SI units	Gravitational units
F : force	[N]	[kgf]
m : mass	[kg]	[kg]
A : acceleration	[m/s^2]	[G]

That is to say, when a mass of 1 kg is accelerated to an acceleration of 1 m/s^2 the required force is 1 N. Gravitational acceleration “G” equals to 9.8 m/s^2.

To describe vibration, frequency and vibration level need to be specified. Vibration is a form of movement; with a consequent relationship between acceleration, velocity and displacement. To describe vibration level, any of these units can be used. Here are the relationships between each of the units.

We have an object moving in a sine wave.

The displacement is;

$D = D0 \sin\omega t$

The velocity is obtained by differentiation of the displacement. Therefore

$V = \frac{dD}{dt}$

$V = \omega D0 \cos\omega t$

The acceleration is obtained by differentiation of the velocity. Therefore;

$A = \frac{dV}{dt}$

$A = -\omega^2 D0 \sin\omega t$

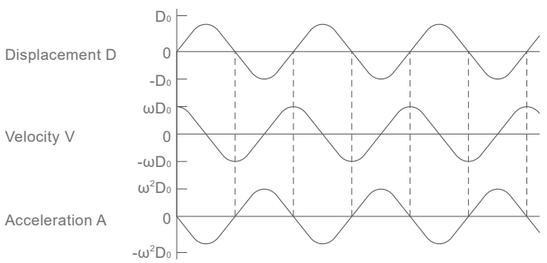
As we substitute

$\omega = 2\pi ft$

We have formulae indicated only in amplitude;

$V = \omega D = 2\pi fD$	D:Displacement	[m$^{0\text{-}p}$]
$A = \omega^2 D = (2\pi f)^2 D$	V:Velocity	[m/s]
	A:Acceleration	[m/s^2]

The following diagram shows waveforms for displacement, velocity and acceleration.



We get the formulae below by transforming the above formulae.

$f = \frac{A}{2\pi V}$

$A = \frac{V^2}{D}$

$V = 2\pi fD$

$D = \frac{A}{(2\pi f)^2}$

In the field of vibration test, we use mm p-p for the peak to peak displacement.

Therefore

$D = \frac{d}{2000}$

is substituted in to all of the above formulae

$f = \frac{A}{2\pi V}$	f : Frequency[Hz]
$A = \frac{(2\pi f)^2 d}{2000}$	A : Acceleration[m/s^2]
$V = \frac{2\pi fd}{2000}$	V : Velocity[m/s]
$d = \frac{2000A}{(2\pi f)^2}$	d : Displacement[mmp-p]

The following is an example

[ex] i) f = 50[Hz], d = 2[mmp-p]

$V = \frac{2\pi fd}{2000} = \frac{2\times\pi\times50\times2}{2000} = 0.314$[m/s]

$A = \frac{(2\pi f)^2 d}{2000} = \frac{4\times\pi^2\times50^2\times2}{2000} = 98.7$[m/s^2]

ii) A = 100[m/s^2], V = 0.5[m/s]

$f = \frac{A}{2\pi V} = \frac{100}{2\times\pi\times0.5} = 31.8$[Hz]

$d = \frac{2000V^2}{A} = \frac{2000\times0.5^2}{100} = 5$[mmp-p]

Please see the conversion chart (Exchange table) on page 72 for calculation.

About [dB]

We use ”dB” as a unit when describing the proportional relationship of physical quantities. Especially, in cases where one value is thousands or millions times a multiple of a reference value, then we use the logarithmic scale “dB” instead of a linear scale. This makes the values more sensible and is an industry standard practice.

“dB” is expressed by the following

$a = 20 \log\frac{A_1}{A_0}$[dB] A_1 = Comparison value, A_0 = Reference value

One million times is ;

$a = 20 \log\frac{1{,}000{,}000}{1} = 120$[dB]

Not only does dB reduce the number of digits (smaller numbers to handle) but also simplifies calculations. For example, adding 25 dB and 30 dB makes 55 dB but if you do it in a linear way ;

25[dB] = 20 log A $A = 10^{\frac{25}{20}} = 17.78$

30[dB] = 20 log B $B = 10^{\frac{30}{20}} = 31.62$

A×B = 17.78×31.62 = 562.3 = 20 log 562.3 = 55[dB]

Now you see you can use addition instead of multiplication by using “dB”. That is to say, it is very easy to calculate by using “dB”.

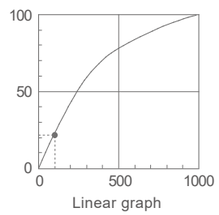
The following is a conversion table for “dB” and multiple.

dB	0	0.1	1	3	6	10	20	30	40	60
Multiple	1	1.01	1.12	1.41	2.0	3.16	10	31.6	100	1000

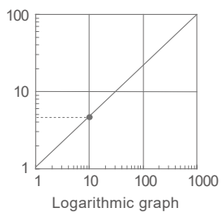
dB	0	-0.1	-1	-3	-6	-10	-20	-30	-40	-60
Multiple	1	0.99	0.891	0.709	0.501	0.316	0.1	0.0316	0.01	0.001

Use of a logarithmic graph

We often use a logarithmic graph when we need to plot data for vibration testing or other physical phenomena.



Linear graph



Logarithmic graph

On the linear graph, we can read 20 for Y when X is 100. But we can hardly read Y when X is 10 or 1. Whereas on the logarithmic graph, we can read the value even if it is 1/100 or 1/1000 of the maximum value. We use a logarithmic graph for such benefit.

Sine test graph

We often use the graph below when running a Sine vibration test. This is a log-log graph that was discussed above. Asymptotes of constant displacement, velocity and acceleration are shown. Here is an example of an asymptote of constant velocity. From the formulae we learned before

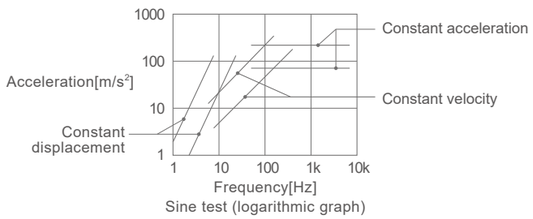
$A = 2\pi fV$ A : Acceleration, f : Frequency, V : Velocity

From this equation we can read that acceleration A is increased 10 times when frequency f is also increased 10 times. On the graph below, we see that the acceleration increases to 100 m/s^2 from 10 m/s^2 as the frequency increases from 10 Hz to 100 Hz.

In the case of constant displacement

$A = (2\pi f)^2 D$ D : Displacement

The equation shows that acceleration A is increased by 100(10^2) times when the frequency f is increased by 10 times. Acceleration being proportioned to the second power of Displacement. On the graph below, we can read that the acceleration increases to 100 m/s^2 from 1 m/s^2 as the frequency increases to 10 Hz from 1 Hz.



Sine test (logarithmic graph)

The graph shows the asymptotes when velocity or displacement stays constant.

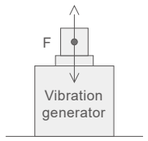
Technical Guidance

For installation of vibration test systems

Vibration insulation for a vibration generator

When using a vibration generator, the vibration is transmitted to the building and other facilities through the floor.
Particularly in the frequency range of 2 Hz to 20 Hz, even a small proportion of vibration from the vibration generator can have a large effect on buildings because they have their own resonances in this frequency range.
Therefore, a vibration generator needs a vibration isolation system.
The following shows some examples.

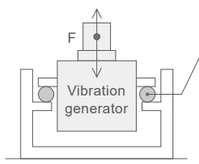
1) No insulation



F:Force

All the force generated by the vibration system is transmitted in to the floor. This may excite resonances in the buildings and other facilities. The vibration generator itself may sometimes jump up and down.

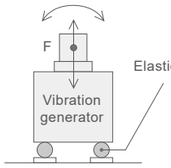
2) Body suspension



Air springs

IMV uses this method of vibration isolation except for the small, compact shaker range. This may limit a shaker system's maximum displacement when the operating frequency is low.
See "Limitation of maximum displacement"

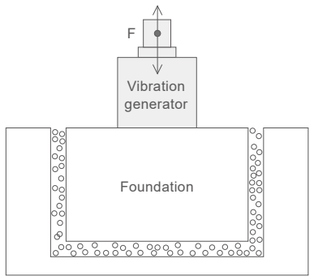
3) Bottom suspension



Elastic objects or air springs

This has a similar effect of vibration isolation but it can also cause lateral motion at low frequency.

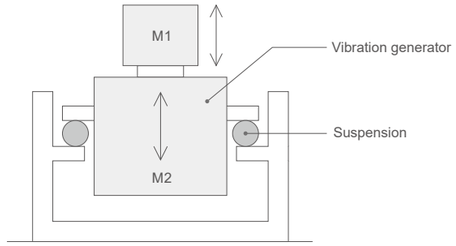
4) Isolated foundation



This is the best way of vibration isolation.
Generally, the mass of the foundation block should be at least ten times heavier than the rated force of the system. Typically, the mass of the foundation should be twenty times heavier.
If you are interested in this method of isolation, please contact IMV.

Limitation of maximum displacement

There are several methods for vibration isolation. All of these ways bring limitations on maximum displacement.
In the case of body isolation, the vibration generator body reacts against the movement of the specimen.

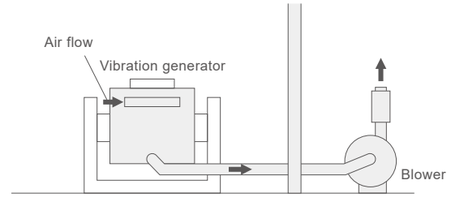


In the case of body isolation, the vibration generator body will be excited by the reaction force. If the shaker excitation frequency is 2-7 Hz, this may coincide with the resonant frequency of the armature suspension system and the body suspension system. The armature and body motion could be almost in "anti-phase" resulting in the absolute value of the available armature displacement becoming severely limited.
Typically only 10 mmp-p displacement is available from a 51 mmp-p rated vibration generator.
If using an "isolated foundation", the effective mass of the foundation plus vibration generator body could be much heavier than specimen+armature assembly. Therefore, limitation for the available displacement becomes negligible.

Noise control

When the vibration test system is installed, it is necessary to think about the noise. There are several sources of noise such as excitation noise, suction noise (for air-cooled systems), blower noise, blower exhaust noise and cooling fan noise of the power amplifier etc.
The shaker excitation noise might exceed 100 dBA at a typical maximum acceleration of 980 m/s^2. The suction noise is about 90 dBA, and blower noise + blower exhaust noise is about 80 dBA. However, these figures can differ depending on the shaker model.

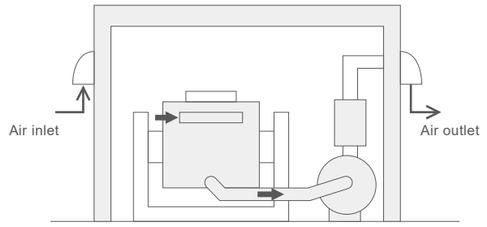
1) Installing the blower outside the room



This is generally a simple method.
The blower noise and the blower exhaust noise are reduced in the test area. However, this method doesn't change the suction noise or the excitation noise of the vibration generator. * The blower cannot be installed outdoors.

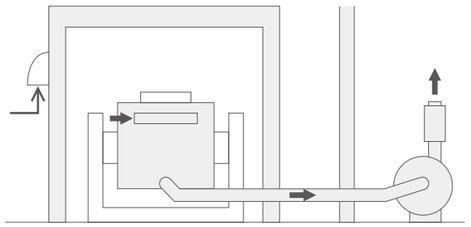
2) Sound proof box

A.Vibration generator and blower



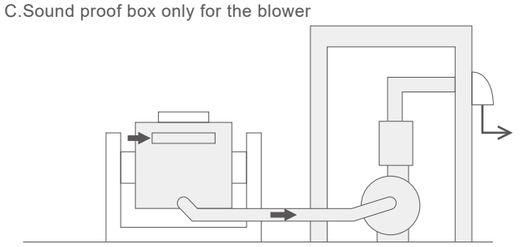
This method reduces the excitation noise and the blower noise. *During the blower is stopped, it is recommended to make treatments to prevent air backflow.

B.Vibration generator only (blower is outside the room)



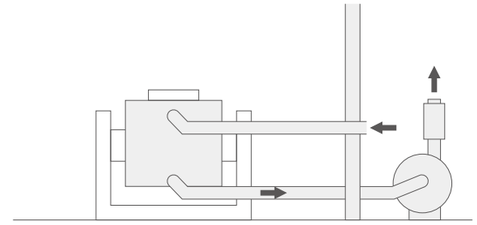
The excitation noise and the air inlet noise are lowered.
It is recommended to place the blower outside the room.
* The blower cannot be installed outdoors.

C.Sound proof box only for the blower



The blower noise is reduced
This method doesn't change the suction noise nor the excitation noise of the vibration generator. *During the blower is stopped, it is recommended to make treatments to prevent air backflow.

3) Concentrated suction type



The suction noise of the vibration generator falls by about 5 dB. The main purpose of concentrated suction is to take air from the outside without using the air in the room to cool the shaker (typically used for clean rooms etc.)
* The blower cannot be installed outdoors.

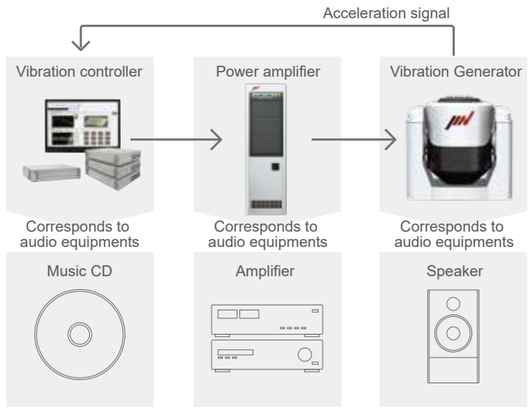
Technical Guidance

Mechanism of vibration test systems

Mechanism of vibration test systems

Electrodynamic vibration test systems

This principle is similar to audio systems where electronic signals from different sources (e.g. CDs) are amplified and converted to sound by loudspeakers. For vibration test systems, the vibration generators correspond to the loudspeakers of the audio systems. They have vibration controllers instead of a sound source to drive the vibration generators feeding the electric current through the amplifiers. The difference is that the signals from the transducers mounted on the specimens and/or vibration tables to monitor their motions are fed back to the vibration controllers in order to control the vibrations and meet the requested test conditions.



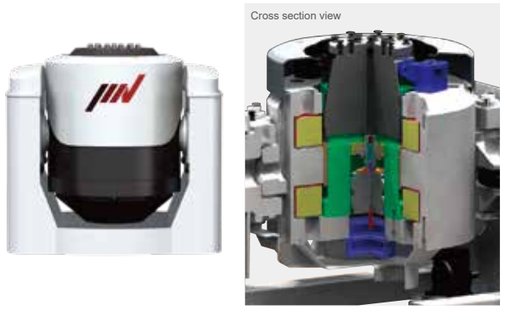
Vibration controller

The original waveforms will not be reproduced by merely applying the vibration data obtained in the field or from test specimens. The waveforms will be totally deformed due to the characteristics of the amplifiers and combined dynamics of the vibration generators and test specimens. The vibration controllers cause the vibration generators to generate the designated vibration and automatically compensate for these dynamics. All IMV vibration controllers are customised for each of our clients in order to meet their particular needs. We always put the customer first and make our products user-friendly.

Complicated tests are professionally programmed and executed.

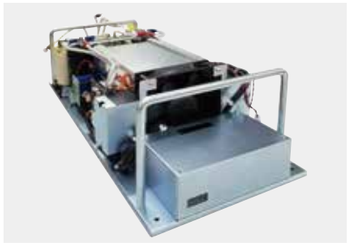
Vibration generator

The operating principle is based on Fleming's "left hand rule". When an electric current flows into a wire within a magnetic field, it creates a force perpendicular both to the field and the direction of the current.



Power amplifier

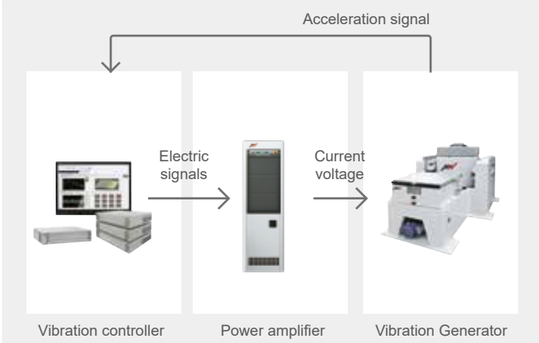
The role of the power amplifier is to feed driving current to the vibration generator, converting the small electrical signal generated in the vibration controller to the large current of higher voltage. IMV's power amplifiers employ the switching amplifier system. They use mainly the compact and highly efficient power modules of the top level in this industry to contribute to energy and space-saving.



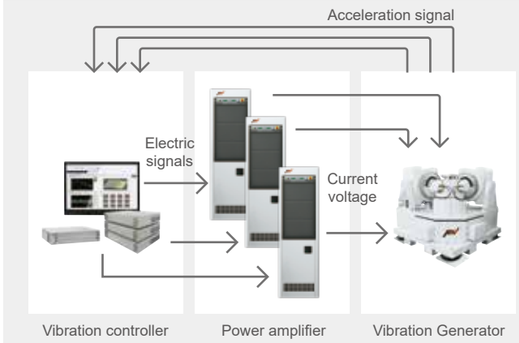
Power module SA-320

Principles of operation

Signal flow, voltage/current supply in single-axis system



Signal flow, voltage/current supply in multi-axis system



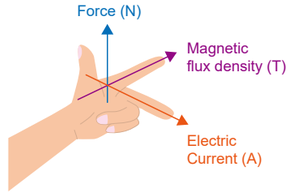
Vibration generator

The operation principle is based on Fleming's "left hand rule".

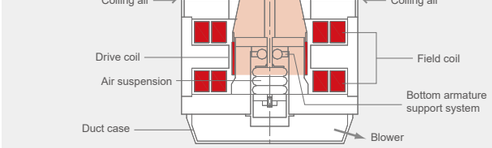
The formula below represents Fleming's left hand rule.

$$F = B \times I \times L$$

F : Force [N]
B : Magnetic flux density [T]
I : Electric current [A]
L : Length of cable [m]



Inside of vibration generator (Air cooling method)



Cooling method of vibration generator

The vibration test system can employ either of two methods to cool: air- or water-cooling. Each method has its own key features. You can select a cooling method that meets your installation requirements based on the key features listed below.

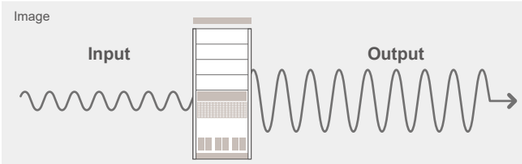
Cooling method	Air cooling	Water cooling
How it works	Cools the coils by using air from outside. Forces exhaust by blower.	The coils are made of pipe and distilled water is circulated to cool the coils using a heat exchanger and a cooling water.
Key features	Employs only a blower as cooling equipment. Easy to install.	Operation noise is significantly lower compared to air cooling.
Points to ponder	Duct connection or soundproof treatments may be necessary to reduce suction noise from the vibration generator and exhaust noise from the blower.	A primary water-cooling facility is necessary.

Power amplifier

A power amplifier in the system supplies electric power to the vibration generator. The power amplifier generates a higher current of higher voltage in response to low power electric signals from the vibration controller.

Electric power (VA) = Electric voltage (V) x Electric current (A)

Image



Technical Guidance

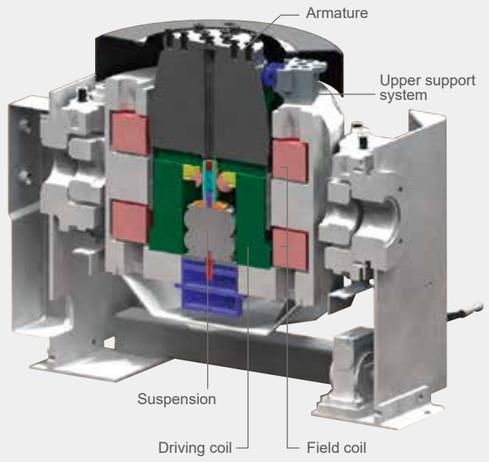
Invention with IMV's originality

Original technology utilised to improve durability and performance of vibration generators

Upper (armature) support system PS guide

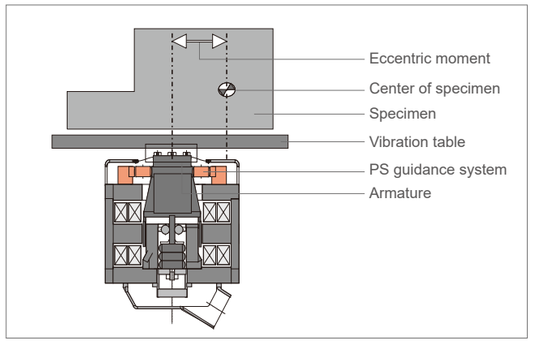
The vibration generator receives dynamic stress from its own vibration. The patented Parallel Support Guide (PSG) design can support the armature. PSG significantly improves durability, reliability of the system, and quality of vibration at the same time. This compact design provides enough stiffness to exceed functions of the roller support system and achieves high durability, producing a self-holding supporting system through the alternative alignment of uniquely-curved gears.

Vibration generator cross section view (image)



Large allowable eccentric moment

When the table working surface of the vibration generator is not wide enough to mount the specimen, it must be expanded using a fixture or auxiliary table. Large lateral rigidity of the table guidance systems is important, because it is difficult to place the center of gravity of the specimen on the center line of the vibration table. The larger the specimen is, the more important this becomes.
Our PS guidance system (Parallel Support Guide) realizes a 130% increase in rigidity over conventional models with the same force range. It has enabled specimens whose centers of gravity are not located on the center line of the vibration table to be tested at a higher acceleration.



Compatibility of lateral rigidity and waveform regeneration accuracy

Usually lateral rigidity and waveform accuracy conflict with each other. The PS Guidance system makes their compatibility possible. It enables vibrations of lower waveform distortion to be combined with high fidelity.

Improvement of durability

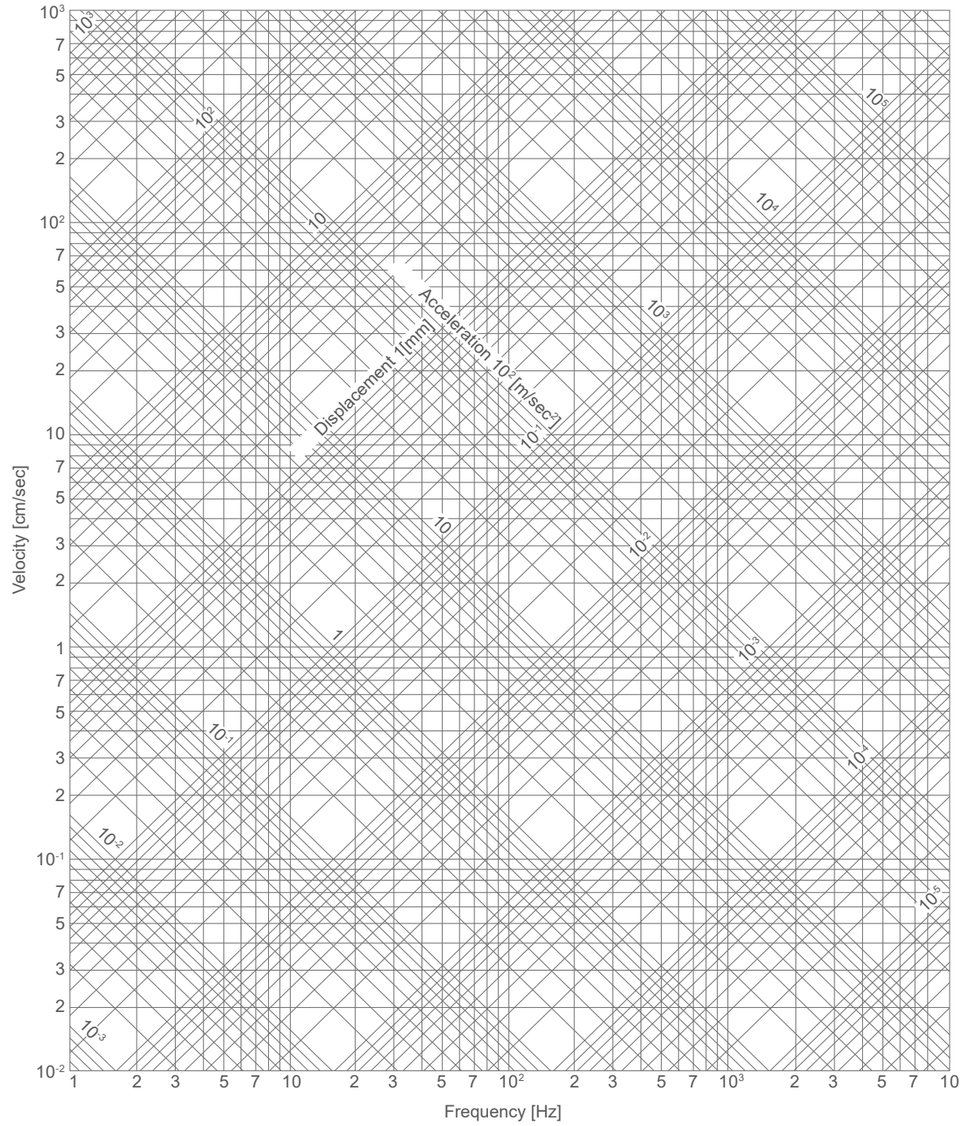
System lifespan has been increased by 10 times (compared to conventional systems), lengthening intervals between maintenance.

Flexibility to respond to demand for large displacement tests

Flexibility enables the system to respond to demand for 100 mm-stroke vibration tests.

Conversion Table

Relationship between frequency, displacement, velocity and acceleration in sine vibration testing



Displacement	D=d [mm]
Velocity	$V=\frac{2\pi fd}{10}$ [cm/sec]
Acceleration	$A=\frac{(2\pi f)^2}{1000}d$ [m/sec²]

f: Frequency [Hz]

Note: D,V and A are in single amplitude

Example

1) f=50 Hz, D=1 mm
   V=31 cm/sec, A=99 m/sec²
2) f=100 Hz, V=100 cm/sec
   D=1.6 mm, A=630 m/sec²
3) f=600 Hz, A=60 m/sec²
   D=0.0042 mm(4.2 μm), V=1.6 cm/sec

IMV Test Laboratory Network

IMV's test laboratory network provides full support to customers

IMV's full service offerings make us the customer's partner of choice

Since 1988, IMV has been pioneering the test laboratory business in Japan. IMV opened six test laboratories in Japan and two overseas. IMV's test experts solve problems with the highest quality and using the most advanced test systems. IMV has worked on over 20,000 test projects.

Certified to ISO/IEC 17025

IMV's test laboratories are authorised and operating under quality control management systems in accordance with the international standard ISO/IEC 17025, which specifies the testing capability and test laboratory calibration.

【Outline of Japanese laboratory】
① Certification number: RTL04240
② Authorisation organisation: Public Interest Incorporated Association the Japan Accreditation Board
③ Authorisation date: March 15th, 2016
④ Authorised field: Vibration test/shock, test/temperature, cycling test / vibration and temperature cycling test/ISO16750-3 TEST Ⅰ (engine) and TEST Ⅳ (vehicle body)

【Outline of Thai laboratory】
① Certification number: 4784.01
② Authorisation organisation: A2LA
③ Authorisation date: June 26th, 2018
④ Authorised field: Vibration test (Sine), Vibration test (Random), Shock test, Temperature cycling test, Vibration and temperature cycling test, Temperature test (hot), Temperature test (cold), Temperature and humidity cycling test, Temperature and humidity static test

【Outline of Vietnam laboratory】
① Accreditation number: VILAS 1284
② Certification Bodies: Bureau of Accreditation Vietnam (BoA)
③ Accreditation date: 2nd March 2020
④ Accreditation scope: Vibration test (Sinusoidal), Vibration test (Broad band random), Shock test, Dry heat environmental test, Cold environmental test, Change of temperature test, Damp heat environmental test (steady), Damp heat environmental test (cyclic).

Testing LAB RTL04240 ISO/IEC 17025

ACCREDITED CERT #4784.01

VILAS 1284

e-Test Centre Japan

Focused on solving problems for our customers, the latest test laboratory brings together Japan's technology for reliability evaluation. Companies complement each other, offering high value-added services such as precise analysis, new test methods, development of new facilities and so on. EMC testing has been carried out by dedicated engineers since November 2019.

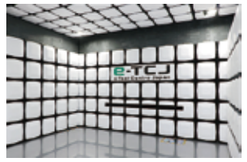
- Reliability evaluation test for e-mobility parts such as large-sized motor or inverter of EV/HEV
- Evaluation of large parts (e.g.100 kg), 1 m is possible while the part is in operation
- Various environmental tests such as high stress temperature cycle test or salt spray test
- Ultra-high temperature (900 °C) chamber combined vibration test is available
- EMC testing by dedicated engineers
- Full security system

4102-142 Miyadera, Iruma, Saitama, 358-0014, Japan
Tel: +81-4-2009-1043
Fax: +81-4-2009-1044
E-mail: info-etcj@imv-corp.com

Chamber Combined Vibration Test System with a Slip Table

High Stress Temperature Cycle Test System

Cyclic Corrosion Test System



Anechoic chamber

For more information (Japanese only)

Advanced Technology Centre for Environmental Testing

In order to meet future needs, we installed a full range of vibration test systems for battry testing and very large specimens.
ATC is a facility that takes into consideration the IT environment and the security of information based on ISO 27001.

- Installed Japan's largest vibration test system, 350 kN
- Lithium-ion battery testing for EV/HEV
- Installed a large earthquake resistance test system capable of reproducing earthquake waves
- High-velocity shock test is available
- Full security system

2193-28, Yatsusawa, Uenohara-shi, Yamanashi, 409-0133, Japan
Tel: +81-554-62-6677
Fax: +81-554-62-6678
E-mail: info-uenohara@imv-corp.com

The world's largest 350 kN Vibration Test System with a Slip Table

3-axis Large Earthquake-Resistance Vibration Test System

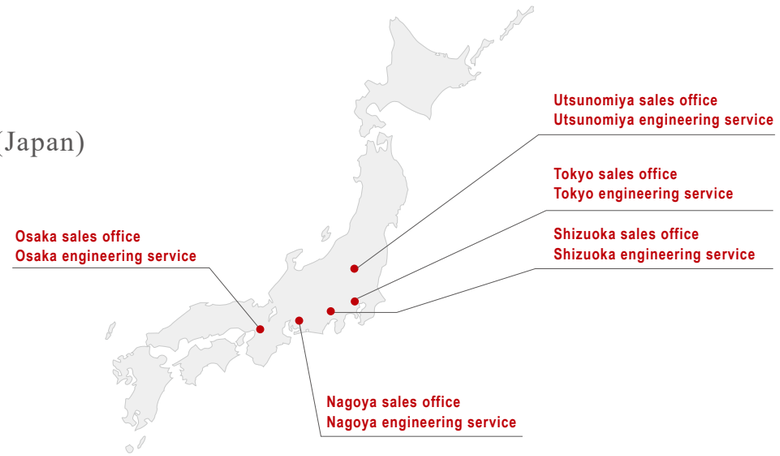
Chamber Combined Vibration Test System with a Slip Table

For more information (Japanese only)

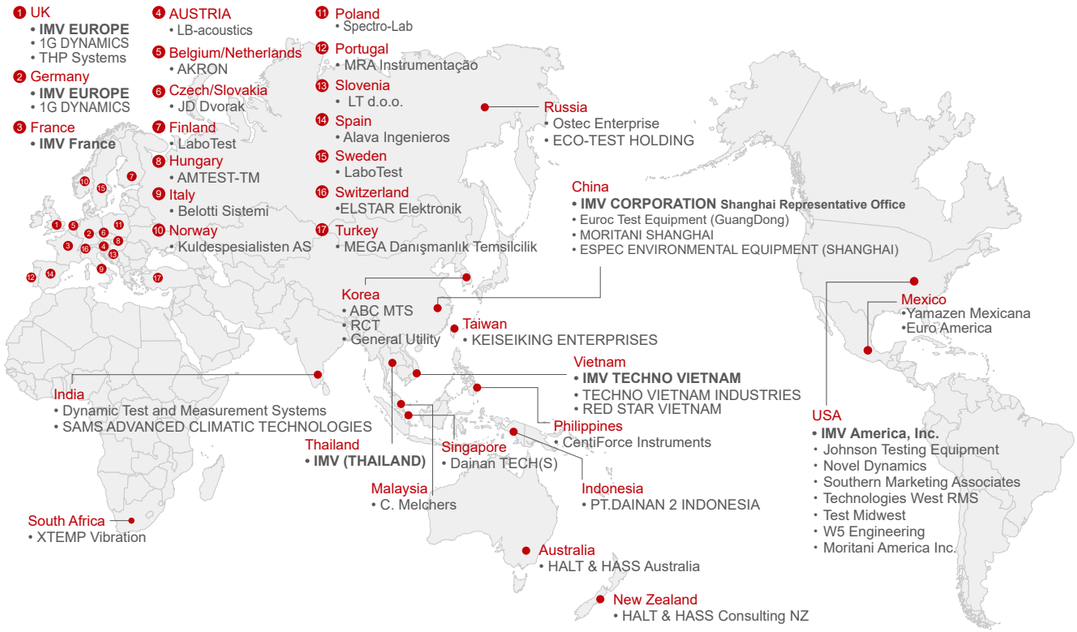
Coverage

Service area

Service networks (Japan)



Global Networks



Thailand **IMV(THAILAND)CO.,LTD.**

UK **• IMV EUROPE LIMITED**
• Manufacturing and Demonstration Centre

Germany **IMV EUROPE LIMITED**
German sales Office

China **IMV CORPORATION**
Shanghai Representative Office

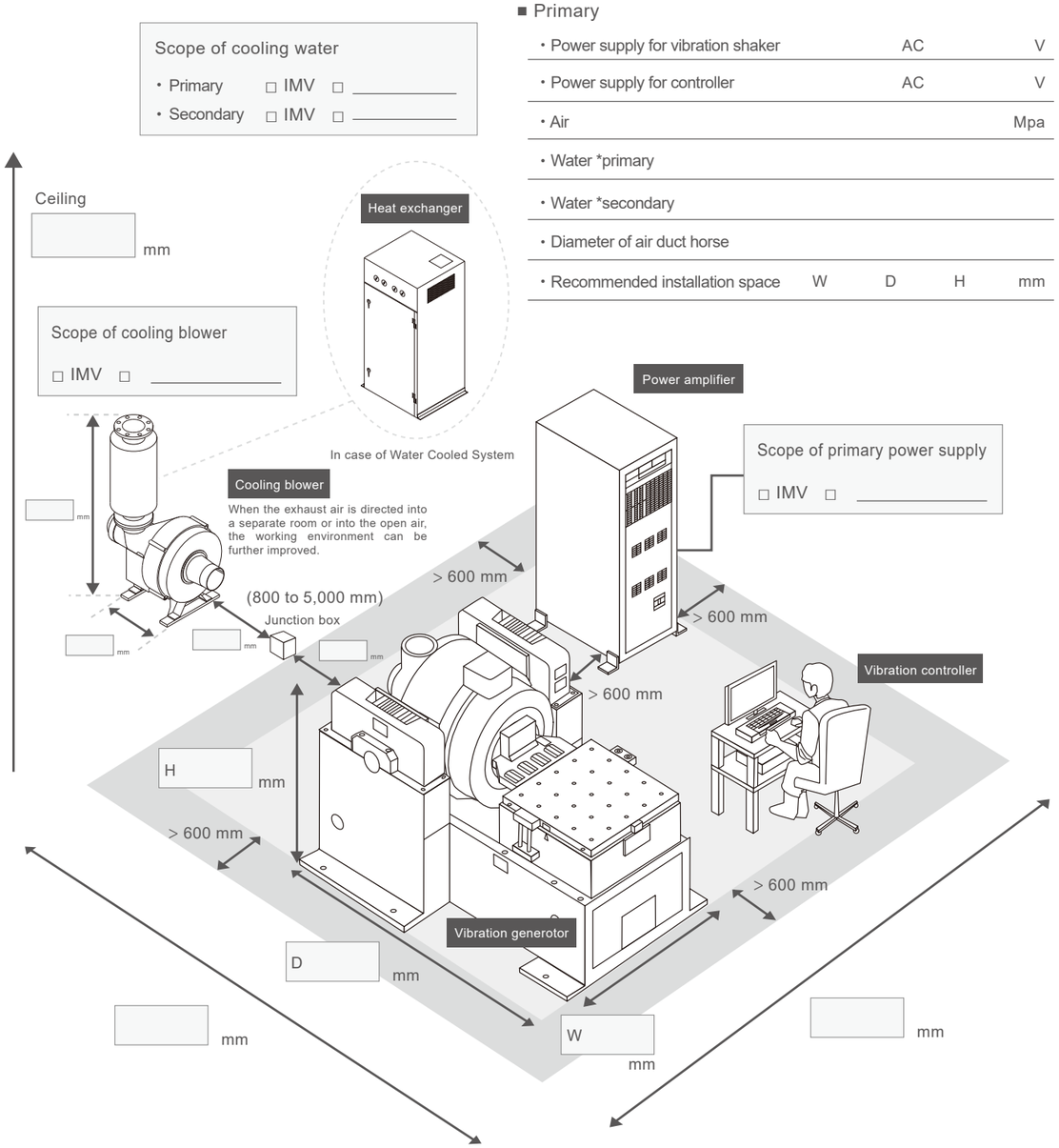
USA **IMV America, Inc**

Vietnam **IMV TECHNO VIETNAM COMPANY LIMITED**

France **IMV France**

System Layout

InstIlation Example



■ Model

■ Primary

• Power supply for vibration shaker	AC			V
• Power supply for controller	AC			V
• Air				Mpa
• Water *primary				
• Water *secondary				
• Diameter of air duct horse				
• Recommended installation space	W	D	H	mm

*Room layout can be changed to suit the customer's needs.

Note