IMV CORPORATION

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

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MES Business Division
IMV Advanced Technology Research Laboratory
Sales Division
Quality Assurance Department
Personnel/General Affairs Department

JQA-1573

CN/14640E Osaka Site

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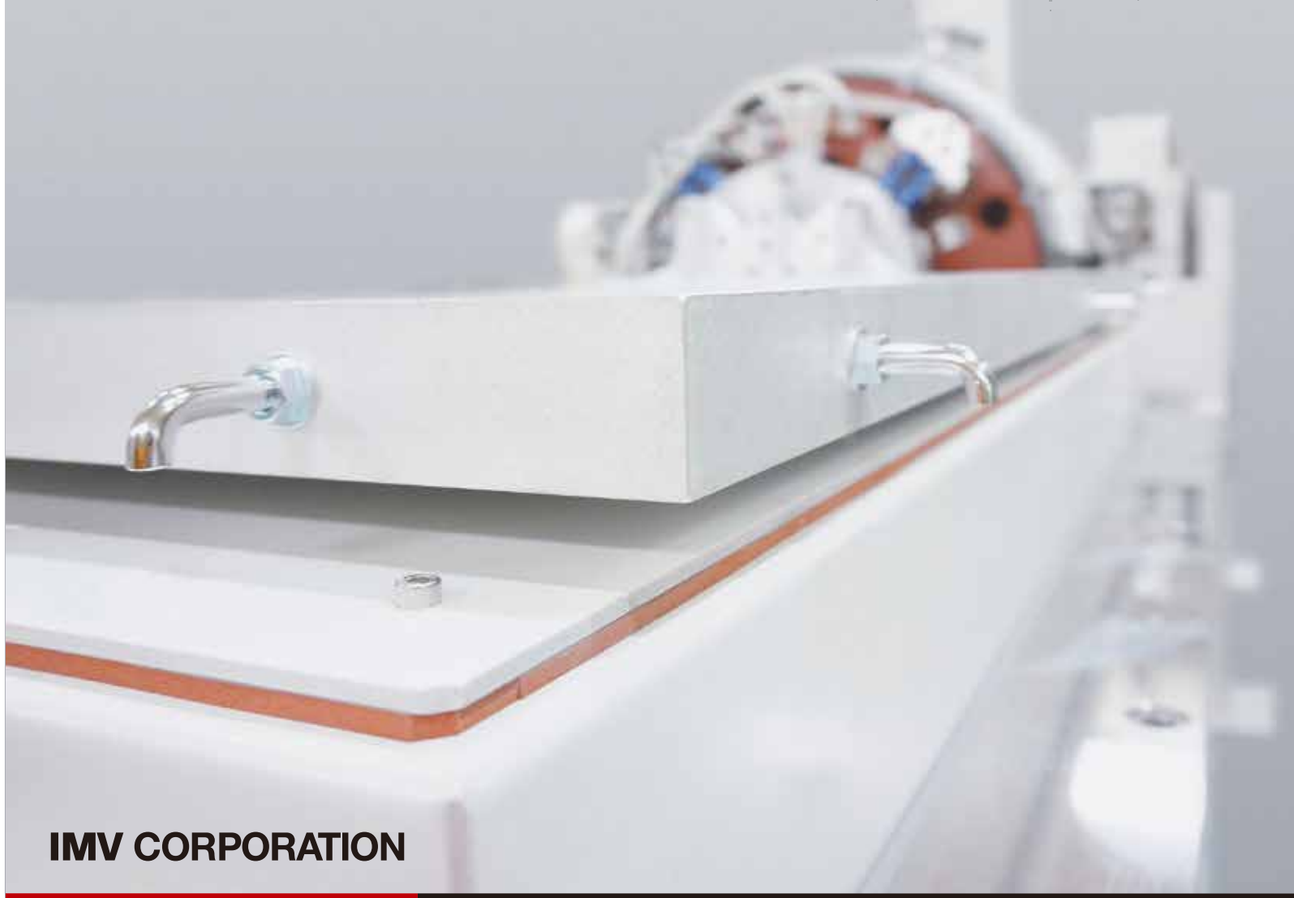
Global version

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 technically-advanced systems, with safety and reliability as first priorities.

The range of IMV vibration-test systems includes single-axis and simultaneous multi-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.

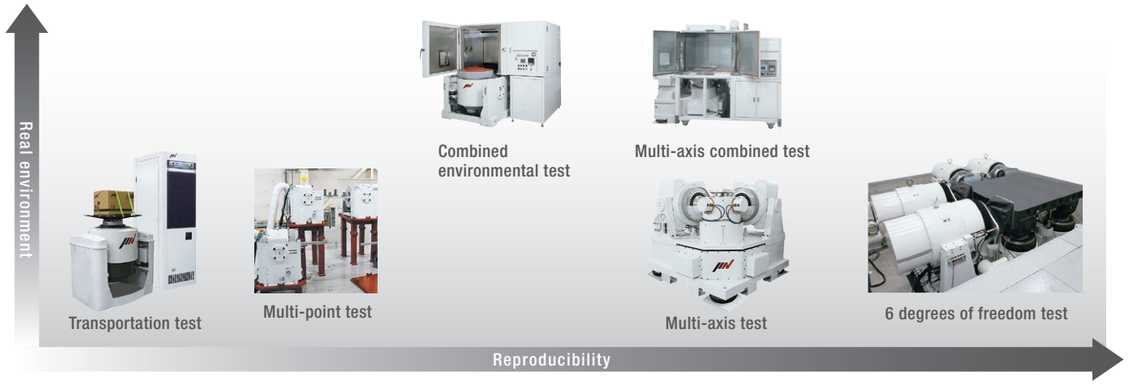
We are proud to be contributing to the safety and reliability of a wide range of products by working with the automotive, aerospace, electrical machinery and structural engineering industries to solve problems caused by vibration.

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

INDEX

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 i-series J-series	High Grade Range Standard Range Large Displacement 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
C-series	Transportation Test Range	P17	Door mirror	—	Packing material, Transportation package, Usage environmental transportation, Domestic electric appliances, Projector		Packing material	Packing material, Transportation package, Usage environmental transportation, Game equipment	Inverter equipment	Transportation for medicine	Packing material
K-series	High Excitation Force Water Cooled Range	P19	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	P21	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)
VSH/PET	High Frequency and Compact Range	P23	O_2 sensor, Exhaust sensor	—	Filling, Piezo-electric element, Sensor associated component, SW associated component		—	—	—	—	—
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		Car navigation, 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, Car 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

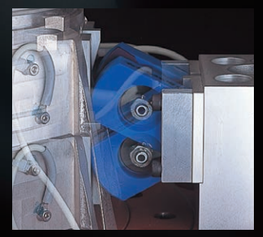
Vibration Test Systems
Basic Systems

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.

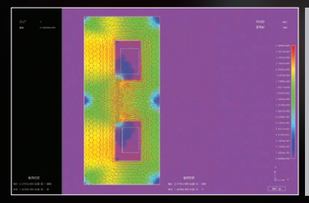
Upper (armature) support system PS Guide

High vibration levels intensity places 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.

Vibration controller K2

[Features]

- Only vibration test pattern 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)

Effect of energy saving

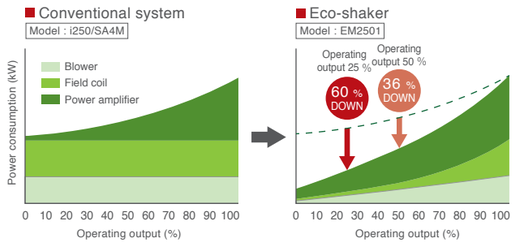
The lower the system output, the more energy saving can be achieved.

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

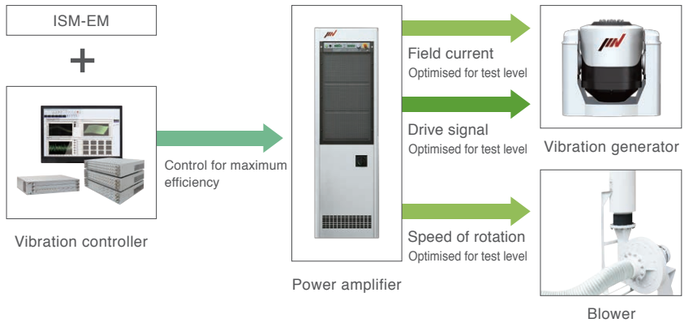
Reduce yout CO_2 emissions by up to 80 %



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 CO_2 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

優秀省エネルギー機器

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

Contribution to the environment

Many countries have legislated, 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/EM3HM

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]

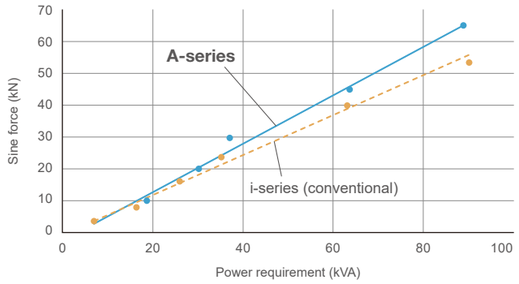
Improvement of performance

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.

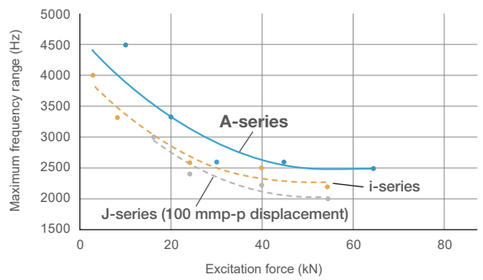
i-series (conventional)
51 mmp-p displacement

A-series

J-series (conventional)
100 mmp-p displacement

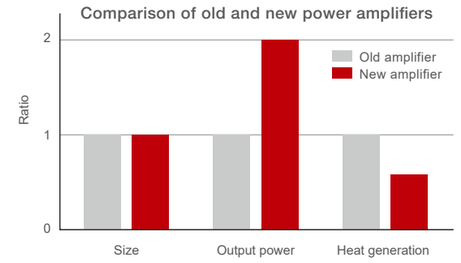
Increase in frequency range

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

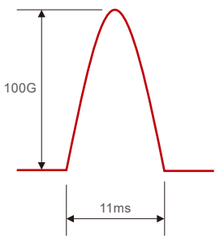
By developing a power amplifier that uses a new next generation Silicon Carbide power module, IMV has achieved low noise and high efficiency.
This new power module is standard-issue for all A-series models.



High velocity shock testing

Where a test requires a high shock velocity, traditional shaker systems use a matching transformer to achieve the necessary higher armature 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 3.5 m/s shock velocity testing.

Examples of shock test



	Model	i220/SA1AM
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/SA3AM	J240/SA4AM	J250/SA6AM	J260/SA7AM	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/EM1HAM	A22/EM2HAM	A30/EM3HAM	A45/EM4HAM	A65/EM5HAM	A74/EM8HAM
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

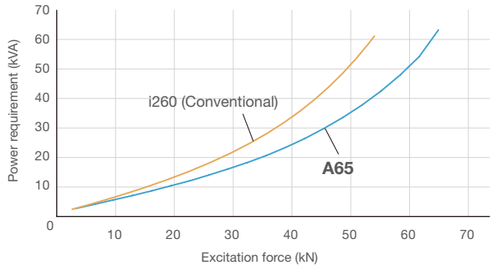
A-series changes

Advanced automatic energy saving, high level of functionality and a protected test environment.
A-series improves the working environment of 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 saving is achieved across all force ranges.

Comparison of consumed power per excitation force A65 vs i260



International safety standards

A-series complies with internation-al safety standards.

Combined option with high thermal insulation

*Only for A30, A45, A65, A74

Combined option of direct coupling of A-series uses a newly designed high thermal insulation structure. Improved temperature uniformity inside the chamber reduces the effect of dew condensation.

Down to 1/5

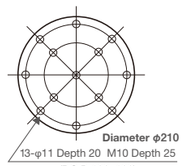
Optional built-in vibration controller

*Only for A12, A22, C10

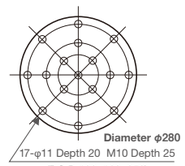
It is possible to save the space by incorporating PC, display and keyboard for vibration controller into the power amplifier.
The keyboard can be stored when it is not used.

* Display size is 17 inch
* Keyboard with numeric keypad

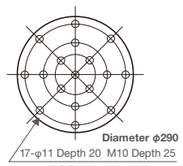
Table Insert Pattern (Unit: mm)



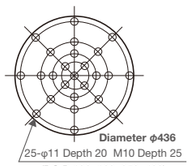
A11



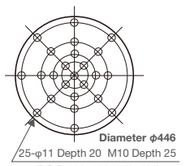
A22



A30



A45



A65/A74

Specifications

System Model			A11/ SA1HAM	A11/ EM1HAM	A22/ SA2HAM	A22/ EM2HAM	A30/ SA3HAM	A30/ EM3HAM	A45/ SA4HAM	A45/ EM4HAM	A65/ SA5HAM*8	A65/ EM5HAM*8	A74/ EM6HAM*8	A74/ EM8HAM*8
System Specifications	Frequency Range (Hz)		0-4500*5	0-4500*5	0-3300	0-3300	0-2600	0-2600	0-2600	0-2600	0-2600*6	0-2600*6	0-2600*6	0-2600*6
	Rated Force	Sine (kN)	11	11	22	22	30	30	45	45	65	65	74	74
		Random (kN rms)*1	11	11	22	22	30	30	45	45	65	65	74	74
		Shock (kN)	22	22	44	44	60	60	90	90	130	130	148	180
		High Velocity Shock (kN)	-	16.5	-	36	-	50	-	80	-	120	120	160
	Maximum Acc.	Sine (m/s²)	1000	1000	1000	1000	900	900	900	900	900	900	1000	1000
		Random (m/s² rms)	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
		High Velocity Shock (m/s² peak)	-	1500	-	1636	-	1515	-	1600	-	1666	1621	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
		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
		High Velocity Shock (m/s peak)	-	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
		High Velocity Shock (mmp-p)	-	55	-	55	-	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
	Maximum Load (kg)		200	200	300	300	400	400	600	600	1000	1000	1000	1000
	Power Requirements (kVA)*2		20.4	20.4	30	30	36	36	57	57	83	83	118	118
	Breaker Capacity (A)		75*3	75*3	100*3	100*3	125*3	125*3	200*3	200*3	300*3	300*3	250*4	250*4
Vibration Generator	Model		A11	A11	A22	A22	A30	A30	A45	A45	A65	A65	A74	A74
	Armature Mass (kg)		11	11	22	22	33	33	50	50	72	72	74	74
	Armature Diameter (φmm)		210	210	280	280	290	290	436	436	446	446	446	446
	Allowable Eccentric Moment (N•m)		294	294	700	700	850	850	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
	Shaker Body Diameter (φmm)		585	585	678	678	725	725	825	825	925	925	925	925
	Mass (kg)		1080	1080	1600	1600	2000	2000	3000	3000	4200	4200	4800	4800
Power Amplifier	Model		SA1HAM-A11	EM1HAM-A11	SA2HAM-A22	EM2HAM-A22	SA3HAM-A30	EM3HAM-A30	SA4HAM-A45	EM4HAM-A45	SA5HAM-A65	EM5HAM-A65	EM6HAM-A74	EM8HAM-A74
	Maximum Output (kVA)		12	12	24	24	31	31	44	44	68	68	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
	Mass (kg)		280	470	350	560	520	590	900	1000	1000	1150	1340	1850
Controller	Vibration Controller		See Vibration Controller K2											
Cooling	Cooling Method		Air cooling											
	Blower	Dimensions (mm) W × H × D*7	606 × 1315 × 891	708 × 1421 × 782	707 × 1531 × 917	707 × 1531 × 917	707 × 1531 × 917	707 × 1531 × 917	1057 × 1841 × 1125	1169 × 2123 × 799	1214 × 2006 × 1124	1128 × 2380 × 899	1462 × 2800 × 927	1462 × 2800 × 927
		Mass (kg)	125	140	210	210	210	210	250	280	420	228	536	536
		Wattage (kw)	3.7	3.7	5.5	5.5	5.5	5.5	11	11	18.5	18.5	30	30
		Duct Hose Diameter (φ)	125	125	200	200	200	200	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 200/220/380/400/415 V (A74 is only AC380/400/415 V), 50/60 Hz. A transformer is required for other supply voltages.
*3 Breaker capacity for AC200 V.
*4 Breaker capacity for AC400 V.
*5 Above 4000 Hz, the force rolls-off at a rate of -6 dB/oct.
*6 Above 2000 Hz, the force rolls-off at a rate of -12 dB/oct.
*7 Specification above applies to 60 Hz. Dimensions change for 50 Hz.
*8 An export license is required for exporting the shaker system of over 50 kN sine force. (see P. 76)
*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.
*Mass and dimensions may change for CE-marked systems.

i-series
Standard Range

i220/SA1AM
(With a slip table)

Universally applicable with over 15 years of sales success.

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

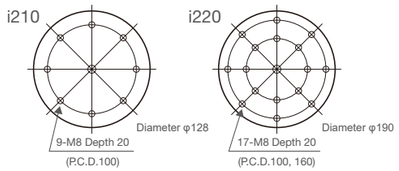
[Maximum test range]

• Maximum acceleration: 1250 m/s² •Maximum velocity: 3.5 m/s •Maximum displacement: 51 mmp-p •Maximum loading mass: 200 kg

[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			i210/SA1AM	i220/SA1AM
System Specifications	Frequency Range (Hz)		0-4000	0-3300
	Rated Force	Sine (kN)	3	8
		Random (kN rms)*1	3	8
		Shock (kN)	9	16
	Maximum Acc.	Sine (m/s²)	1000	1250
		Random (m/s² rms)	700	875
		Shock (m/s² peak)	2000	2000
	Maximum Vel.	Sine (m/s)	2.2	2.2
		Shock (m/s peak)	2.2	2.2
	Maximum Disp.	Sine (mmp-p)	30	51
	Maximum Travel (mmp-p)		40	60
	Maximum Load (kg)		120	200
	Power Requirements (kVA)*2		6.8	16.4
	Breaker Capacity (A)*3		30	60
Vibration Generator	Model		i210	i220
	Armature Mass (kg)		3	6.4
	Armature Diameter (φmm)		128	190
	Allowable Eccentric Moment (N•m)		160	294
	Dimensions (mm) W×H×D		868×700×458	1020×903×550
	Shaker Body Diameter (φmm)		458	550
	Mass (kg)		350	900
Power Amplifier	Model		SA1AM-i10	SA1AM-i20
	Maximum Output (kVA)		5	10
	Dimensions (mm) W×H×D		580×1750×850	580×1750×850
	Mass (kg)		240	280
Controller	Vibration Controller		See Vibration Controller K2	
Cooling	Cooling Method		Air cooling	
	Blower	Dimensions (mm) W×H×D*4	386×882×369	492×1128×625
		Mass (kg)	22	70
		Wattage (kw)	0.4	1.5
		Duct Hose Diameter (φ)	125	125

Eco Specifications

System Model			i220/EM1AM
System Specifications	Frequency Range (Hz)		0-3300
	Rated Force	Sine (kN)	8
		Random (kN rms)*1	8
		Shock (kN)	16
		High Velocity Shock (kN)*5	10
	Maximum Acc.	Sine (m/s²)	1250
		Random (m/s² rms)	875
		Shock (m/s² peak)	2000
		High Velocity Shock (m/s² peak)*5	1562
	Maximum Vel.	Sine (m/s)	2.2
		Shock (m/s peak)	2.2
		High Velocity Shock (m/s peak)*5	3.5
	Maximum Disp.	Sine (mmp-p)	51
		High Velocity Shock (mmp-p)*5	51
	Maximum Travel (mmp-p)		60
	Maximum Load (kg)		200
	Power Requirements (kVA)*2		16.4
	Breaker Capacity (A)*3		60
Vibration Generator	Model		i220
	Armature Mass (kg)		6.4
	Armature Diameter (φmm)		190
	Allowable Eccentric Moment (N•m)		294
	Dimensions (mm) W×H×D		1020×903×550
	Shaker Body Diameter (φmm)		550
	Mass (kg)		900
Power Amplifier	Model		EM1AM-i20
	Maximum Output (kVA)		10
	Dimensions (mm) W×H×D		580×1750×850
	Mass (kg)		330
Controller	Vibration Controller		See Vibration Controller K2
Cooling	Cooling Method		Air cooling
	Blower	Dimensions (mm) W×H×D*4	492×1128×625
		Mass (kg)	70
		Wattage (kw)	1.5
		Duct Hose Diameter (φ)	125

*1 Ranfom 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 200/220/380/400/415 V, 50/60 Hz. A transformer is required for other supply voltages. *3 Breaker capacity for 200 V. *4 Specification above applies to 60 Hz. Dimensions change for 50 Hz. *5 For high velocity option
*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. *Mass and dimensions may change for CE-marked systems.

J-series

Large Displacement Range

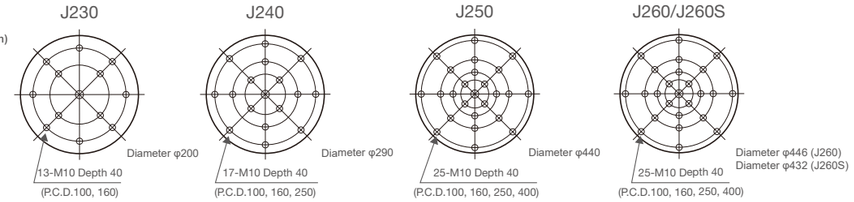
J240/SA4AM
(With a slip table)

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 furnished with functions 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
[Low noise] Optimised design of the air intake based on fluid dynamics has reduced the air-intake noise.
[All models can be directly coupled to a climatic chamber]

Table Insert Pattern (Unit: mm)



Specifications

System Model			J230/SA3AM	J230S/SA7AM	J240/SA4AM	J240S/SA6HAM	J250/SA5AM	J250/SA6AM	J260/SA7AM*6	J260S/SA16HAM*6
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/s²)	941	888	923	857	777	888	857	857
		Random (m/s² rms)	658	622	646	600	544	622	600	600
		Shock (m/s² 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	127
	Breaker Capacity (A)*3		100	150	150	200	200	200	300	500
	Model		J230	J230S	J240	J240S	J250	J250	J260	J260S
Vibration Generator	Armature Mass (kg)		17	18	26	28	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	1657×1319×1100
	Shaker Body Diameter (φmm)		630	630	720	720	860	860	920	920
	Mass (kg)		1800	1800	2400	2400	3500	3500	4100	5000
Power Amplifier	Model		SA3AM-J30	SA7AM-J30S	SA4AM-J40	SA6HAM-J40S	SA5AM-J50	SA6AM-J50	SA7AM-J60	SA16HAM-J60S
	Maximum Output (kVA)		23	30	34	40	50	57	70	76
	Dimensions (mm) W×H×D		580×1750×850	580×1950×850	580×1750×850	1160×1950×850	580×1950×850	580×1950×850	580×1950×850	1740×1950×850
	Mass (kg)		330	500	440	1200	880	910	1000	3000
Controller	Vibration Controller		See Vibration Controller K2							
Cooling	Cooling Method		Air cooling							
	Blower	Dimensions (mm) W×H×D*5	606×1315×891	606×1315×891	707×1531×917	707×1531×917	1057×1841×1125	1057×1841×1125	1328×2410×1097	1328×2410×1097
		Mass (kg)	125	125	210	210	250	250	370	370
		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/EM3AM	J240/EM4AM	J250/EM5AM	J250/EM6AM	J260/EM7AM*6
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)*7	30	48	68	77	96
	Maximum Acc.	Sine (m/s²)	941	923	777	888	857
		Random (m/s² rms)	658	646	544	622	600
		Shock (m/s² peak)	2000	2000	1555	1777	1714
		High Velocity Shock (m/s² peak)*7	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)*7	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)*7	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		100	150	200	200	300
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	1234x1145x890	1463x1301x1100	1463x1301x1100	1527x1319x1100
	Shaker Body Diameter (φmm)		630	720	860	860	920
	Mass (kg)		1800	2400	3500	3500	4100
Power Amplifier	Model		EM3AM-J30	EM4AM-J40	EM5AM-J50	EM6AM-J50	EM7AM-J60
	Maximum Output (kVA)		23	34	50	57	70
	Dimensions (mm) W×H×D		580×1750×850	580×1750×850	580×2100×850	580×2100×850	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	708×1421×782	707×1531×917	1169×2123×799	1169×2123×799	1328×2410×1097
		Mass (kg)	140	210	280	280	370
		Wattage (kw)	3.7	5.5	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 200/220/240/380/400/415 V, 50/60 Hz. A transformer is required for other supply voltages. *3 Breaker capacity for 200 V. *4 Above 2000 Hz, the force rolls-off at a rate of -12 dB/oct. *5 Specification above applies to 60 Hz. Dimensions change for 50 Hz. *6 An export license is required for exporting the shaker system of over 50 kN sine force. (See P. 76) *7 For high velocity option *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. *Mass and dimensions may change for CE-marked systems.

C-series

Transportation Test Range

C10/SA1MM

Large displacement is ideal for heavy weight transportation testing.

C-series is optimized for transportation tests.

[Heavy weight load] The improved load capacity realizes vibration testing with heavy weight specimen.

[Large maximum displacement] C-series is suitable for low-frequency, high-displacement tests commonly used in transport vibration testing.

Standard 76.2 mmp-p displacement

C-series has a displacement of 76.2 mmp-p (3 inch stroke).

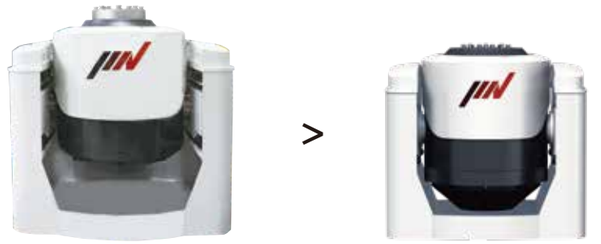
Maximum load 1,000 kg

C-series vibration generators are enhanced for the maximum allowable payload surpassing the conventional. It enables them to perform vibration testing for heavier specimens.

High rigidity

C-series vibration generators are designed to support specimens whose center of gravities are high or deviated from the center lines.

* Please refer to page 73 for allowable eccentric moment.



C10

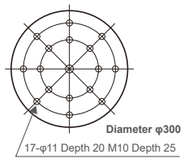
Rated force: 10 kN
Allowable eccentric moment: **686 N•m**

>

A11

Rated force: 11 kN
Allowable eccentric moment: 294 N•m

Table Insert Pattern (Unit: mm)



C10

Specifications

System Model			C10/SA1AM
System Specifications	Frequency Range (Hz)		0-2000
	Rated Force	Sine (kN)	10
		Random (kN rms)	7
		Shock (kN)	20
	Maximum Acceleration	Sine (m/s^2)	400
		Random (m/s^2 rms)	280
		Shock (m/s^2 peak)	800
	Maximum Velocity	Sine (m/s)	1.2
		Shock (m/s peak)	2.0
	Maximum Displacement (mmp-p)		76.2
	Maximum Load (kg)		1000
	Power Requirements (kVA)*1		11.9
	Breaker Capacity (A)*2		50
Vibration Generator	Model		C10
	Armature Mass (kg)		25
	Armature Diameter (φmm)		300
	Allowable Eccentric Moment (N•m)		686
	Dimensions (mm)		1100×1142×840
	Mass (kg)		2000

Power Amplifier	Model		SA1AM-C10
	Maximum Output (kVA)		6.2
	Dimensions (mm)		580×1950×850
	Mass (kg)		260
Controller	See Vibration Controller K2		
Cooling	Cooling Method		Air cooling
	Blower	Dimensions W×H×D (mm)*3	479×1075×667
		Mass (kg)	56
		Wattage (kw)	2.2
		Duct Hose Diameter (φ)	200

*1 Power supply required is 3-phase 200/220/380/400/415 V, 50/60 Hz. Voltage Down Transformer (Step-down transformer) is required for other voltage.
*2 Breaker capacity for 200 V
*3 Specifcation above applies to 60 Hz. Dimensions change for 50 Hz.
*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.
*Armature mass and acceleration may change when a chamber is added.

K-series

High Excitation Force Water Cooled Range

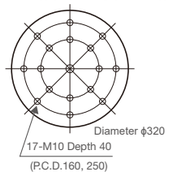
K350
(With a slip table)

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

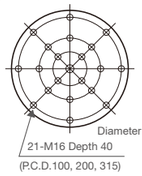
K-series, high excitation force water cooled vibration simulating test systems fully developed by IMV.
Advanced function of the K-series will significantly improve the test environment.

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

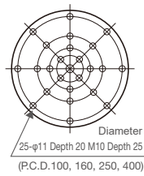
Table Insert Pattern (Unit: mm)



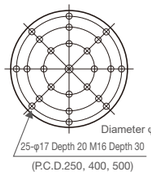
K030



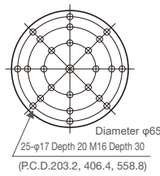
K060



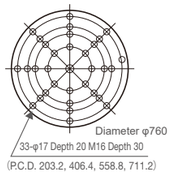
K080



K125A / K125LS



K200



K350

Specifications

System Model			K030/SA4AM	K062/SA8AM*6	K080/SA10HAM*6	K100A/SA14HAM*6	K125A/SA18HAM*6	K100LS/SA16HAM*6	K125LS/SA20HAM*6	K160/SA20HAM*6	K200/SA24HAM*6	K350/SA36HAM*6
System Specifications	Frequency Range (Hz)		0-3000	0-2500	0-2500	0-2500	0-2500	0-2000	0-2000	0-2000	0-2000	0-2000
	Rated Force	Sine (kN)	30.8	61.7	80	100	125	100	125	160	200	350
		Random (kN rms)*1	21.5	61.7	80	100	125	100	125	160	200	315
		Shock (kN)	61.6	123.4	160	200	250	200	250	320	400	700
	Maximum Acc.	Sine (m/s²)	1000	1000	1000	1000	1000	1000	1000	800	1000	1000
		Random (m/s² rms)	557	700	700	700	700	700	700	560	700	700
		Shock (m/s² peak)	2000	2000	2000	2000	2000	2000	2000	1600	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	2.0
		Shock (m/s peak)	1.8	2.0	2.0	2.0	2.0	2.0	2.0	2.4	2.4	3.5
	Maximum Disp.	Sine (mmp-p)	51	51	51	51	51	100	100	76.2	76.2	76.2
	Maximum Travel (mmp-p)		58	60	59	62	62	132	132	86	86	94
	Maximum Load (kg)		500	1000	1000	2000	2000	2000	2000	2000	2000	3000
	Power Requirements (kVA)*2		49	87	100	150	170	170	190	270	300	325
	Breaker Capacity (A)*4		175	350	350	600	600	600	700	-	-	-
Vibration Generator	Model		K030	K060	K080	K125A	K125A	K125LS	K125LS	K200	K200	K350
	Armature Mass (kg)		27	40	60	80	80	100	100	200	200	350
	Armature Diameter (φmm)		320	400	446	560	560	560	560	650	650	760
	Allowable Eccentric Moment (N•m)		980	980	1550	2450	2450	2450	2450	4900	4900	4900
	Dimensions (mm) W×H×D		1100×1090×824	1380×1085×1000	1595×1200×1050	1776×1373×1300	1776×1373×1300	1990×546×1370	1990×1546×1370	2465×1908×1740	2465×1908×1740	3020×2306×2080
	Shaker Body Diameter (φmm)		760	900	1000	1100	1100	1100	1100	1260	1260	1630
	Mass (kg)		3000	3700	5000	7000	7000	8000	8000	16000	16000	42000
Power Amplifier	Model		SA4AM-K30	SA8AM-K60	SA10HAM-K80	SA14HAM-K125A	SA18HAM-K125A	SA16HAM-K125LS	SA20HAM-K125LS	SA20HAM-K200	SA24HAM-K200	SA36HAM-K350
	Maximum Output (kVA)		33	60	100	98	124	124	155	256	320	400
	Dimensions (mm) W×H×D		580×1950×850	1160×1950×850	1160×1950×850	1740×1950×850	1740×1950×850	1740×1950×850	1740×1950×850	2900×1950×850	2900×1950×850	4060×1950×850
	Mass (kg)		950	1350	1500	2500	2600	2600	3300	4850	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	690*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	1050×1900×800	1050×1900×800	1200×1950×1400
		Mass (kg)	400	400	400	400	400	400	400	600	600	950

Eco Specifications

System Model			K030/EM4AM	K062/EM8AM*6	K080/EM10HAM*6	K100A/EM14HAM*6	K125A/EM18HAM*6	K100LS/EM16HAM*6	K125LS/EM20HAM*6	K160/EM20HAM*6	K200/EM24HAM*6	K350/EM36HAM*6
System Specifications	Frequency Range (Hz)		0-3000	0-2500	0-2500	0-2500	0-2500	0-2000	0-2000	0-2000	0-2000	0-2000
	Rated Force	Sine (kN)	30.8	61.7	80	100	125	100	125	160	200	350
		Random (kN rms)*1	21.5	61.7	80	100	125	100	125	160	200	315
		Shock (kN)	61.6	123.4	160	200	250	200	250	320	400	700
	Maximum Acc.	Sine (m/s²)	1000	1000	1000	1000	1000	1000	1000	800	1000	1000
		Random (m/s² rms)	557	700	700	700	700	700	700	560	700	700
		Shock (m/s² peak)	2000	2000	2000	2000	2000	2000	2000	1600	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	2.0
		Shock (m/s peak)	1.8	2.0	2.0	2.0	2.0	2.0	2.0	2.4	2.4	3.5
	Maximum Disp.	Sine (mmp-p)	51	51	51	51	51	100	100	76.2	76.2	76.2
	Maximum Travel (mmp-p)		58	60	59	62	62	132	132	86	86	94
	Maximum Load (kg)		500	1000	1000	2000	2000	2000	2000	2000	2000	3000
	Power Requirements (kVA)*2		49	87	100	150	170	170	190	270	300	325
	Breaker Capacity (A)*4		175	350	350	600	600	600	700	-	-	-
Vibration Generator	Model		K030	K060	K080	K125A	K125A	K125LS	K125LS	K200	K200	K350
	Armature Mass (kg)		27	40	60	80	80	100	100	200	200	350
	Armature Diameter (φmm)		320	400	446	560	560	560	560	650	650	760
	Allowable Eccentric Moment (N•m)		980	980	1550	2450	2450	2450	2450	4900	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	2465×1908×1740	3020×2306×2080
	Shaker Body Diameter (φmm)		760	900	1000	1100	1100	1100	1100	1260	1260	1630
	Mass (kg)		3000	3700	5000	7000	7000	8000	8000	16000	16000	42000
Power Amplifier	Model		EM4AM-K30	EM8AM-K60	EM10HAM-K80	EM14HAM-K125A	EM18HAM-K125A	EM16HAM-K125LS	EM20HAM-K125LS	EM20HAM-K200	EM24HAM-K200	EM36HAM-K350
	Maximum Output (kVA)		33	60	100	98	124	124	155	256	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	2900×1950×850	4060×1950×850
	Mass (kg)		950	1350	1500	2500	2600	2650	3350	4850	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*5	390*5	390*5	390*5	650*5	650*5	590*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	1050×1900×800	1050×1900×800	1200×1950×1400
		Mass (kg)	400	400	400	400	400	400	400	600	600	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 200/220/240/380/400/415 V (K200 and K350 is AC380/400/415V) , 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 200 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. (See P. 76)
*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. *Mass and dimensions may change for CE-marked systems.

m-series

Low Acoustic Noise and Compact Range

m030/MA1

Accessories

A pair of carrying handles

Safely and easily carried 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.

Silent model suitable for abnormal noise inspection

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

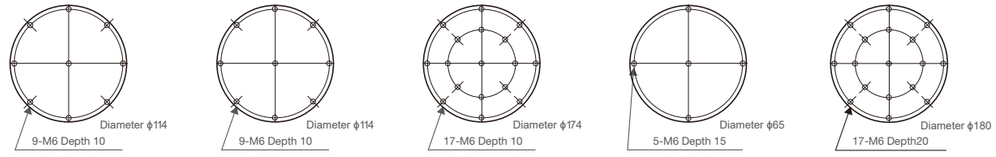
[Silent design employing a built-in cooling fan] DC-powered cooling fan is built into the shaker. Natural air-cooling is also used when the cooling fan is stopped for silent operation (with a reduction in performance).

Specifications

System Model			m030/MA1-CE	m060/MA1-CE	m120/MA1-CE	m030H/MA1	m030LS/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	1	1	1	1
	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)



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.

*A supplementary 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.

Supplementary guidance system (GDP)

Slip table

Model	Dimensions (mm)	Maximum frequency (Hz)	Mass (kg)		
			m030	m060	m120
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

*The material of slip plate is aluminum alloy.

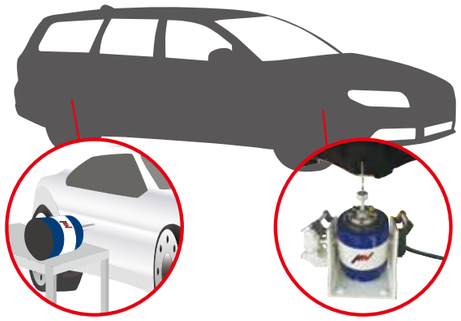
Head expander

Slip table

Soundproof enclosure

Acoustic noise testing is made possible by placing the shaker in a soundproof box.

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.

VSH/PET

High Frequency and Compact Range

Suitable for bench-top simulation

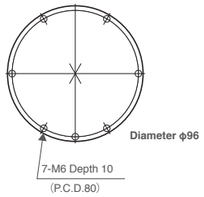
Ideal for bench-top testing

[Compact] Portable

[Compatible vibration controllers] Versatile vibration controller provides wide range of test types.

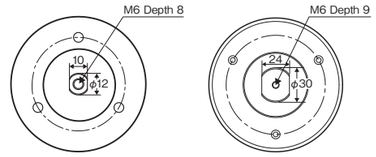
VEH-100

■ Table Insert Pattern (Unit:mm)



VEH-100,VEH-100R

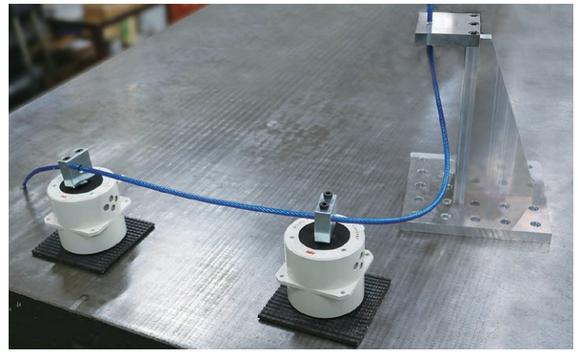
■ Table Insert Pattern (Unit:mm)



PET-01　　PET-05/PET-05H

■ Option

Adapter for PET



By attaching the adapter to PET series, it is possible to increase the moment restraint force and it can be used as a vibration source for modal analysis. It also possible to apply vibration to products intricately shaped by combining multiple units.

■ Specifications

System Model			VSH-100-M2	VSH-100R-M2
System Specifications	Frequency Range (Hz)		0-8000	0-10000
	Rated Force	Sine (N)	980	980
		Random (N rms)	392	392
		Shock (N)	980	980
	Maximum Acceleration (m/s²)*1		980	980
	Maximum Velocity (m/s)		0.8	0.8
	Maximum Displacement (mmp-p)		10	10
	Maximum Load (kg)		30	Up to the spring constant
	Power Requirements (kVA)*2		4.0	4.0
Vibration Generator	Model		VEH-100	VEH-100R
	Armature Support Method		Roller / Air suspension	Flexures / Rollers
	Armature Support Spring Constant (kN/m)		—	49
	Armature Mass (kg)		1.0	1.0
	Armature Diameter (ϕmm)		96	96
	Dimensions (mm) W×H×D		ϕ390×H306	ϕ390×H306
	Mass (kg)		120	120
Power Amplifier	Model		VAH-M2	VAH-M2
	Maximum Output (kVA)		1.5	1.5
	Dimensions (mm) W×H×D		580×1750×850	580×1750×850
	Mass (kg)		230	230
Cooling	Cooling Method		Air cooling	Air cooling
	Blower	Dimensions W×H×D (mm)	247×252×284	247×252×284
		Mass (kg)	10.5	10.5

*1 Spec described above is under bare table condition. The maximum acceleration decreases when accelerometer and mounting adapter are mounted.
*2 Power supply : three-phase AC200 V±10 %, 50 / 60 Hz (Voltage down transformer [step-down transformer] is required for other voltage)
* The specification shows the maximum system performance. For long-duration tests, de-rating by up to 70 % must be applied. Continuous use at maximum levels may cause failure. Please contact IMV if you use more than 70 %.
* Frequency range values vary according to sensor and vibration controller.

■ Specifications

System Model			PET-01/PA	PET-05/PA	PET-05H/PA
System Specifications	Frequency Range (Hz)		2-12000	2-14000	5-40000
	Rated Force	Sine (N)	9.8	49	49
		Random (N rms)	—	—	—
		Shock (N)	—	—	—
	Maximum Acceleration (m/s²)*1		326	326	376
	Maximum Velocity (m/s)		—	—	—
	Maximum Displacement (mmp-p)		5	5	5
	Maximum Load (kg)		Up to the spring constant	Up to the spring constant	Up to the spring constant
	Power Requirements (kVA)*2		0.08	0.1	0.1
Vibration Generator	Model		PET-01	PET-05	PET-05H
	Armature Support Method		Diaphragm spring	Diaphragm spring	Diaphragm spring
	Armature Support Spring Constant (kN/m)		9.8	15.6	15.6
	Armature Mass (kg)		0.03	0.15	0.13
	Armature Diameter (ϕmm)		12	30	30
	Dimensions (mm) W×H×D		75×72×75	116×115×116	116×115×116
	Mass (kg)		1.3	5.0	5.0
Power Amplifier	Model		PA01	PA05	PA05H
	Maximum Output (kVA)		0.03	0.045	0.045
	Dimensions (mm) W×H×D		300×140×280	279×140×280	279×140×280
	Mass (kg)		9	9	9
Cooling	Cooling Method		Natural radiation	Natural radiation	Natural radiation

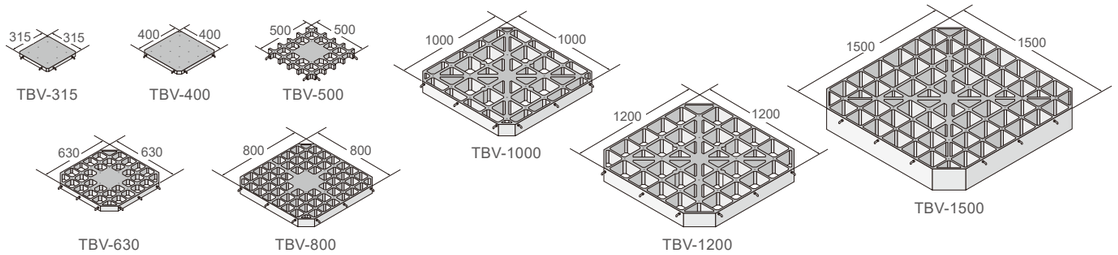
*1) Spec described above is under bare table condition. The maximum acceleration decreases when accelerometer and mounting adapter are mounted.
*2) Power supply : single phase AC100 V ±10 %, 50/60 Hz (Voltage down transformer [step-down transformer] is required for other voltage)
* The specification 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.

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.

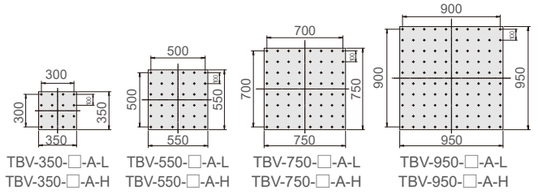


Model	Dimensions (mm)	Mass (kg)	Maximum Frequency (Hz)	A-series						i-series	
				A11	A22	A30	A45	A65	A74	i210	i220
TBV-125-□-A	125×125 t 20	0.9	2000	–	–	–	–	–	–	○	–
TBV-125-□-M		0.6		–	–	–	–	–	–	○	–
TBV-315-□-A	315×315 t 30	8.5	1000	○	○	○	–	–	–	○	○
TBV-315-□-M		5.8		○	○	○	–	–	–	○	○
TBV-400-□-A	400×400 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-1200-□-M		120		–	○	○	○	○	○	–	–
TBV-1500-□-A	1500×1500 t 200	300	200	–	–	–	○	○	○	–	–
TBV-1500-□-M		200		–	–	–	○	○	○	–	–

Model	Dimensions (mm)	Mass (kg)	Maximum Frequency (Hz)	J-series				C-series	K-series					
				J230	J240	J250	J260	C10	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-1200-□-M		120		–	○	○	○	○	○	○	○	○	○	○	○
TBV-1500-□-A	1500×1500 t 200	300	200	–	–	○	○	–	○	○	○	○	○	○	○
TBV-1500-□-M		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 Depth 25	□100 mm Pitch
TBV-350-□-A-H	350×350×t 65	11	1500	M10 Depth 25	□100 mm Pitch
TBV-550-□-A-L	550×550×t 30	17	300	M10 Depth 25	□100 mm Pitch
TBV-550-□-A-H	550×550×t 60	30	600	M10 Depth 25	□100 mm Pitch
TBV-750-□-A-L	750×750×t 38	30	200	M10 Depth 25	□100 mm Pitch
TBV-750-□-A-H	750×750×t 75	55	400	M10 Depth 25	□100 mm Pitch
TBV-950-□-A-L	950×950×t 45	45	150	M10 Depth 25	□100 mm Pitch
TBV-950-□-A-H	950×950×t 90	80	300	M10 Depth 25	□100 mm Pitch
TBV-1150-□-A-L	1150×1150×t 60	90	120	M10 Depth 25	□200 mm Pitch
TBV-1150-□-A-H	1150×1150×t 120	160	240	M10 Depth 25	□200 mm Pitch
TBV-1450-□-A-L	1450×1450×t 80	135	100	M10 Depth 25	□200 mm Pitch
TBV-1450-□-A-H	1450×1450×t 160	240	200	M10 Depth 25	□200 mm Pitch

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

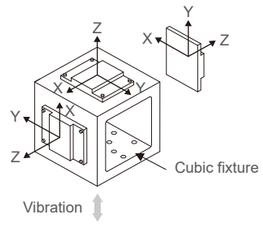
High-frequency model

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

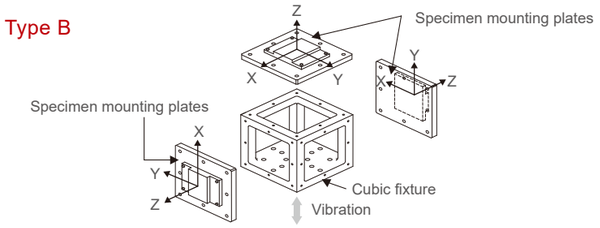
Cubic fixture

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)		
TCJ-A150-□-A	150×150×150	5.5	2000		
TCJ-A150-□-M		4			
TCJ-A160-□-A	160×160×160	6.5	2000		
TCJ-A160-□-M		4.6			
TCJ-A200-□-A	200×200×200	8	1000		
TCJ-A200-□-M		5.6			
TCJ-A250-□-A	250×250×250	13.5	650		
TCJ-A250-□-M		9.5			
TCJ-A300-□-A	300×300×300	20	400		
TCJ-A300-□-M		14			

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

(1) MS: Simultaneous use of Mechanical Bearing and Oil Film

Employs a combined structure of a high rigid linear bearing and an oil film method which purpose is to improve vibration dumping characteristic.

Model	TBH-550			TBH-750			TBH-950			TBH-1150		
Table Size (mm)	550×550			750×750			950×950			1150×1150		
Moment (N•m)	1100			2200			2200			4600		
Maximum Load (kg)	700			1000			1500			2000		
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)
A11	55	2000	40	93	2000	40	138	1250	40	-	-	-
A22	58			95			140			200	800	40

Model	TBH-550			TBH-750			TBH-950			TBH-1150		
Table Size (mm)	550×550			750×750			950×950			1150×1150		
Moment (N•m)	1100			2200			2200			4600		
Maximum Load (kg)	700			1000			1500			2000		
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)
C10	60	2000	40	100	2000	40	145	1250	40	208	800	40
A30												
A45	68			108			153			213		
A65												

*The weight is referring the plate made of aluminum.

(2) 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			TBH-750			TBH-950			TBH-1150		
Table Size (mm)	550×550			750×750			950×950			1150×1150		
Moment (N•m)	1100			2200			2200			4600		
Maximum Load (kg)	700			1000			1500			2000		
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)
A11	55	2000	40	93	2000	40	138	1250	40	-	-	-
A22	58			95			140			200	800	40

Model	TBH-550			TBH-750			TBH-950			TBH-1150		
Table Size (mm)	550×550			750×750			950×950			1150×1150		
Moment (N•m)	1100			2200			2200			4600		
Maximum Load (kg)	700			1000			1500			2000		
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)
C10	60	2000	40	100	2000	40	145	1250	40	208	800	40
A30												
A45	68			108			153			213		
A65												

*The weight is referring the plate made of aluminum.
*Please contact us about the table size over 1150×1300.

(3) 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			TBH-630			TBH-800			TBH-1000		
Table Size (mm)	500×500			630×630			800×800			1000×1000		
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 weight is referring the plate made of aluminum.

(4) 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. Bearings are built in heat insulated oil tanks and a whole table unit fits inside a chamber. Therefore there is no need to attach a thermal barrier. And it is the structure which doesn' t require an elastic rubber connecting a table plate and chamber bottom.

TT-L: Hydrostatic Bearing (Low Pressure)

Model	TBH-500-A-TT			TBH-630-A-TT			TBH-800-A-TT			TBH-1000-A-TT			TBH-1200-A-TT			TBH-1500-A-TT			TBH-1800-A-TT			TBH-2000-A-TT		
Table Size (mm)	500×500			630×630			800×800			1000×1000			1200×1200			1500×1500			1800×1800			2000×2000		
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 weight is referring the plate made of aluminum. Please contact us for more information.

TT-H: Hydrostatic Bearing (High Pressure)

Model	HB-500-A-TT			HB-630-A-TT			HB-800-A-TT			HB-1000-A-TT			HB-1200-A-TT			HB-1500-A-TT			HB-1800-A-TT			HB-2000-A-TT		
Table Size (mm)	500×500			630×630			800×800			1000×1000			1200×1200			1500×1500			1800×1800			2000×2000		
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)		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														
K125A	103			118			155			205														
K125LS	113	1600		128	1600		170	1250		220	1000													

*The weight is referring the plate made of aluminum. Please contact us for more information.

Optional Units

Slip table

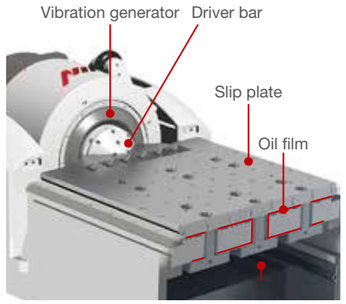
(5) TH: Hydrostatic Bearing & Oil Film
(A-series Only)

Slip table for A-series provides the following features with a newly developed hydrostatic and hydraulic bearing and new structure.

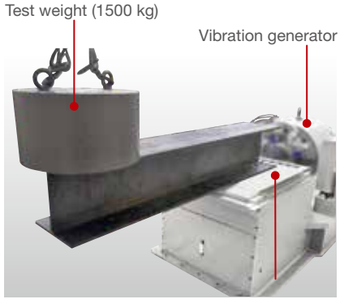
[Features]

- High moment resistance
- Low cross-axis acceleration
- Low distortion
- No requirement for a separate hydraulic unit
- Good work efficacy
- Smaller system installation space

Watch the YouTube video



■ Allowable eccentric moment verification test



Model	TBH-550TH		TBH-750TH		TBH-950TH		TBH-1150TH		TBH-1450TH	
Table Size (mm)	550×550		750×750		950×950		1150×1150		1450×1450	
Thickness (mm)	50		50		50		50		50	
Pitch Moment (N･m)	6000		66000		85000		85000		198000	
Maximum Load (kg)	1500		9000		9000		9000		9000	
Vibration Generator	Moving Mass* (kg)	Frequency (Hz)	Moving Mass* (kg)	Frequency (Hz)	Moving Mass* (kg)	Frequency (Hz)	Moving Mass* (kg)	Frequency (Hz)	Moving Mass* (kg)	Frequency (Hz)
A11	85	2000	159	2000	215	1250	298	800	452	500
A22										
A30										
A45	—	—	180		236		318		473	
A65										
A74										

*The weight is referring the plate made of aluminum.

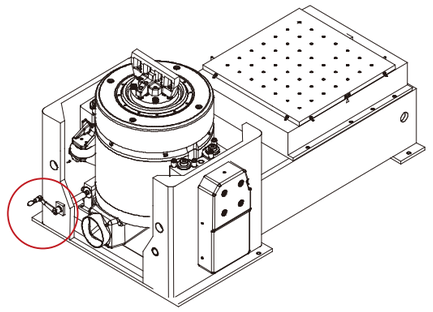
(6) T-Film bearing range

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

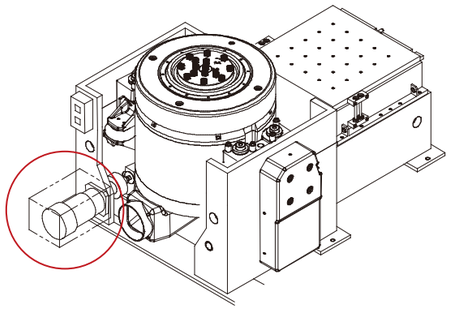
1. Rotation reduction gearing

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



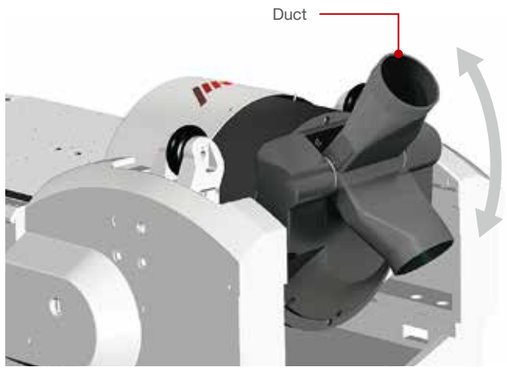
2. Motor drive rotation

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



3. Duct

A newly developed duct is provided as standard.
No operation needed for direction change between vertical and horizontal.
Space behind the shaker is minimised.



4. Drive bar adapter with diagonal bolt access

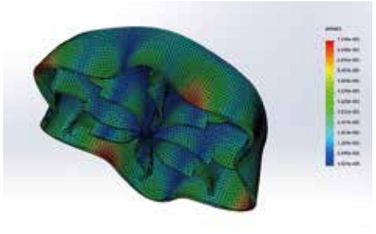
Method of fastening drive bar to a slip table was simplified by reflecting customers feedback.
Usability is improved and easier torque management of bolts is realized.
* Standard for MB/MS

Optional Units

Fixture, Vibration Isolation, Reinforcement

Fixture

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

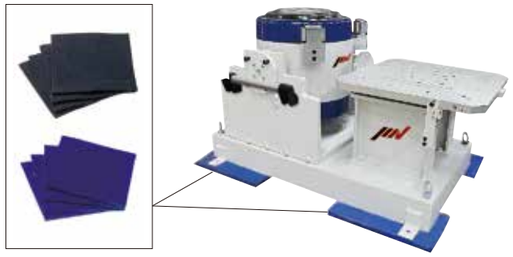


Vibration Isolation

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.



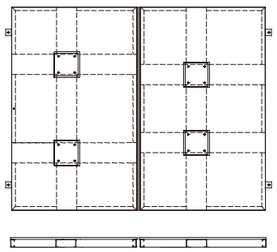
Air spring

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 such load is acceptable.



Optional Units

Sound-proof enclosure, Cooling ducting, Launcher, System monitor

Sound-proof enclosure

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

Cooling ducting

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

Launcher

Test file will be automatically generated just on selection of the test condition defined by the test standard. Then, the test can be carried out just by pressing the start button.

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

System monitor

*Standard for A-series and K-series

Condition of "vibration generator, amplifier test proceeding, specimen status" can be observed on the PC or tablet by either wired or wireless LAN. Solution will be seen on the Web browser on occurrence of any error. Installation of additional software is not necessary to the PC nor tablet.

Home screen

Home screen (error)

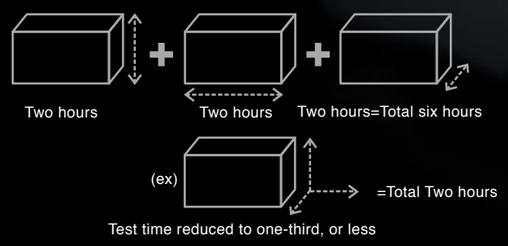
Eco screen

Camera screen

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

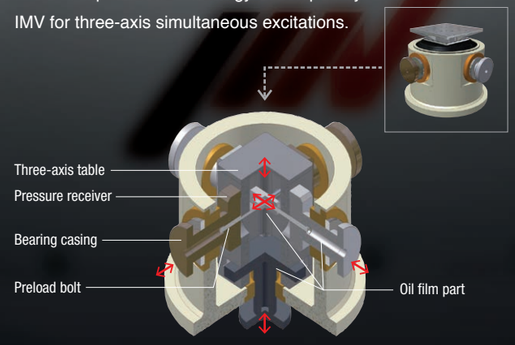
Three-axis simultaneous vibration testing reproduces real environments more accurately than sequential single-axis tests can.

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.

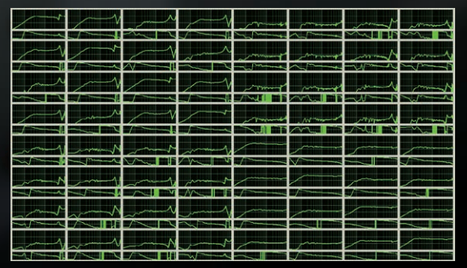
ICCU (Integrated Cross Coupling Bearing Unit)

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	1	1	1	1	1	1	0.9	1	1
	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	0.9	1	1	0.9	0.9	1	1	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. Please contact us for more information.

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	1	1	1	1	1	1	0.9	1	1
	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	0.9	1	1	0.9	0.9	1	1	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. Please contact us for more information.

DS-series

2-Axis Simultaneous Systems

DS-2000-4H

Specifications

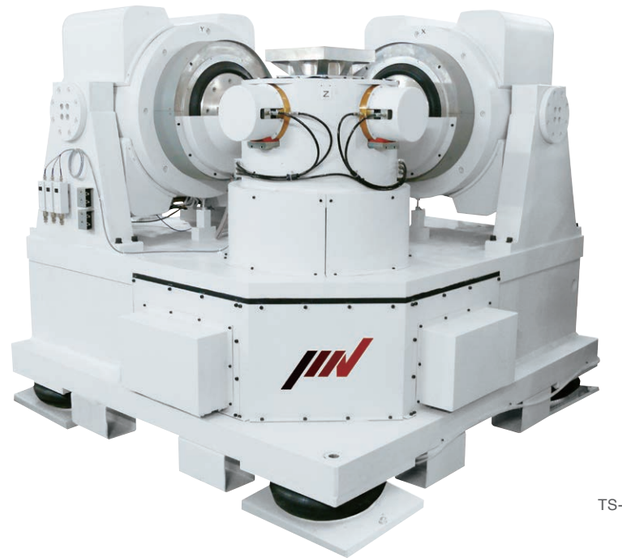
	System Model		DS-1000-4H	DS-1000-6H	DS-1000-8H	DS-1000-10M	DS-2000-5H	DS-2000-8M	DS-2000-10M	DS-2000-15M	DS-3000-5H	DS-3000-8M
System Specifications	Table Size (mm)		□400	□600	□800	□1000	□500	□800	□1000	□1500	□500	□800
	Rated Force	Sine (kN)	9.8	9.8	9.8	9.8	19.6	19.6	19.6	19.6	29.4	29.4
		Random (kN)	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	1	1	1	1	1	1	0.9	1	1
	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)		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
		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	0.9	1	1	0.9	0.9	1	1	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)		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. Please contact us for more information.

TS-series

3-Axis Simultaneous Systems



TS-1000-4H

Specifications

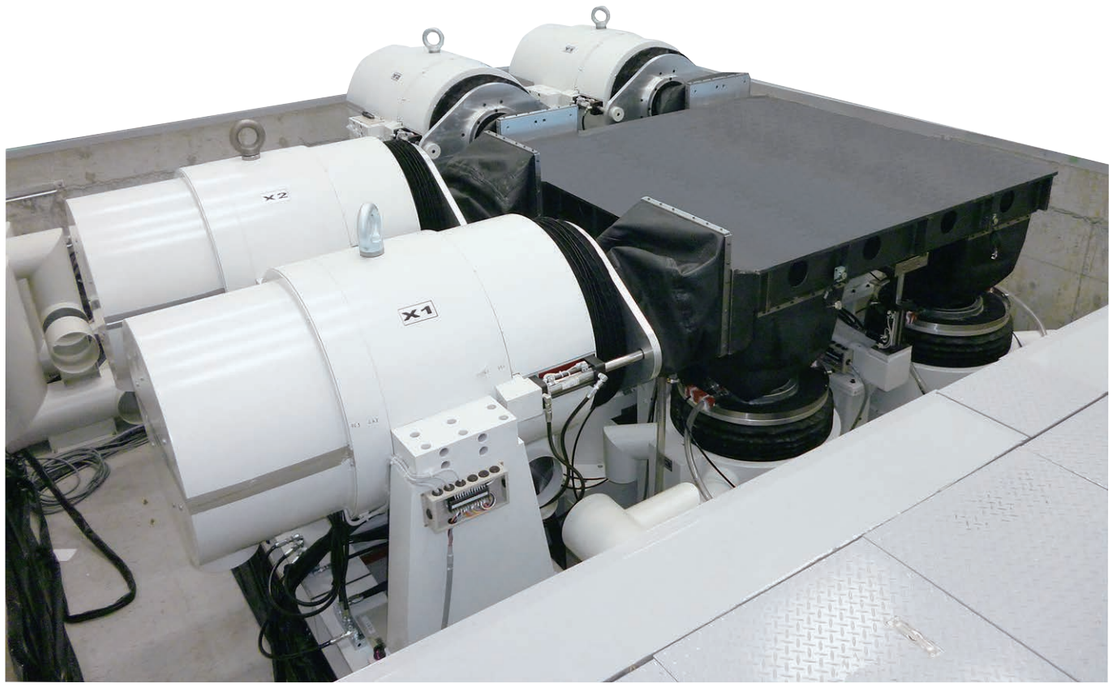
	System Model		TS-1000-4H	TS-1000-6H	TS-1000-8H	TS-1000-10M	TS-2000-5H	TS-2000-8M	TS-2000-10M	TS-2000-15M	TS-3000-5H	TS-3000-8M
System Specifications	Table Size (mm)		□400	□600	□800	□1000	□500	□800	□1000	□1500	□500	□800
	Rated Force	Sine (kN)	9.8	9.8	9.8	9.8	19.6	19.6	19.6	19.6	29.4	29.4
		Random (kN)	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	1	1	1	1	1	1	0.9	1	1
	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)		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
		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	0.9	1	1	0.9	0.9	1	1	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)		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. Please contact us for more information.

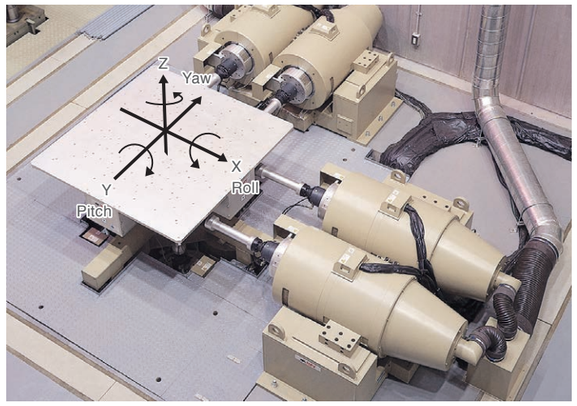
TTS-series

6 Degrees of Freedom Systems



6 degrees of freedom systems

At least 6 vibration generators are located in 3D space with integrated control are employed to create or simulate 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 available 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. The spherical bearings are used to allow such rotational motions. By using electrodynamic vibration generators the system can operate over a wide frequency range with a high degree of accuracy. No preparatory operation in nessessary.



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 YouTube

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.

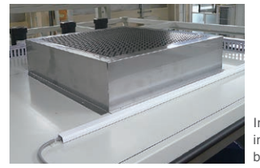
Excitation Direction	X axis	Y axis	Z axis
Rated Force (N)	1600	1600	3200
Maximum Displacement (mmp-p)	30		
Frequency Range (Hz)	5-100		
Table Size (mm)	1500×3500		
Vibration Generator	2	2	4

(Per 1 system)

Vibration 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

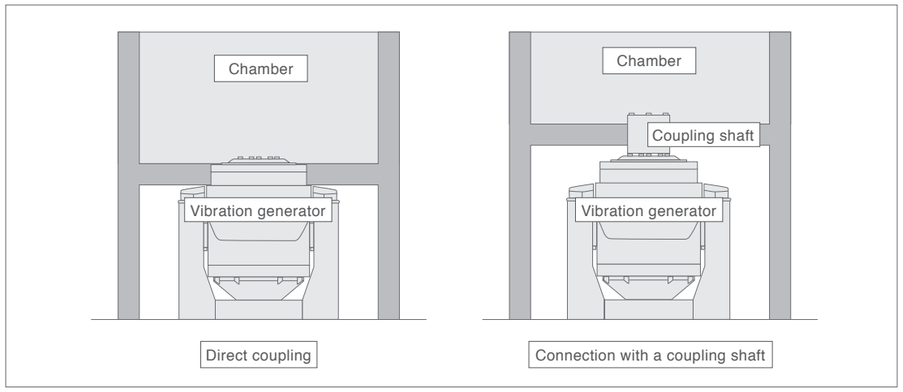


Inner pressure regulator:Reduce internal pressure fluctuation caused by vibration (Standard equipment)

Model : Syn-3HA-40-V

Internal dimensions	W1000×D1000×H1100 mm
Temperature range	-40 °C - +150 °C
Humidity range	20 % - 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 - +80 °C
Humidity range	30 % - 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 - +180 °C
Humidity range	20 % - 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 YouTube

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 means such as observation door and body suspension automatic adjustment mechanism etc are equipped.

Side window

With a side window, chamber combination docking is possible with the specimen attached to the vibration generator 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 conventionally needed time to reconfigure for testing each axis.

2-axis

Model : Syn-4HA-40-M

Internal dimensions	W1200×D1200×H1000 mm
Temperature range	-40 °C - +150 °C
Humidity range	20 % - 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 - +180 °C
Humidity range	20 % - 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)

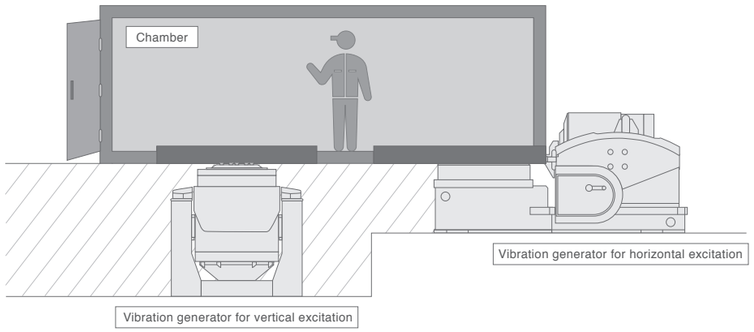
Prefabricated Chamber for Large Specimens

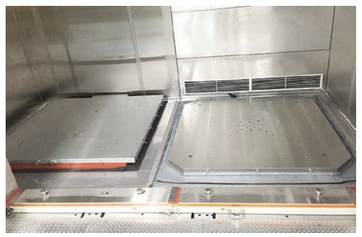
Large-sized specimen can be tested by a chamber combined test in both vertical and horizontal axis.

Model : Syn-6HA-40-VH

Internal dimensions	W4000×D2000×H2500 mm
Temperature range	-40 °C - +120 °C
Humidity range	30 % - 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



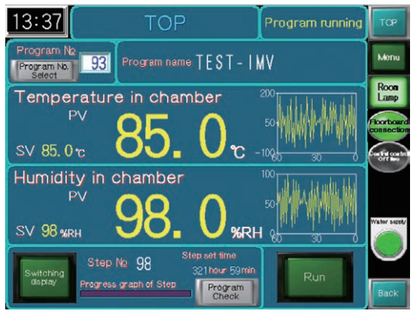


Climatic Chamber Controllers

Chamber controller

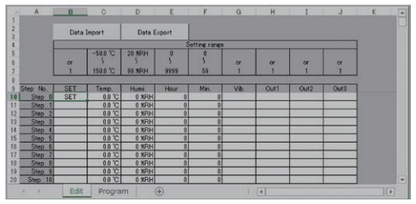
8.4-inch touch panel

Clear display of information and buttons on the 8.4-inch touch-panel.



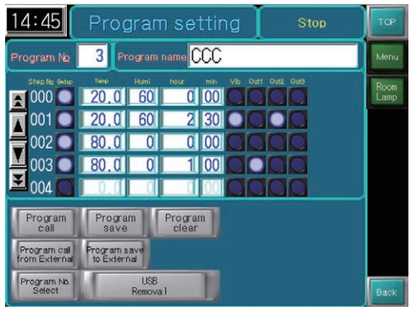
Program editable in PC

Setting-up a test can be performed using a spreadsheet. Programs use the standard CSV file format.



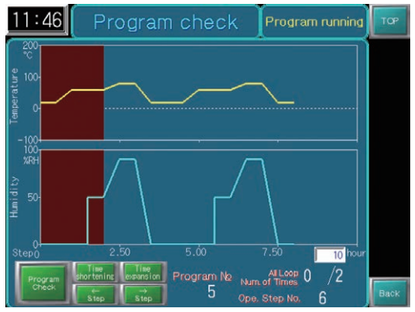
Program selection

Up to 100 programs can be stored in memory. Selecting the program to be used is straightforward.



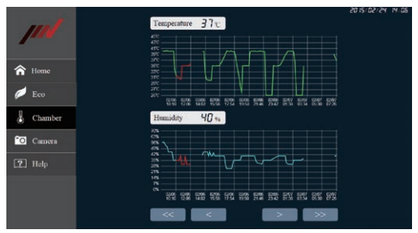
Program confirmation

Progress of the test is confirmed by tabular and graphical displays.



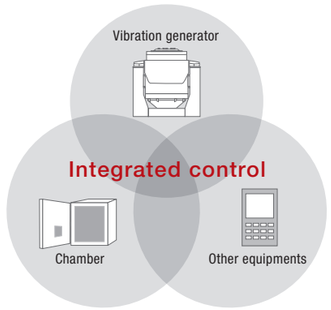
System monitor (option)

Connected to system monitor by Ethernet.
The test status of both vibration generator and chamber can be monitored remotely.



Integrated control system (option)

Vibration generator, chamber and other equipments can be controlled at one place.



Option

Many options are available to make easier such operation as different door positioning and observation window location.

Observation door

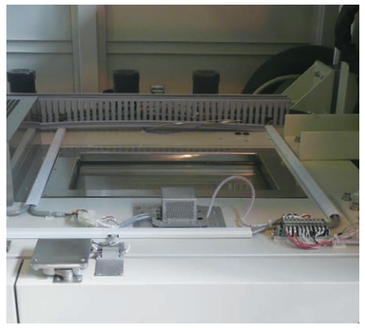
An observation door enables monitoring of the test specimen.

Infrared irradiation

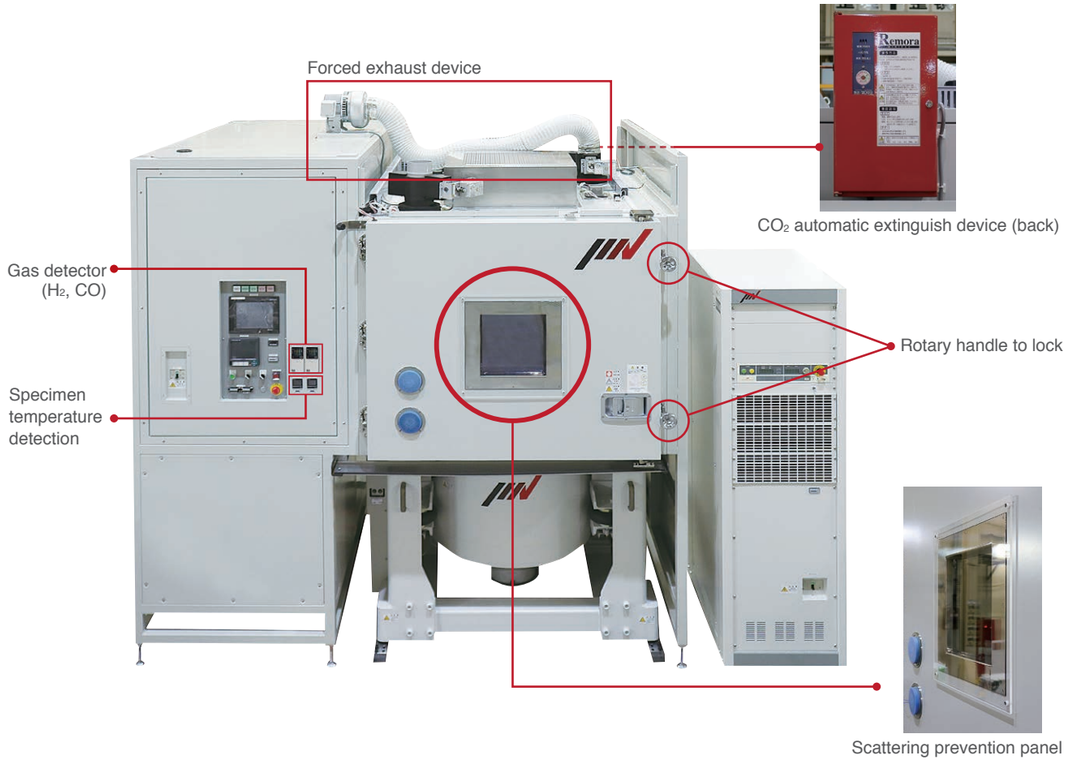
Car instrumental panel, door, bumper, or body sections can be tested.

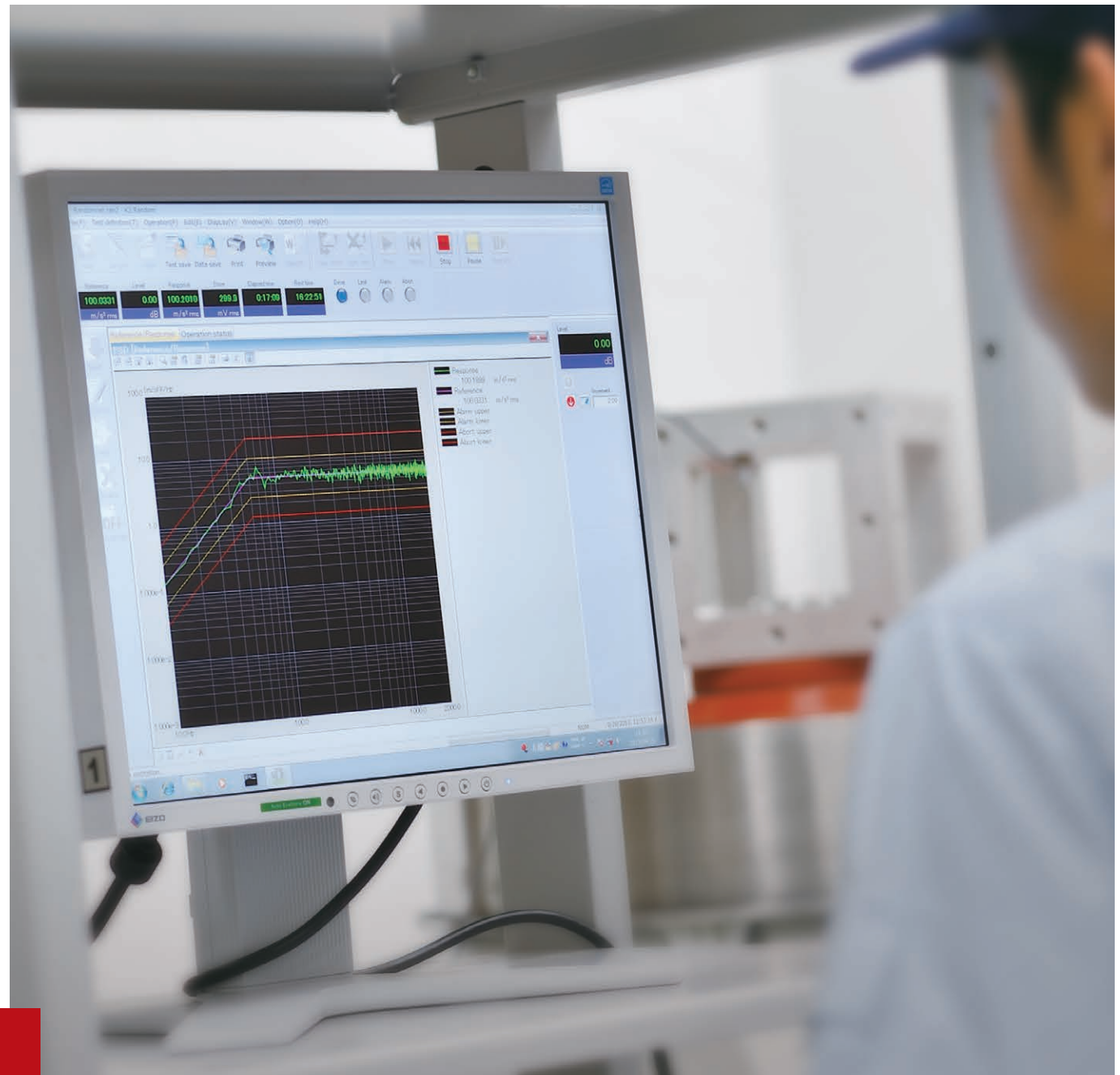
Ceiling observation window

A ceiling observation window allows full visibility of the vibration table and test specimen with no blind-spots.



Safety measures for fuel cell tests





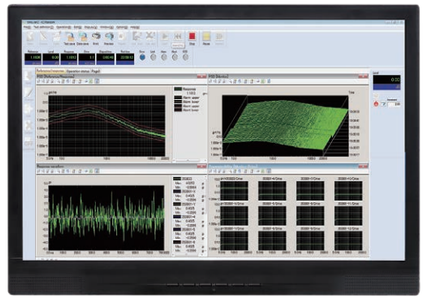
Vibration Controller K2

Common hardware supports all types of vibration test.

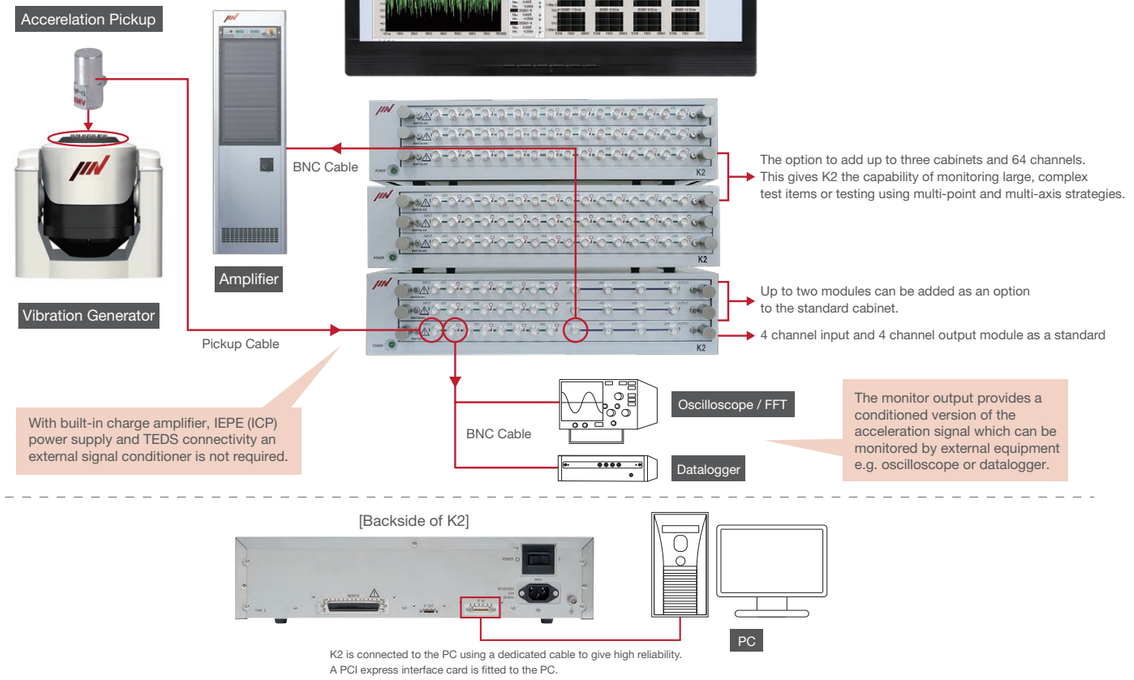
The K2 controller provides the precision and repeatability required to test with confidence during both product development and series production. The K2 hardware and software has been developed in-house, giving IMV full design control of this important part of a vibration system.

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



Hardware Specification

Main Enclosure	
Number of Slots	3 (Expandable by connecting additional slave units)
AC Power	Single-phase AC, 100 V-240 V (auto-selected)
Expansion	Additional units can be interconnected (Providing support for large-scale systems)
External Communication	Contact I/O (for emergency stop)
Ambient Conditions	0-40 °C, below 85 %RH, non-condensing
Dimensions	W430×H100×D340 mm (excluding connectors etc.)
Mass	Approximately 6.0 kg

Minimum Specification of PC

- One built-in PCI Express x1 slots
- Microsoft Windows 10 Pro (64bit), Windows 10 IoT Enterprise (64bit) or Windows 7 Professional SP1 (32bit/64bit) is required*.
- Memory required (for 8 input channels)
  Windows 7 (32 bit): 2 GB or more, Windows 7/10 (64 bit): 4 GB or more
- DVD-ROM Drive (required for installation)
- One USB port
- 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/K2 Sprint also requires Japanese government export license (E/L).

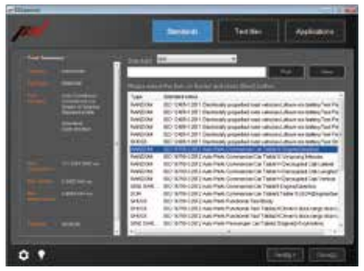
		4-channel Input and 4-channel Output Module (standard)	8-channel Input Module (option)
Input Section	Number of Channels	4	8
	Input Connector	BNC	
	Input Signal	Charge, Voltage, IEPE	
	Charge Amplifier Sensitivity	1.0 mV/pC or 10 mV/pC	
	Charge Amplifier Cut-off	0.32 Hz	
	Maximum Input	Charge Input: ±10000 pC or ±1000 pC Voltage Input: ±10000 mV IEPE input: ±10000 mV	
	Sampling Frequency	51.2 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: 24-bit Dynamic range: 117 dB Digital filter: Pass-band ripple: ±0.001 dB, Stop-band attenuation: 110 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	51.2 kHz maximum	
	D/A Converter	Type: ΔΣ Resolution: 24-bit Dynamic range: 120 dB Digital filter: Pass-band ripple: ±0.005 dB Stop-band attenuation: 75 dB	

Intuitive Operation

Launcher

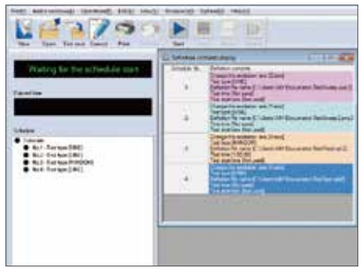
Easily-recognised icons are used for file management.

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 14.5.0.0 onwards) are as follows as of August 2021. 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

*Version upgrade will incur an additional cost.

K2 Related Products

K2 Sprint

Mass: Approx. 2.0 kg

While inheriting all of the performance and features of K2, K2 Sprint offers improved cost-effectiveness with 2-channel hardware.
K2 Sprint is best-suited to single monitor-channel operation.

Differences from K2 • Input 2 channels (No expansion) • Output 2 channels (No expansion)

K2/SINE Manual Test Remote Control Box (Option)

A control box for remotely controlling digital vibration controller K2/SINE.
The unit includes push buttons for test start and stop, and rotary controls for manually adjusting vibration frequency and acceleration.

Optional Software

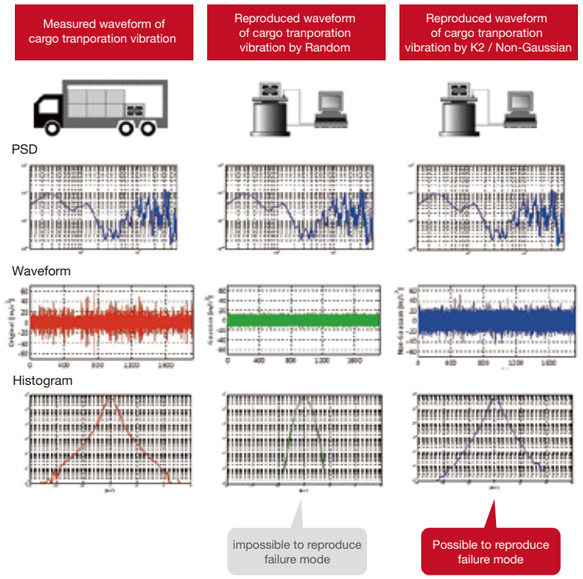
Non-Gaussian

Random test application that can reproduce accurate vibrations closer to the real environment

Actual vibrations such as transport vibrations are often non-Gaussian random vibrations in which large peaks are generated. The K2 Non-Gaussian application accurately reproduces real-world vibration having a non-Gaussian amplitude distribution.

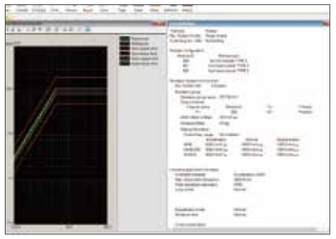
Effectiveness of non-Gaussian random vibration testing

The figures on the right explain the effect of using Gaussian Random and Non-Gaussian Random control in a vibration test based on the replication of vibration measured while driving on a highway.
The PSD and rms value of the three waveforms are the same.
It is clear that the vibration reproduced by "K2/Non-Gaussian" is closer to the real measured vibration than the vibration reproduced by "Standard Random''.
Generally, the greater the acceleration, the greater the impact on the product, but "K2/Non-Gaussian" can accurately reproduce this characteristic of real-world vibration.
It can be stated that "K2/Non-Gaussian" can simulate fatigue which is closer to the real environment experienced by the product than a "Standard Random" test in this example.

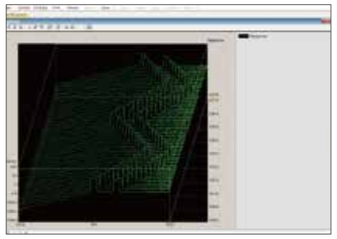


K2 DataViewer Free software

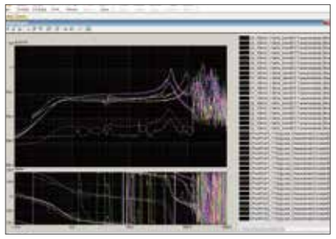
It is the software to display result data file saved after the test of SINE, RANDOM and SHOCK.
It can be used for display of test condition, result graph, or for comparison between past test data (overlapping display), generation of reports.



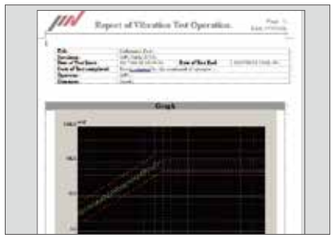
Test condition, result graph



3D graph



Overlapping display



Report

System Requirement

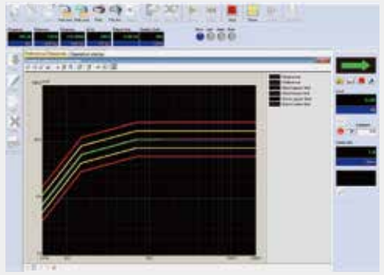
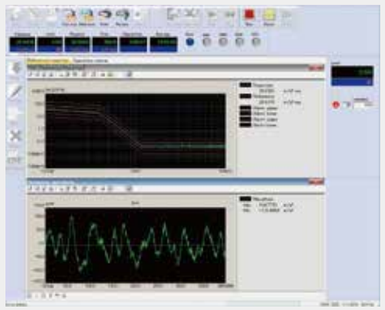
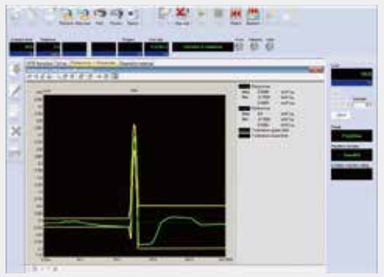
[Supported OS]
Windows 10 (64 bit) , Windows 7 (32 bit/64 bit)

[Memory]
More than 512 MB of RAM is recommended

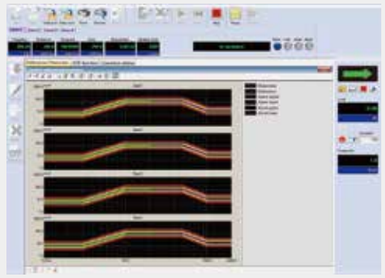
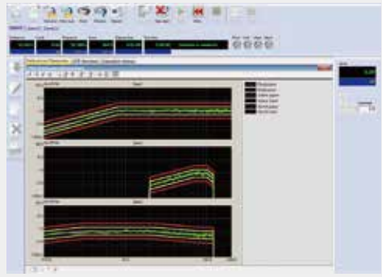
[Hard Disk]
More than 200 MB of free space is required

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 114 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 64 * 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 controller 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** 20 kHz Maximum • **Number of Control Lines** Maximum 25600 lines • **Control Dynamic Range** More than 94 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 64 * Specifications may be affected by other conditions	• **SOR: Sine on Random** Random vibration and sine vibration frequencies are combined. Sine vibration can be swept. • **ROR: Random on Random** Broad-band random combined with sweeping or non-sweeping narrow-band random overlaid. • **EXTENDED ROR** The extended ROR makes it possible to operate 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 would exceed its limit, the test level is reduced over that range of frequencies to keep with the limit level • **Non-Gaussian** It is a vibration testing method which precisely reproduces non-Gaussian vibration such as transportation vibrations with large spikes. • **Soft-Clipping** A clipping function that can reduce the peak value of the output voltage without affecting control performance.
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 84 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 64 * Specifications may be affected by other conditions	• **LONG WAVEFORM** The length of a reference waveform is 16 K points as standard. 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 the test in which the test condition 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.

Software

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 114 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 64 (Main control channel is Maximum 32 Chs) • **Output Channel** Maximum 16 * 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 90 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 64 (Maximum of 32 control channels) • **Output Channel** Maximum 16 * Specifications may be affected by other conditions	• **PSD LIMIT CONTROL** If a response point is specified to be a limit control channel, the level of PSD doesn't exceed the specified PSD level in the test. • **Non-Gaussian** It is a vibration testing method which precisely reproduces non-Gaussian vibration such as transportation vibrations with large spikes.
BMAC 	• **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 84 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 32 • **Output Channel** Maximum 32 * Specifications may be affected by other conditions	• **ENDURANCE2** A drive file created in K2/BMAC can be used to run a durability test. Multiple drive files may be combined to create an equivalent of complex real-life vibrations. • **SRS: Shock Response Spectrum** SRS (Shock Response Spectrum) can execute the test in which the test condition 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.

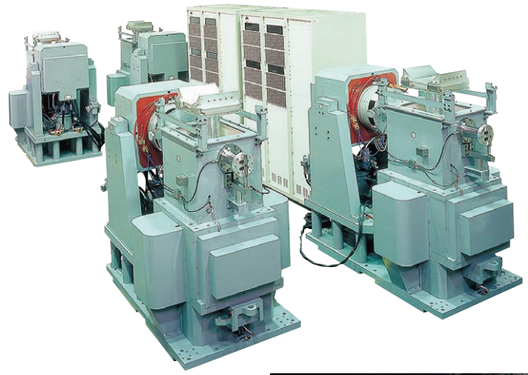
Common optional software	Outline		
CAPTURE: Analogue waveform signal data program	Provides analogue waveform signal capture, saved data can then be used as the reference of SHOCK, BMAC waveform controls or Random vibration PSD control.	• Sampling Frequency	51.2 kHz maximum
		• Data Length	Maximum 5000 k points
		• Input Channel	Maximum 64
		• Waveform edit/analysis function	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 producing products that are customised to the specific needs of our customers. IMV is proud of our continuous contribution to improvements in product safety and comfort for the wider society through increasing product reliability as a ''solution partner'' for all industries.

Customised Products [Case Studies]

Customised Products
Automotive Parts

Case Studies

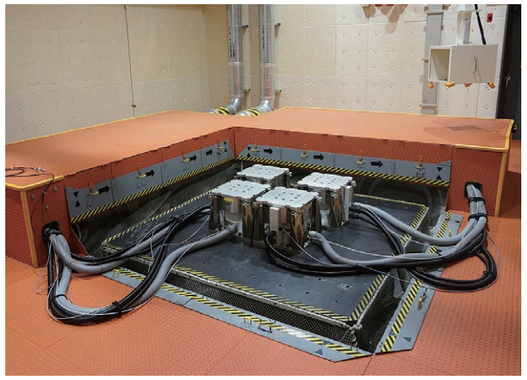


Electrodynamic multi-axis 4 poster system

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

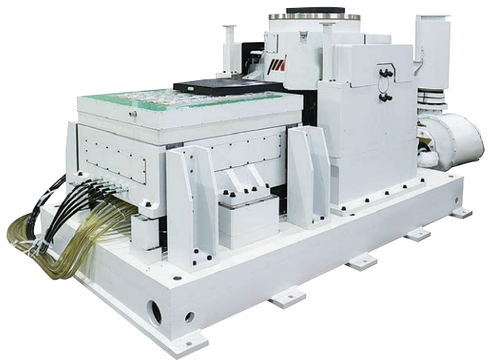
3-axis simultaneous vibration test system

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



Torsion vibration test system

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



Low cross axis motion vibration test system

Ensures low cross axis motion, equipped with the mechanism to match the center gravity of the assembly of specimen + fixture (+ slip table) to the excitation axis by up and down of the table support bearing assembly.

Customised Products

Automotive Parts

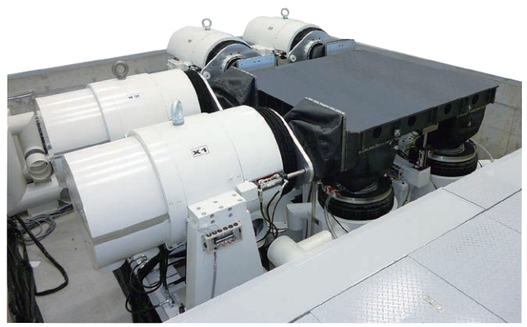
Case Studies

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 in to one wheel.

200 mm peak-to-peak displacement vibration test system

System is particularly suited for applications requiring high velocity at low frequencies. The system has a high over-turning moment due to 4 linear guide bearings, allowing test of specimens with a large offset centre of gravity.

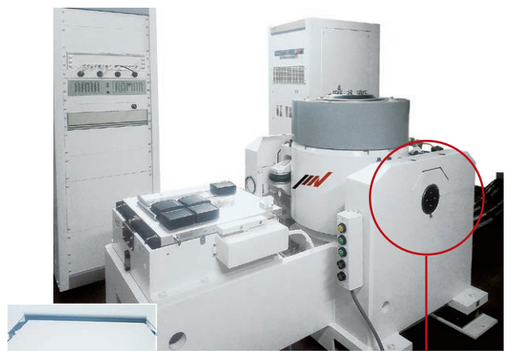


6-DOF large vibration test system

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

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

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



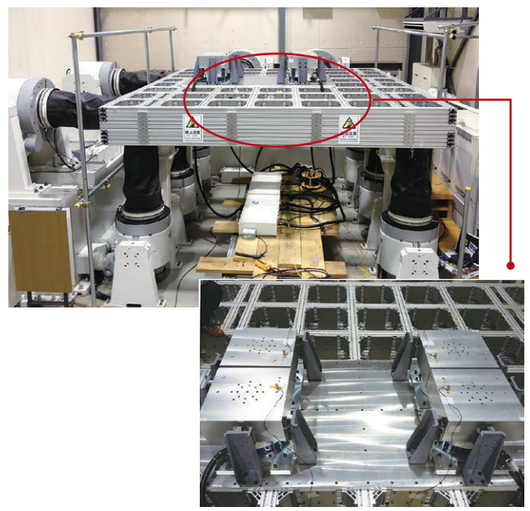
Rotation adjustment

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.

Environmental test system

Environmental test system combining vibration, temperature, gasoline circulation, oil circulation and rotational drive.



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

6 DOF vibration test with measured running data is possible. Torsion on car body during running can be simulated. Torsion exaction for car equipment.

Exhaust system durability testing

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

Customised Products

Automotive Parts

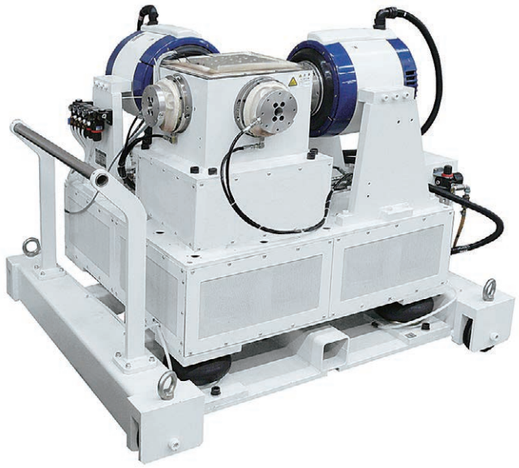
Case Studies

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 in an environment with a background noise level of less than 30 dB is possible.



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

Vibration test system can move along the guide rails. The system can be combined with other test equipment if necessary, for example a temperature chamber.

Vertical / Horizontal changeover chamber combined 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

Double-sided door makes easy to reach the specimen. Equipped with temperature alarm meter for surface temperature monitoring and CO_2 automatic fire extinguisher.
Sine: 1000 Hz, Random: 2000 Hz,

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

Applicable to temperature and humidity environmental testing for products which may be exposed to ultra-high temperature 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 test and earthquake regeneration. Vibrations in three directions can be simultaneously applied to the specimen.

Compact chamber combined 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 - 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 for the vibration test system and horizontal slip table.

Crimping terminal evaluation system

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

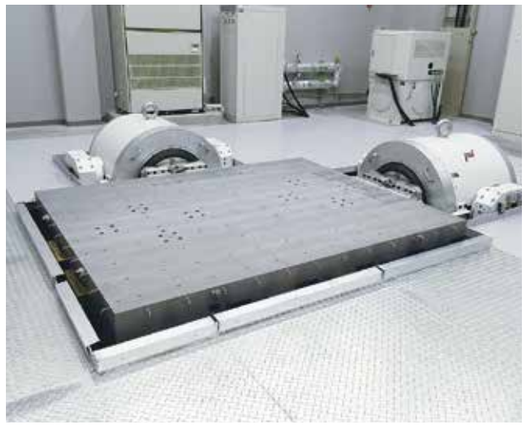
Customised Products

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

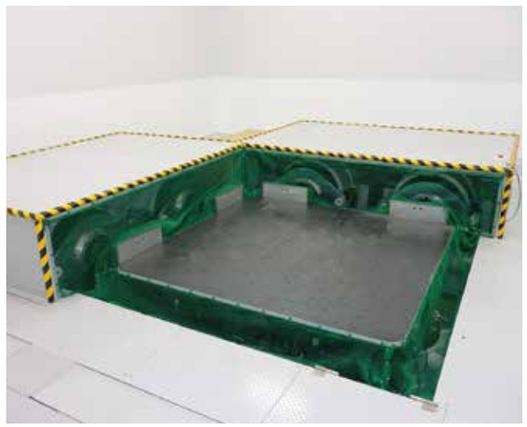
GDP (Guide system with air spring load support)

Energy saving type vibration test system with large size 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 optimizes 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 without time loss.



6-DOF vibration test system

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.

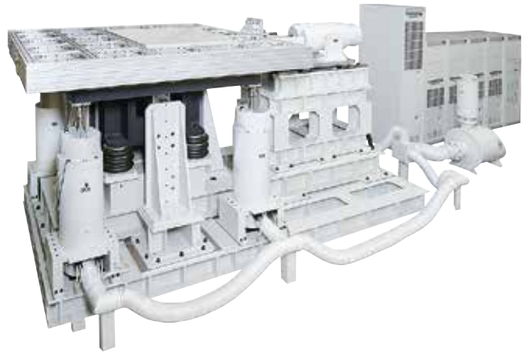
Large vibration test system for high frequency testing (up to 5000 Hz)

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

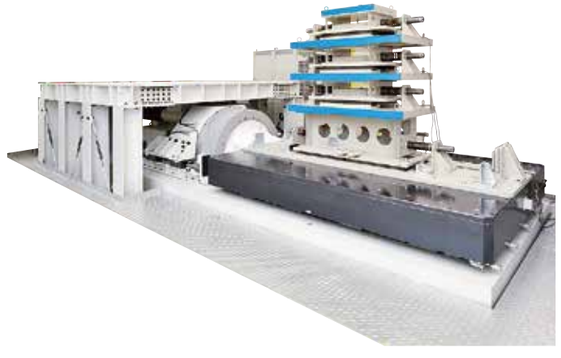
Case Studies



Large scale earthquake resistance vibration test system

Watch the YouTube video

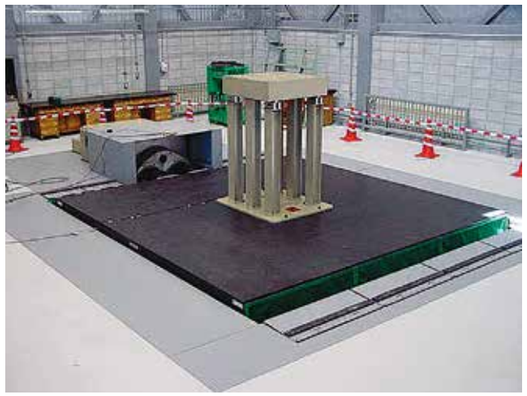
The unique hybrid method achieves accurate reproduction of both large-displacement and high-frequency waveforms by utilising the benefits from an electrodynamic vibration generator and an AC servomotor.



Large scale earthquake resistance vibration test system

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 shaker 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

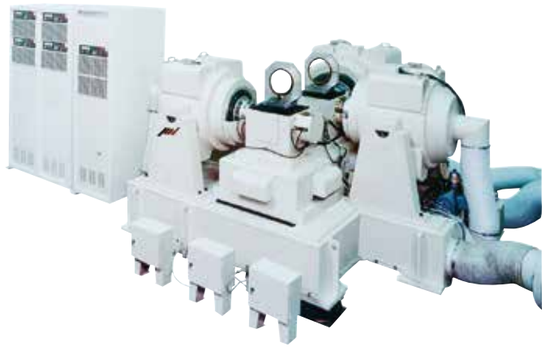
One of the world's largest excitation force systems, with a distinctive 76.2 mm p-p (3 inches) alternative displacement rating.
High-velocity shock tests of 3.5 m/s are also possible.

Vibration test systems for clean rooms

The air inlet and outlet for the shaker are ducted from outside of the clean room; this maintains the cleanliness of the room.

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

etc. Other Applications

Case Studies

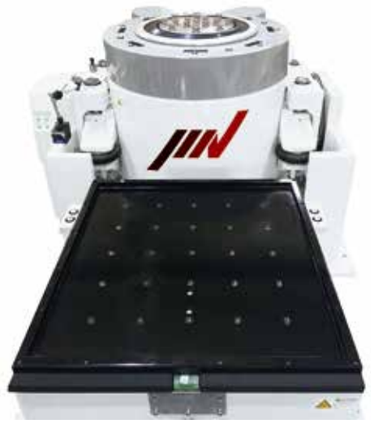
Vibration test system for fatigue testing of copper plate

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

Adopted by JQA (Japan Quality Assurance Organization)

Compact vibration test system for sensor calibration

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 endurance test

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.

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;

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

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

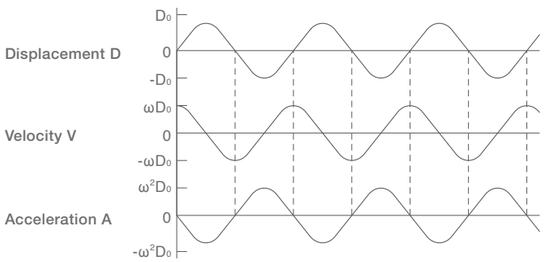
As we substitute

$\omega = 2\pi ft$

We have formulae indicated only in amplitude;

$V = \omega D = 2\pi fD$	D:Displacement	[m$^{o\text{-}p}$]
$A = \omega^2 D = (2\pi f)^2 D$	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]
$d = \frac{2000\,A}{(2\pi f)^2}$	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]

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

Please see the conversion chart (Exchange table) on page 74 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”.

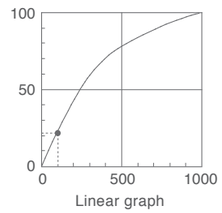
The following is a conversion table for “dB” and multiple.

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

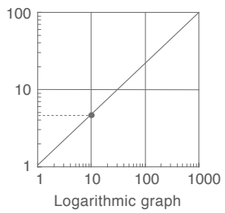
dB	0	-0.1	-1	-3	-6	-10	-20	-30	-40	-60
Multiple	1	0.99	0.891	0.709	0.501	0.316	0.1	0.0316	0.01	0.001

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

$A = 2\pi fV$

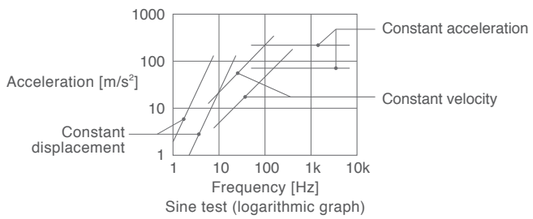
A : Acceleration
f : Frequency
V : Velocity

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.

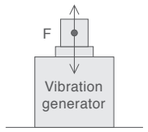
Technical Guidance

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.

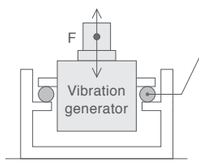
1) No insulation



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.

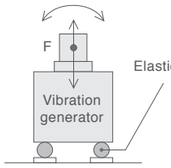
2) Body suspension



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"

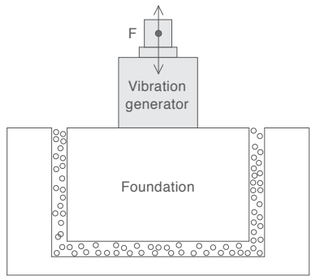
3) Bottom suspension



Elastic objects or air springs

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

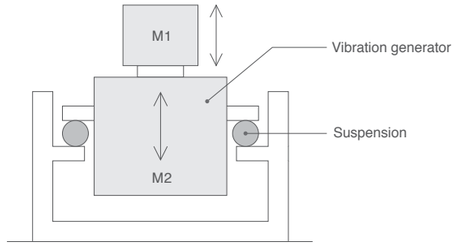
4) Isolated foundation



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.

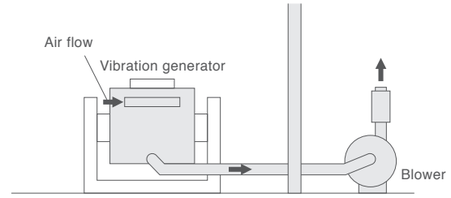


In the case of body isolation, the vibration generator body will be excited by the reaction force. If the shaker excitation frequency is 2-7 Hz, this may coincide with the resonant frequency of the armature suspension system and the body suspension system. The armature and body motion could be almost 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.

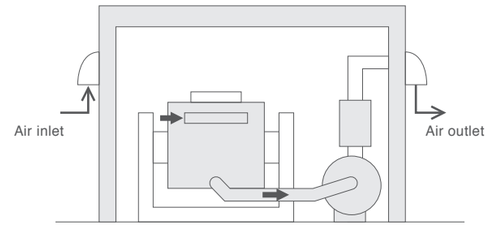
1) Installing the blower outside the room



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.

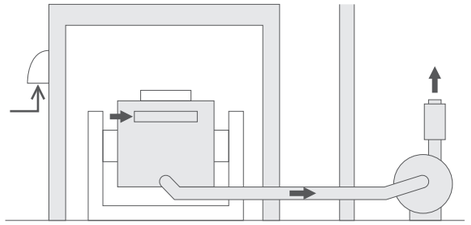
2) Sound proof box

A. Vibration generator and blower



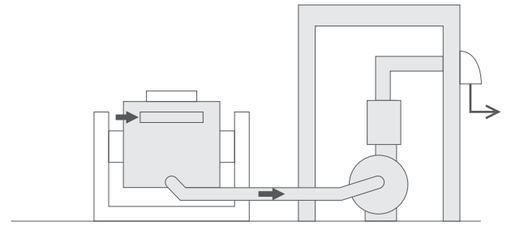
This method reduces the excitation noise and the blower noise.
* During the blower is stopped, it is recommended to make treatments to prevent air backflow.

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



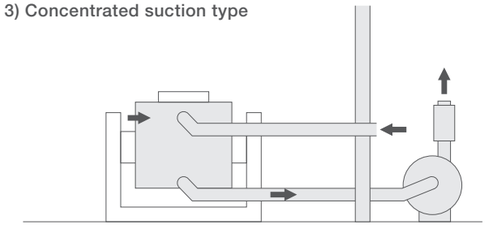
The excitation noise and the air inlet noise are lowered.
It is recommended to place the blower outside.
* The blower cannot be installed outdoors.

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 dBA. 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.

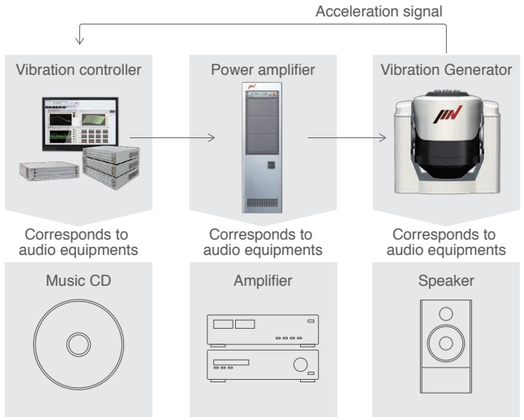
Technical Guidance

Mechanism of vibration test systems

Mechanism of vibration test systems

Electrodynamic vibration test systems

The principle is similar to the audio systems where electronic signals from different sources (i.e CDs) are amplified and converted to sound by loud speakers. For the vibration test systems, the vibration generators correspond to the loud speakers of the audio systems. They have the vibration controllers instead of the 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 to meet the requested test conditions.



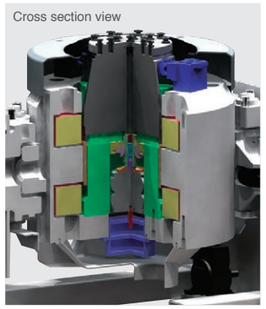
Vibration controller

The original waveforoms will not be reproduced by just applying the vibration data obtained in the field or form test specimens. The waveforms will be totally defomed due to the characterisitics of the amplifiers , combined dynamics of the vibration generators and test specimens. The vibration controllers the equipments to have the vibration generators generate the designated vibration compensating automatically these characteristics or dynamics. All IMV vibration controllers are customised for each of our clients in order to meet their particular needs. “User Friendly” has been always pursued.

Complicated tests are professionally programmed and executed.

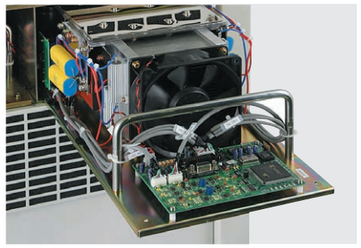
Vibration generator

The operation principle is based on “Fleming’s left hand rule”.
When an electric current flows in a wire put in a magnetic field, it gets a force perpendicular both to that field and the direction of that current.



Power amplifier

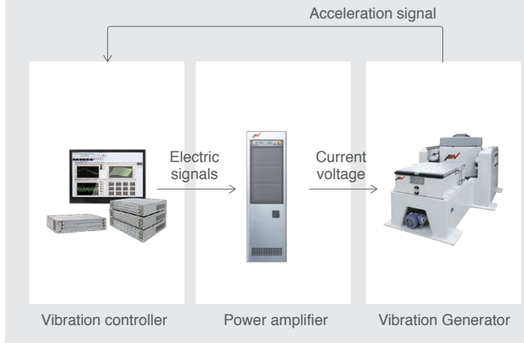
The role of the power amplifier is to feed driving current to the vibration generator converting the small electrical signal generated in the vibration controller to the large current of higher voltage.
IMV’s power amplifiers employ the switching amplifier system.
They use mainly the compact and highly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



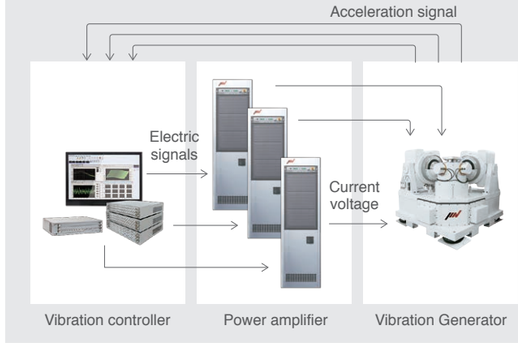
Power module SA-300

Principles of operation

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



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



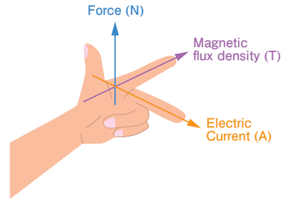
Vibration generator

The operation principle is based on “Fleming’s left hand rule”.

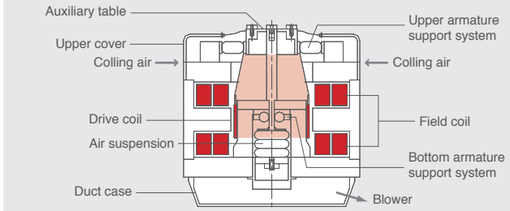
The formula below represents the Fleming’s left hand rule.

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

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.
Selecting a cooling method that meets to your installation requirements based on the key feature as below.

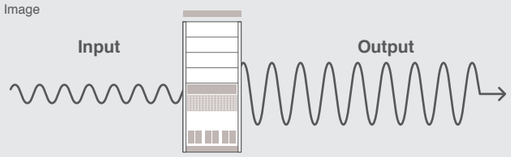
Cooling method	Air cooling	Water cooling
How to cool	Cools the coils by using air from outside. Forces exhaust by blowser.	The coils are made of pipe and distilled water is circulated to cool the coils using a heat exchanger and a cooling water.
Key feature	Employs only a blower as cooling equipment. 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 cooling water facility is necessary.

Power amplifier

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

$$\text{Electric power (VA)} = \text{Electric voltage (V)} \times \text{Electric current (A)}$$

Image

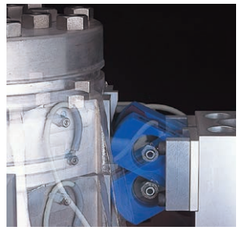


Technical Guidance

Invention with IMV's originality

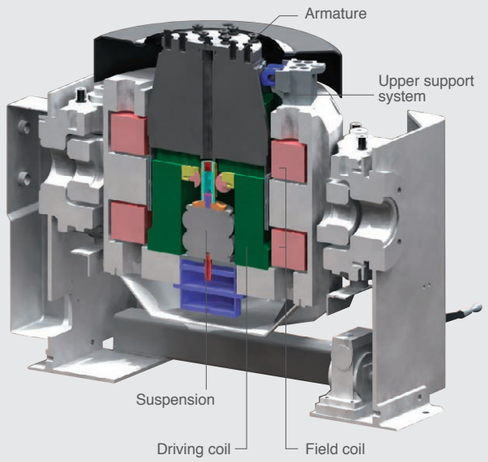
Original technology utilised to improve durability and performance of vibration generators

Upper (armature) support system PS guide



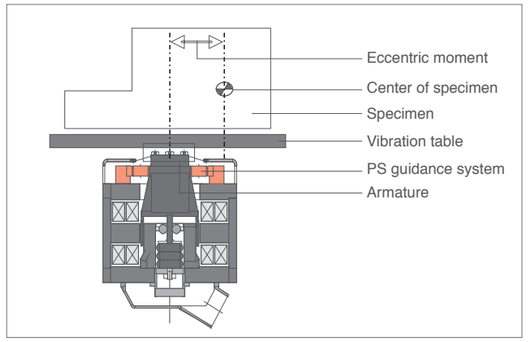
Vibration generator receives a dynamic stress by its own vibration. The Parallel Support Guide (PSG) design is a patented one that can support the armature. PSG significantly improves durability, reliability of the system, and quality of vibration at the same time.
This compact design provides enough stiffness which exceeds such functions of roller support system and realizes high durability and self-holding supporting system by alternative alignment of gears that have a unique curve.

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 some fixture or auxiliary table. Large lateral rigidity of the table guidance systems is important, because it is hard to bring the center of gravity of the specimen on the center line of the vibration table. The larger the specimen is , its importance is increasing.
Our PS guidance system (Parallel Support Guide) realizes 130 % increase of rigidity over those of the same force range conventional models. It achieved that the specimens whose center of gravity are not located on the center line of the vibration table can be tested being applied higher acceleration.



Compatibility of lateral rigidity and waveform regeneration accuracy

Usually lateral rigidity and waveform accyracy conflict each other. PS Guidance system achieved their compatibility. It realizes vibrations of lower waveform distortion with high fidelity.

Improvement of durability

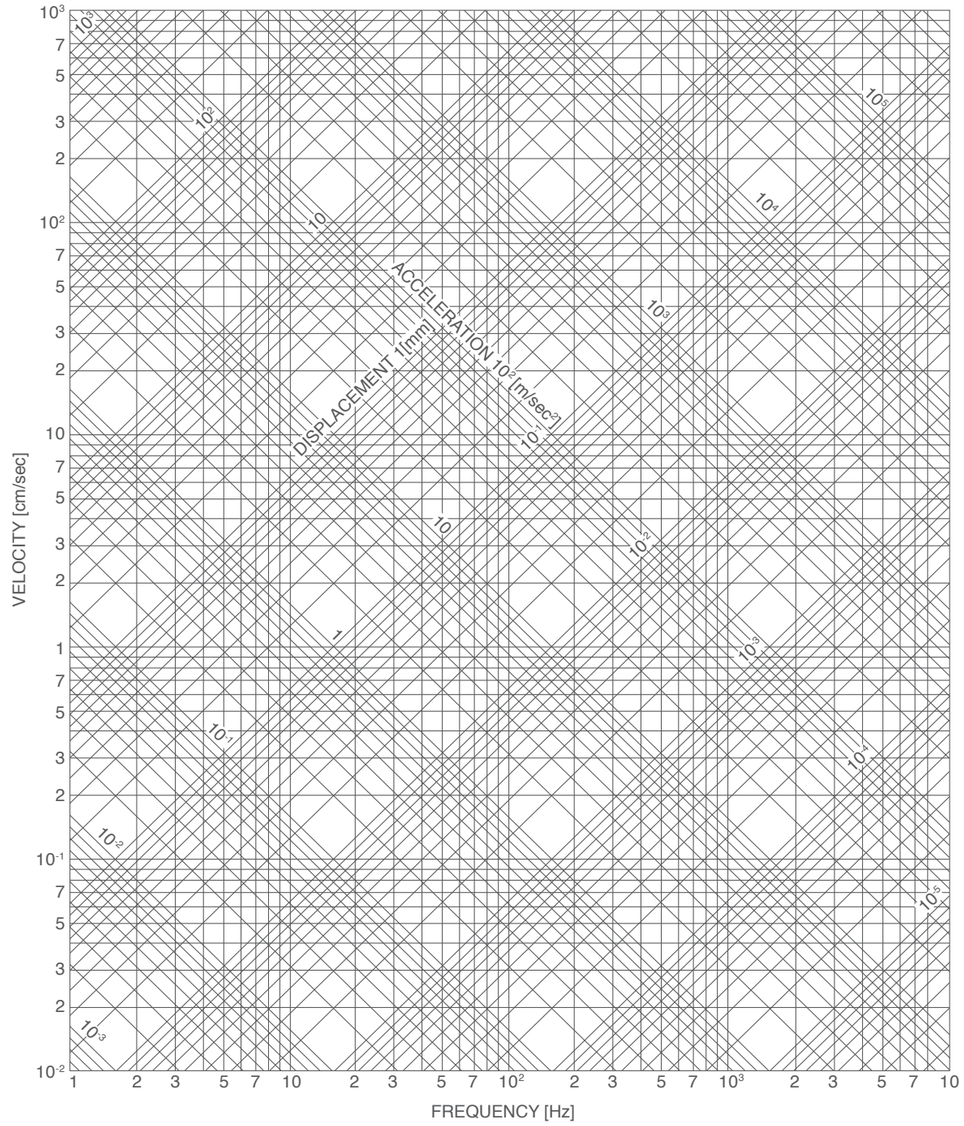
10 times longer (compared to conventional system's) life was achieved to make much longer the interval of maintenance.

Flexibility to respond to demand for large displacement tests

Flexibility is provided 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

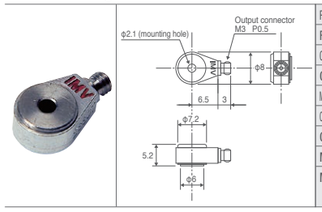
1) f=50 Hz, D=1 mm
   V=31 cm/sec, A=99 m/sec²
2) f=100 Hz, V=100 cm/sec
   D=1.6 mm, A=630 m/sec²
3) f=600 Hz, A=60 m/sec²
   D=0.0042 mm(4.2 μm), V=1.6 cm/sec

Related Products

Piezoelectric accelerometer

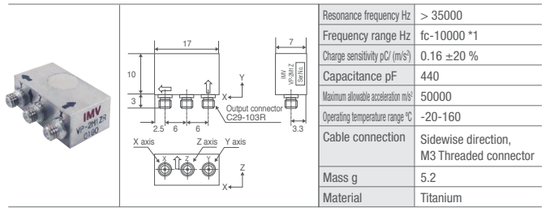
Since IMV has developed assembled accelerometers using in-house manufactured transducer elements, it is possible to offer a wide variety of piezoelectric accelerometers.

Small & light VP-02S



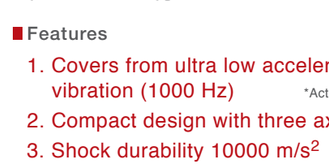
Resonance frequency Hz	> 40000
Frequency range Hz	fc-13000 *1
Charge sensitivity pC/ (m/s²)	0.22 ±20 %
Capacitance pF	1000
Maximum allowable acceleration m/s²	10000
Operating temperature range ℃	-20-150
Cable connection	Sidewise direction, M3 Threaded connector
Mass g	1.2
Material	Titanium & Aluminum (A2017B)

Small VP-2M1ZR



Resonance frequency Hz	> 35000
Frequency range Hz	fc-10000 *1
Charge sensitivity pC/ (m/s²)	0.16 ±20 %
Capacitance pF	440
Maximum allowable acceleration m/s²	50000
Operating temperature range ℃	-20-160
Cable connection	Sidewise direction, M3 Threaded connector
Mass g	5.2
Material	Titanium

Wide temperature VP-32

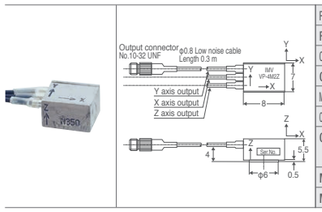


Resonance frequency Hz	> 30000
Frequency range Hz	fc-10000 ±1 dB *1
Charge sensitivity pC/ (m/s²)	3.0 ±10 %
Capacitance pF	1500
Maximum allowable acceleration m/s²	9800
Operating temperature range ℃	-40-160
Cable connection	Sidewise direction, 10-32 Threaded connector
Mass g	24
Material	Stainless steel (SUS303)

Micro VP-4M2

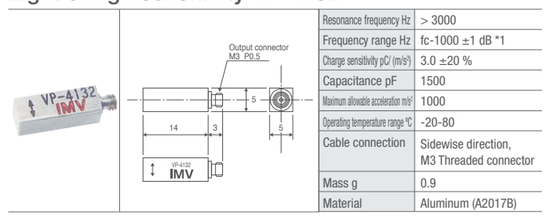
Resonance frequency Hz	> 60000
Frequency range Hz	fc-13000 ±1 dB *1
Charge sensitivity pC/ (m/s²)	0.035 ±20 %
Capacitance pF	340
Maximum allowable acceleration m/s²	100000
Operating temperature range ℃	-50-160
Cable connection	Side-horizontal, 10-32 receptacle
Mass g	0.2
Material	Titanium

Micro VP-4M2Z



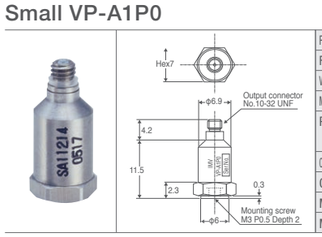
Resonance frequency Hz	> 50000
Frequency range Hz	fc-10000 *1
Charge sensitivity pC/ (m/s²)	0.04 ±20 %
Capacitance pF	250
Maximum allowable acceleration m/s²	50000
Operating temperature range ℃	-50-160
Cable connection	Side-horizontal, 10-32 receptacle on the other side
Mass g	1.2
Material	Titanium

Light & high sensitivity VP-4132



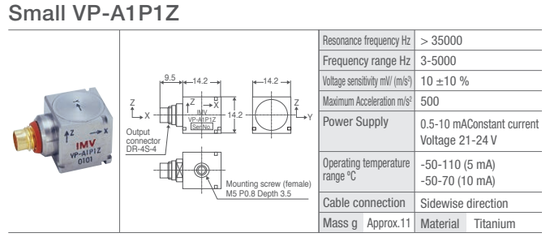
Resonance frequency Hz	> 3000
Frequency range Hz	fc-1000 ±1 dB *1
Charge sensitivity pC/ (m/s²)	3.0 ±20 %
Capacitance pF	1500
Maximum allowable acceleration m/s²	1000
Operating temperature range ℃	-20-80
Cable connection	Sidewise direction, M3 Threaded connector
Mass g	0.9
Material	Aluminum (A2017B)

Small VP-A1P0



Resonance frequency Hz	> 40000
Frequency range Hz	3-12000
Voltage sensitivity mV/ (m/s²)	1 ±10 %
Maximum Acceleration m/s²	3000
Power Supply	0.5-5 mAConstant current Voltage 15-25 V
Operating temperature range ℃	-30-110
Cable connection	Top-vertical M3 threaded connector
Mass g	1.9
Material	Titanium

Small VP-A1P1Z



Resonance frequency Hz	> 35000
Frequency range Hz	3-5000
Voltage sensitivity mV/ (m/s²)	10 ±10 %
Maximum Acceleration m/s²	500
Power Supply	0.5-10 mAConstant current Voltage 21-24 V
Operating temperature range ℃	-50-110 (5 mA) -50-70 (10 mA)
Cable connection	Sidewise direction
Mass g Approx.11	Material Titanium

*1 fc: To be defined by the time constant of amplifier

Broadmotion sensor VP-8013/VP-8013S

Broad motion sensor, VP-8013, with the use of an original sensor module developed by IMV is enabled to measure and monitor vibration in wide frequency range which was not covered by single sensor of any conventional types.

Features

1. Covers from ultra low acceleration (0.04 Hz)* up to high frequency mechanical vibration (1000 Hz) *Actually the output starts from DC, performance confirmed range is from 0.04 Hz.
2. Compact design with three axis detection
3. Shock durability 10000 m/s^2

Export of Products

Export of IMV vibration test system products

IMV CORPORATION has been registered by the Japanese Ministry of Economy, Trade and Industry (METI) regarding export controls as a company in good standing compliant with the Japanese export regulations for Electro-dynamic vibration test systems or the related products composing the test systems (hereafter, "IMV Vibration test system products") that are strictly controlled for export from Japan to end users and/or end use that concerns manufacturing or development of ordinal weapons and/or mass destruction weapons including any equipment to transport them. Therefore, IMV has the obligation to confirm to the ministry in Japan that the customers of IMV vibration test system products are not related to or concerned with such purposes before arrangement of export of the products, even if the products exported do not require an Export License (E / L) by the Japanese government. Therefore, IMV will ask customers to issue the following information and documentation to us in each of the following stages.

** marked products in this catalogue require E / L.

Quotation request stage

IMV requires correct information about the address, name of the end user (including the name of department) and purpose of the end use of the products before we issue the price quotation of the products. Usually, the information is sent to IMV in writing through the sales representative for the end user. Please note that there is a possibility that IMV may not accept the inquiry because of the end user or the end use.

Order stage

Either an E/L of the Japanese government will be required to export the products from Japan or an E / L will not be required to export the products from Japan. In the former case, IMV will inform the end user of the required details etc. before accepting the order, because IMV has to apply for the E / L in Japan. In the latter case, IMV will always request the end user to prepare the "Certification of End User / End Use" after placing the order with the sales representative or IMV. The certificate is required by and will be requested by IMV.

Export arrangement stage

IMV has to obtain the E / L or the Certification of End User / End Use before our export arrangements are made for the products. If not, IMV will have to stop the export arrangements.
Please contact the sales representative or IMV should you have any questions regarding contents of the Japanese export control system or regulations.

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

IMV Test Laboratory Network

IMV's test laboratory network provides customers with full support

IMV offers a full service as 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.

Test Laboratory for railway vehicle parts

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) Certification number : VILAS 1284
(2) Authorisation organisation : Bureau of Accreditation Vietnam (BoA)
(3) Authorisation date : March 2nd, 2020
(4) Authorised field : 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).

e-Test Centre Japan

Focusing 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, proposing new test methods, development of new facilities and so on.

- Reliability evaluation test for e-mobility parts such as large-sized motor or inverter of EV/HEV
- Evaluation of large parts such as 100 kg, 1 m is possible while part is being operated
- 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
- Other tests perfomed in conjuction with specialised agencies
- 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

Advanced Technology Centre for Environmental Testing

To meet the 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

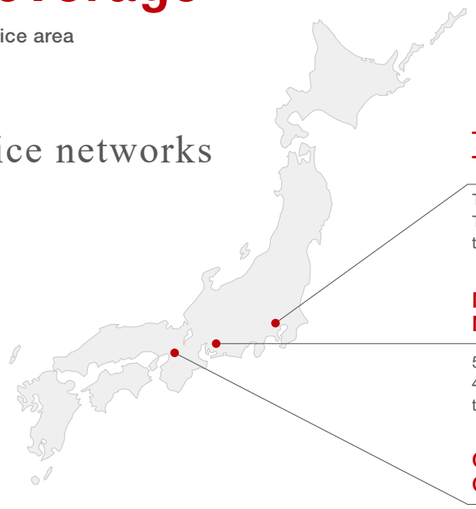
3-axis large earthquake resistance vibration test system

Chamber combined vibration test system with a slip Table

Coverage

Service area

Service networks



Tokyo sales office
Tokyo engineering service

THE TERRACE TSUKIJI. F4 EAST 7-2-1
Tsukiji, Chuo-ku, Tokyo, 104-0045, Japan
tel.+81 3 6226 5031 fax.+81 3 6226 5032

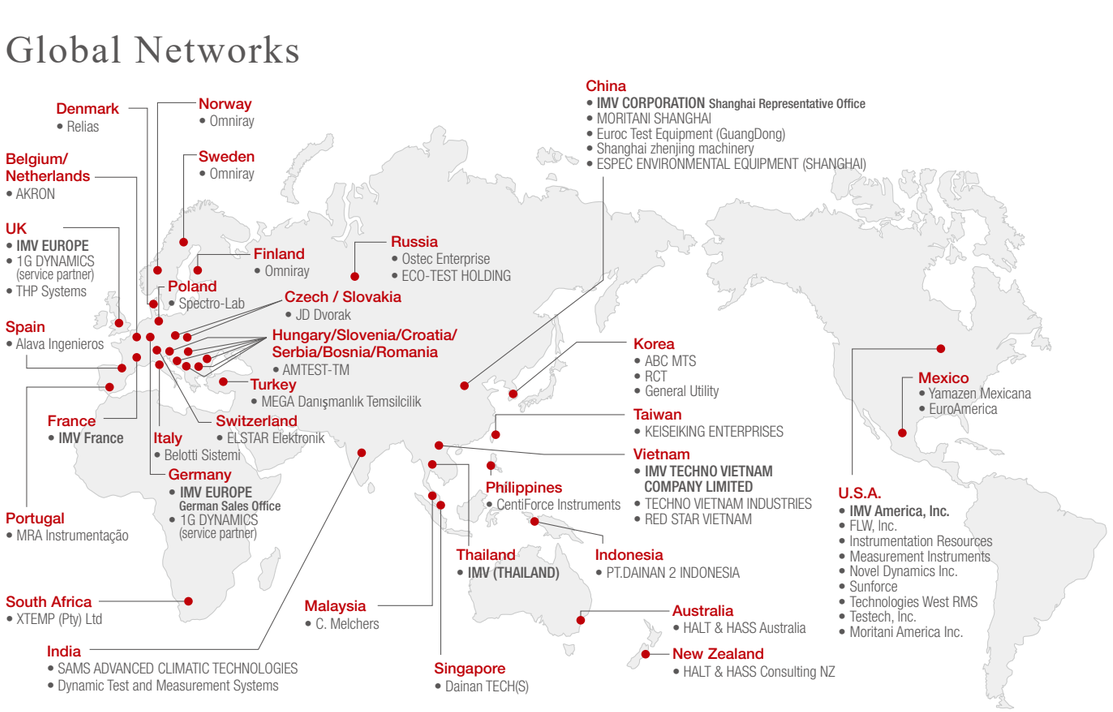
Nagoya sales office
Nagoya engineering service

5-2-18, Neura-cho, Miyoshi-shi, Aichi,
470-0217, Japan
tel.+81 561 35 5188 fax.+81 561 36 4460

Osaka sales office
Osaka engineering service

2-6-10 Takejima, Nishiyodogawa-ku, Osaka,
555-0011, Japan
tel.+81 6 6478 2575 fax.+81 6 6478 2537

Global Networks



Thailand
IMV(THAILAND)CO.,LTD.

UK
- IMV EUROPE LIMITED
- Manufacturing and Demonstration Centre

Germany
IMV EUROPE LIMITED
German Sales Office

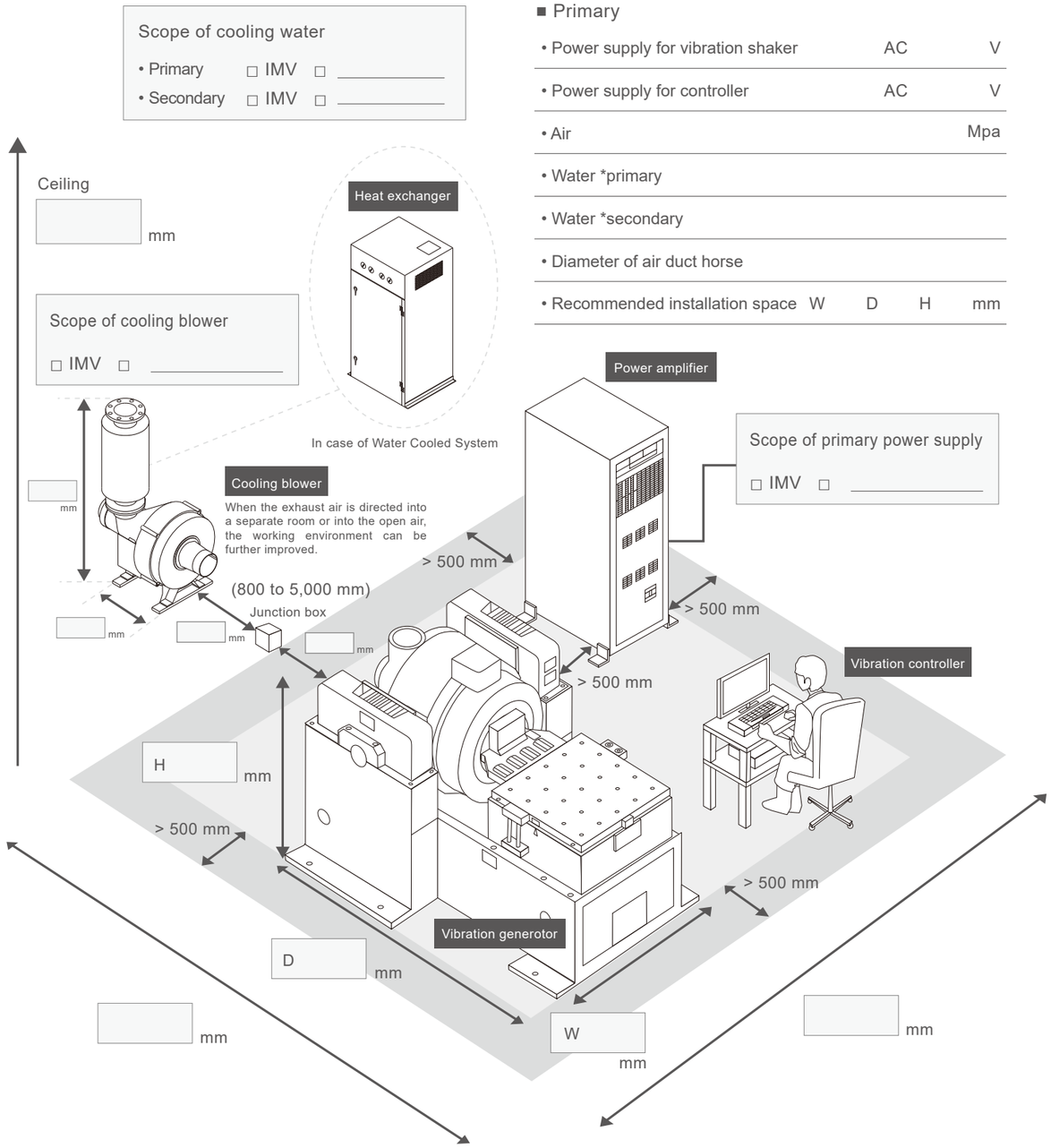
China
IMV CORPORATION
Shanghai Representative Office

America
IMV America, Inc.

Vietnam
IMV TECHNO VIETNAM
COMPANY LIMITED

System Layout

Instllation 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.

Memo