IMV CORPORATION

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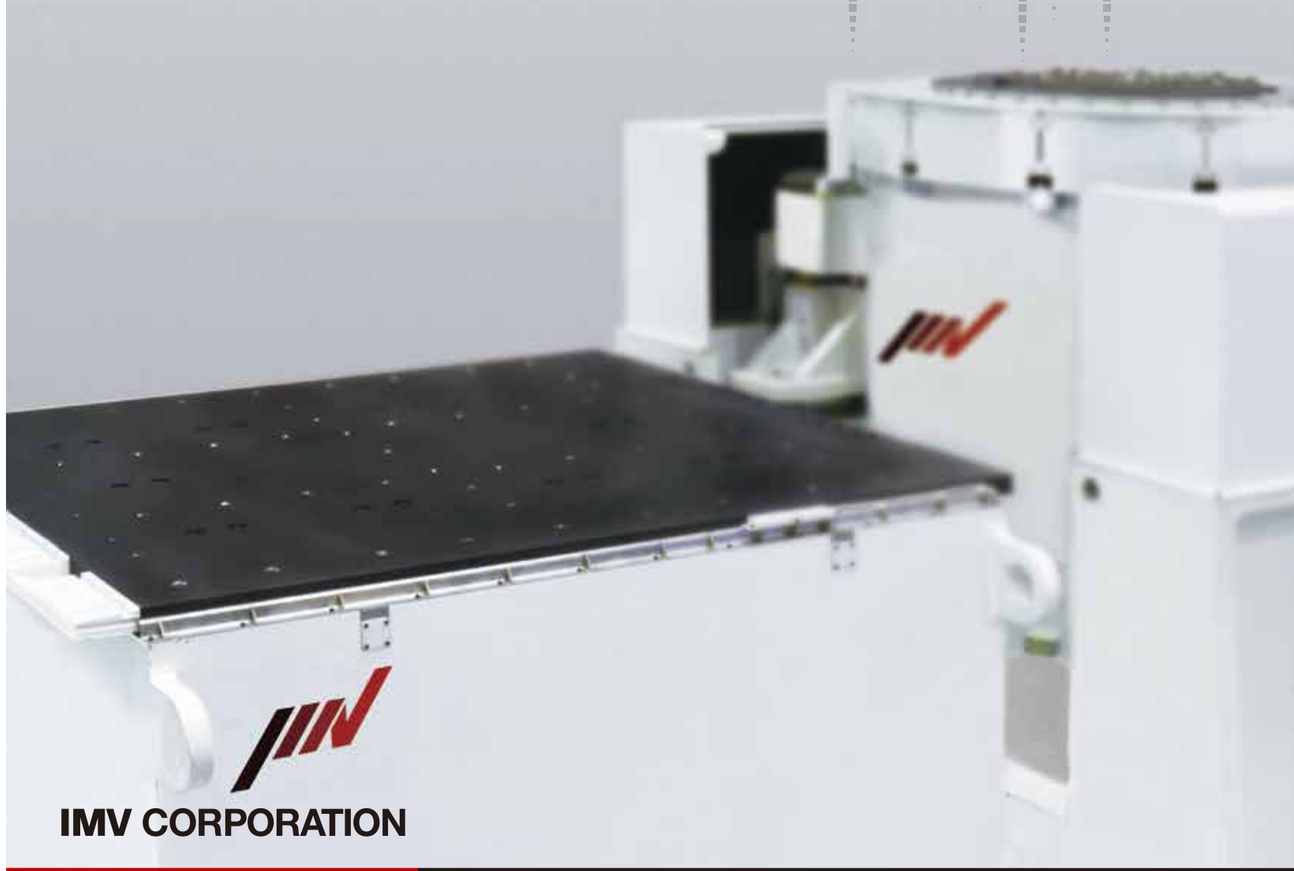
*The specifications and design are subject to change without notice.

Apr 2025
Cat No.2504ⓈDSS_US

IMV-Smart™
ECO-Shaker

Vibration Test System Product Catalog

Japanese-engineered systems



IMV CORPORATION

World’s leading supplier of high-reliability vibration test systems

Benefiting a wide range of industries 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 muti-axis systems for up to six degrees of freedom simulation. A range of vibration and diagnostic instruments are also available. Engineering consultancy services to assist customers with vibration measurement, analysis and testing can also be provided.

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

We are proud to contribute 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.



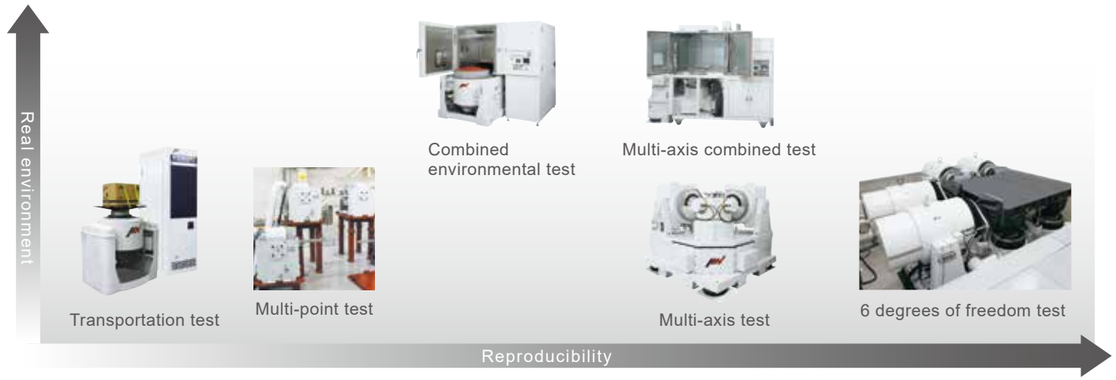




INDEX

Series Arrangements

Vibration Test Systems Lineup Chart

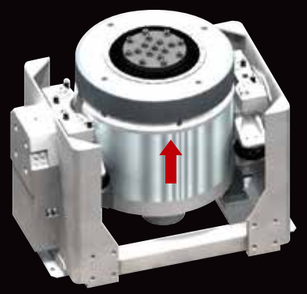


			Automotive parts	Aerospace	Electronic parts		Information and telecommunication equipment	Precision equipment	Electrical equipment	Transportation environment	Usage environment
A-series	High-Grade Range	P09	Car audio, navigation systems, door mirrors, inverters, motors, light-related parts, ECU-associated parts, solenoid, car-mounted meters, electric power station motors, combination meters, fuel pumps, inlet system parts, hybrid-related parts, batteries, electric pumps, mufflers, catalysts, fuel batteries, ABS coils, seat belts, brake systems	Personal monitor TV, communications equipment, resin products, seal material, dishes, chairs, aircraft engine components, space environmental utilization, airborne equipment	LCD TVs, connector components, car-mounted electrical components, general-purpose motors, in-rack equipment, PCs, printed circuit boards, impact from transportation		Navigation systems, car-mounted telecommunication equipment, vending machines on the expressway, industrial motors, antenna-related components, large antennae	Industrial robots, digital cameras, lenses, optical equipment, surface mounter-related components, mobile phones, copy machines, video cameras	Voltage-withstanding transformers, fuel batteries, inverter-related components, space batteries, large lithium batteries	Rail vehicle components, construction equipment, Shipping on rough roads	Combination meters, instrument panel components, solar systems, other car-mounted components, PCs
i-series	Standard Range	P13									
J-series	Large-Displacement Range	P14									
K-series	High-Excitation-Force Water-Cooled Range	P15	Brakes, catalysts, heat insulation, hydraulic sensors, starters, alternators, mufflers, hybrid motors, batteries, sensors, dynamos, power units	Satellite equipment, propeller engines	Servomotors, refrigerators, heaters, washing machines, major electronics		Large parabolic antennae, antenna-related components	—	Large battery equipment, power boards, control boards	Rail vehicle components, railway components	Displays
m-series	Low Acoustic Noise and Compact Range	P17	Air-conditioner vents, ETC, ITS devices, car-mounted sensors, car audio, navigation systems	—	Boards, mobile phones, mobile products, electronic components, compact motors		ETC for motorcycles, mobile phones	Medical equipment, usage boards, digital cameras, semiconductor components	—	—	Structures (miniature)
DC-series	2-Axis Changeover Systems	P29	Radiators, car air-conditioner modules, compressors	Aviation communication equipment, aircraft components	Real environmental shipping, car audio, LCD panels, domestic electric appliances		Navigation systems, car audio, brackets	Video cameras, car audio, copy machines, multi-function printers	Large battery equipment, power boards, control boards	Cushioning material, packing material, transportation equipment	Earthquake simulation systems, Earthquake-resistance test systems
TC-series	3-Axis Changeover Systems	P30	Radiators, car air-conditioner modules								
DS-series	2-Axis Simultaneous Systems	P31	Radiators, car air-conditioner modules, back mirrors								
TS-series	3-Axis Simultaneous Systems	P32	Car audio, navigation systems, air-conditioners, vibration insulation mounts, radiators								
TTS-series	6 Degrees of Freedom Systems	P33	Ride quality, construction equipment, cutaway bodies	—	—		—	—	Battery	—	Cabins for construction equipment

Vibration Test Systems
Single-axis systems

Approach to low noise

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

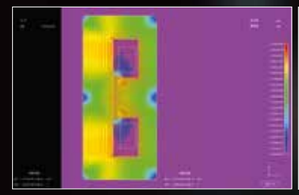


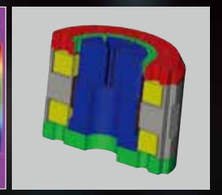
Upper (armature) support system PS Guide

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

World-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 (up to 16,700 lbf) to be achieved. Air-cooled systems are lower in cost both to install and to maintain compared to water-cooled systems.





Simple confirmation of CO_2 reduction 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

IMV-Smart™ ECO-Shaker

IMV-Smart technology

■ Automatic energy savings

The 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 optimized according to the payload and test requirements.
Complicated manual settings are no longer needed.
Changes in the operating environment or in test level are accommodated without operator intervention.

[Features]

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

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

Vibration controller K2+

■ Effects of energy-saving

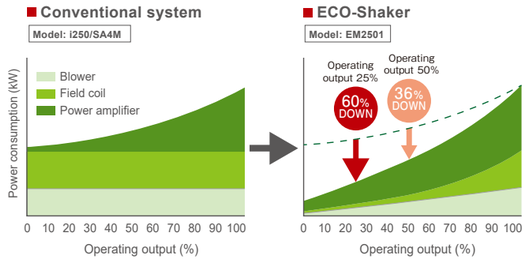
The lower the system output, the more energy can be saved.

Calculation method: Calculation of CO_2 reduction, referring to actual data of our conventional system, i250/SA4M (Maximum force 72,000 lbf)

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

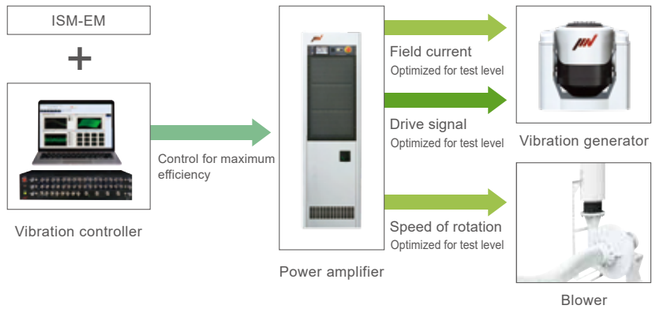
Reduce yout CO_2 emissions by up to 80%



Comparison of power consumption with the conventional system

■ Operation of ISM-EM (Power consumption)

Minimizing 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

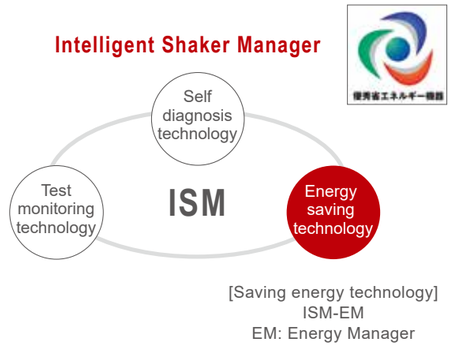
■ Improvement of working conditions

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

Blower

■ Energy-saving vibration test system [ECO-Shaker]

Vibration test systems consume a lot of electricity. IMV has developed environmentally friendly products which minimize the required electric power and cut down electric consumption and CO_2 emissions. Thanks to its great contributions toward energy efficiency, the technology featured in the ECO-Shaker received the Chairman's Award from the Machinery Federation in 2012.



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

■ Contribution to the environment

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

A-series

High-Grade Range

IMV-Smart™
ECO-Shaker

A30/EM3HAG

A new standard created through 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 provides a better working environment for vibration testing.

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

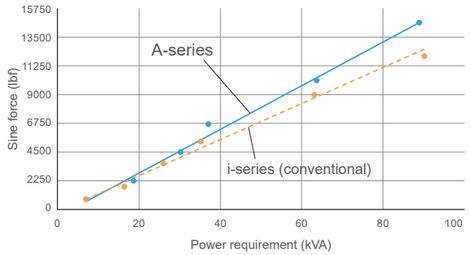
Improvement of performance

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 3.0 inp-p displacement *Only for A30, A45, A65, A74

A-series has a displacement of 3.0 inp-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.

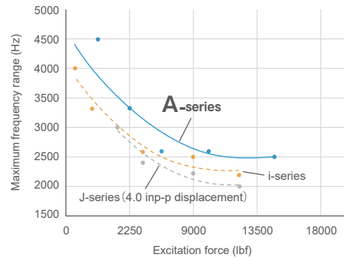
i-series (conventional)
2.0 inp-p displacement

A-series

J-series (conventional)
4.0 inp-p displacement

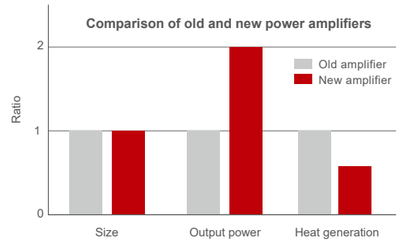
Increase in frequency range

In addition to the increased displacement of 3.0 inp-p, the maximum frequency range is also increased when compared to the i- and J-series.



Introduction of new power module

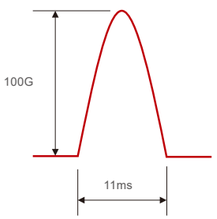
By developing a power amplifier that uses a new next-generation Silicon Carbide power module, IMV has achieved low noise and high efficiency.
This new power module is standard-issue for all A-series models.



High-velocity shock testing

Where a test requires a high shock velocity, traditional shaker systems use a matching transformer to achieve the necessary lower field voltage. Since IMV's ECO-system has complete control over the field level, the field value can be adjusted to increase the maximum shock velocity capability of the system by entering the specified shock profile into IMV's K2 controller. The field level in the shaker is automatically adjusted to ensure that the required velocity is achieved. A-series (EM amplifier model) provides a maximum of 138 inp-p shock velocity testing.

Examples of shock test



	Model	i220/SA1HAG
i-series (conventional)	Rated Force Shock (lbf)	3,600
	Maximum Velocity Shock (in/s peak)	87
	Maximum Displacement (inp-p)	2.4
	Maximum Load (lbs)	Not achievable (not enough velocity and displacement)

	Model	No applicable product	J230/SA3HAG	J240/SA4HAG	J250/SA6HAG	J260/SA7HAG	No applicable product
J-series (conventional)	Rated Force Shock (lbf)	-	9,000	12,400	18,000	24,200	-
	Maximum Velocity Shock (in/s peak)	-	94	94	94	94	-
	Maximum Displacement (inp-p)	-	4.7	4.7	4.7	4.7	-
	Maximum Load (lbs)	-	Not achievable (not enough velocity)				-

	Model	A11/EM1HAG	A22/EM2HAG	A30/EM3HAG	A45/EM4HAG	A65/EM5HAG	A74/EM10HAG
A-series	Rated Force Shock (lbf)	4,950 (3,710)	9,890 (8,090)	13,500 (11,250)	20,240 (18,000)	29,240 (27,000)	50,000 (38,200)
	Maximum Velocity Shock (in/s peak)	99 (138)	99 (138)	99 (138)	99 (138)	99 (138)	99 (138)
	Maximum Displacement (inp-p)	2.0 (2.5)	2.0 (2.5)	3.0	3.0	3.0	3.0
	Maximum Load (lbs)	11	31	38	66	106	190

*Maximum load on bare table

User-friendly and Secure

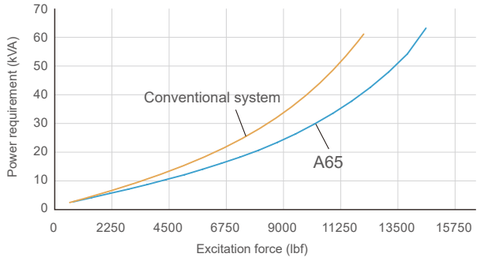
A-series changes

Advanced automatic energy saving, high level of functionality and a protected test environment.
A-series provides a better working environment for vibration testing.

Lower power consumption

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

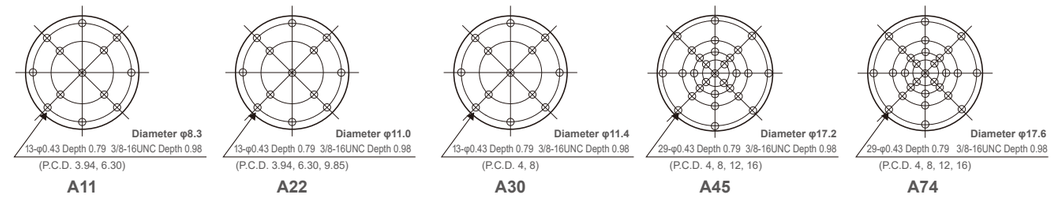
Comparison of consumed power per excitation force



International safety standards

A-series complies with international safety standards.

Table Insert Pattern (Unit: inch)



Specifications

System Model			A11/EM1HAG	A22/EM2HAG	A30/EM4HAG	A45/EM4HAG	A74/EM10HAG*6
System Specifications	Frequency Range (Hz)		0–4,500*4	0–3,300	0–2,600	0–2,600	0–2,600*5
	Rated Force	Sine (lbf)	2,470	4,940	6,800	10,120	16,700
		Random (lbf rms)*1	2,470	4,940	6,800	10,120	16,700
		Shock (lbf)	4,945	9,890	16,800	20,240	50,000
		High Velocity Shock (lbf)	3,710	8,090	13,000	18,000	38,200
	Maximum Acc.	Sine (g)	102	102	92	92	102
		Random (g rms)	65	65	65	65	65
		Shock (g peak)	204	204	185	183	204
		High Velocity Shock (g peak)	153	166	154	163	204
	Maximum Vel.	Sine (in/s)	79	79	79	79	79
		Shock (in/s peak)	99	99	99	99	99
		High Velocity Shock (in/s peak)	138	138	138	138	138
	Maximum Disp.	Sine (inp-p)	2.0	2.0	3.0	3.0	3.0
		High Velocity Shock (inp-p)	2.5	2.5	3.0	3.0	3.0
	Maximum Travel (inp-p)		2.5	2.5	3.2	3.2	3.2
	Maximum Load (lbs)		441	661	882	1,323	2,205
	Power Requirements (kVA)*2		20.4	30	36	57	100
	Breaker Capacity (A)*3		30	50	60	100	175
Vibration Generator	Model		A11	A22	A30	A45	A74
	Armature Mass (lbs)		24	49	73	110	164
	Armature Diameter (φin)		8.3	11	11.4	17.2	17.6
	Allowable Eccentric Moment (lbf•in)		2,600	6,200	7,500	13,700	13,700
	Dimensions (in) W × H × D		37 × 33 × 27	41 × 38 × 31	44 × 42 × 33	49 × 48 × 41	52 × 50 × 41
	Shaker Body Diameter (φin)		23	27	29	33	37
	Mass (lbs)		2,381	3,527	4,630	7,055	9,260
Power Amplifier	Model*7		2□GH1-A11	2□GH2-A22	2□GH3-A30	2□GH4-A45	2□GH10-A74
	Maximum Output (kVA)		12	24	31	44	100
	Amplifier Bay (s)		1	1	1	2	2
	Dimensions (in) W × H × D		23 × 77 × 34	23 × 77 × 34	23 × 77 × 34	46 × 77 × 34	46 × 77 × 34
	Mass (lbs)		1,036	1,235	1,300	2,205	4,409
Controller	Vibration Controller		See Vibration Controller K2				
Cooling	Cooling Method		Air cooling				
	Blower	Dimensions (in) W × H × D*6	28 × 56 × 31	28 × 61 × 37	28 × 61 × 37	46 × 84 × 32	58 × 111 × 37
		Mass (lbs)	309	463	463	618	705
		Wattage (kw)	3.7	5.5	5.5	11	30
		Duct Hose Diameter (φ)	4.92	7.87	7.87	9.84	9.84

*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 480 V, 60 Hz. A transformer is required for other supply voltages.
*3 Breaker capacity for 480 V
*4 Above 4,000 Hz, the force rolls-off at a rate of -6 dB/oct.
*5 Above 2,000 Hz, the force rolls-off at a rate of -12 dB/oct.
*6 An export license is required for exporting a shaker system of over 11,240 lbf sine force.
*7 The alphabet of A, B, or C can be entered in □. A: Voltage AC200V system (200 to 230), B: Voltage AC400V system (380A to 440V), C: 480V system (480V to 520V)
*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 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

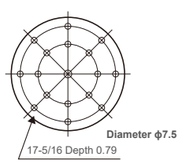
Universally applicable with over 15 years of sales success.

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

i220/EM1HAG
(With a slip table)

[Maximum test range] • Maximum acceleration: 127 g • Maximum velocity: 137 in/s
• Maximum displacement: 2.0 inp-p • Maximum loading mass: 440 lbs
[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: inch)



i220

Specifications

System Model			i220/EM1HAG
System Specifications	Frequency Range (Hz)		0-3,300
	Rated Force	Sine (lbf)	1,800
		Random (lbf rms)*1	1,800
		Shock (lbf)	3,600
		High Velocity Shock (lbf)*5	2,250
	Maximum Acc.	Sine (g)	127
		Random (g rms)	89
		Shock (g peak)	204
		High Velocity Shock (g peak)*5	159
	Maximum Vel.	Sine (in/s)	87
		Shock (in/s peak)	87
		High Velocity Shock (in/s peak)*5	137
	Maximum Disp.	Sine (inp-p)	2.0
		High Velocity Shock (inp-p)*5	2.0
	Maximum Travel (inp-p)		2.4
	Maximum Load (lbs)		440
	Power Requirements (kVA)*2		16.4
	Brekaer Capacity (A)*3		30

	Model	i220
Vibration Generator	Armature Mass (lbs)	14.1
	Armature Diameter (φin)	7.5
	Allowable Eccentric Moment (lbf•in)	2,600
	Dimensions (in) W × H × D	40 × 36 ×2 2
	Shaker Body Diameter (φin)	22
	Mass (lbs)	1,984
Power Amplifier	Model*6	2□GH1-i220
	Maximum Output (kVA)	10
	Amplifier Bay (s)	1
	Dimensions (in) W × H × D	23 × 69 × 33
	Mass (lbs)	728
Controller	Vibration Controller	See Vibration Controller
Cooling	Cooling Method	Air cooling
	Blower: Dimensions (in) W × H × D*4	20 × 45 × 25
	Blower: Mass (lbs)	155
	Blower: Wattage (kw)	1.5
	Blower: Duct Hose Diameter (φ)	125

*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 220/480 V, 60 Hz. A transformer is required for other supply voltages.
*3 Breaker capacity for 480 V.
*4 Specification above applies to 60 Hz. Dimensions change for 50 Hz.
*5 For high-velocity option
*6 The alphabet of A, B, or C can be entered in □. A: Voltage AC200V system (200 to 230), B: Voltage AC400V system (380A to 440V), C: 480V system (480V to 520V)
*For random vibration test, 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 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

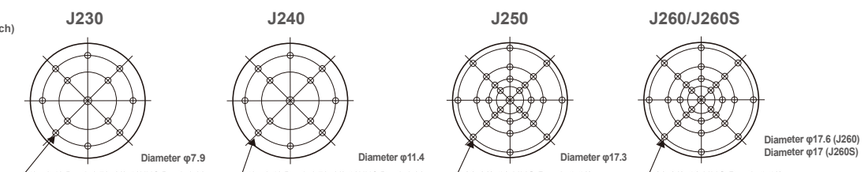
J-series accommodates high-velocity and large-displacement testing

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

J240/EM3HAG
(With a slip table)

[Expanded maximum test range] • Maximum velocity of Sine force: 94 in/s
• Maximum velocity of Shock force: 137 in/s • Maximum displacement: 4.0 inp-p
[Patented upper (armature) support system PS Guide] Parallel Slope Guide is standard
[All models can be directly paired with a climatic chamber]

Table Insert Pattern (Unit: inch)



Eco Specifications

System Model			J230/EM3HAG	J240/EM4HAG	J250/EM5HAG	J250/EM6HAG	J260S/EM16HAG*8
System Specifications	Frequency Range (Hz)		0–3,000	0–2,400	0–2,200	0–2,200	0–2,000*4
	Rated Force	Sine (lbf)	3,600	5,400	7,900	9,000	12,150
		Random (lbf rms)*1	3,600	5,400	7,900	9,000	12,150
		Shock (lbf)	9,000	12,400	15,800	18,000	44,000
		High Velocity Shock (lbf)*7	6,750	10,800	15,300	17,520	-
	Maximum Acc.	Sine (g)	96	94	79	90	87
		Random (g rms)	67	65	55	63	61
		Shock (g peak)	204	204	159	181	204
		High Velocity Shock (g peak)*7	180	188	154	176	-
	Maximum Vel.	Sine (in/s)	94	94	94	94	94
		Shock (in/s peak)	94	94	94	94	137
		High Velocity Shock (in/s peak)*7	137	137	137	137	-
	Maximum Disp.	Sine (inp-p)	4.0	4.0	4.0	4.0	4.0
		High Velocity Shock (inp-p)*7	4.0	4.0	4.0	4.0	4.0
	Maximum Travel (inp-p)		4.7	4.7	4.7	4.7	4.6
	Maximum Load (lbs)		660	880	1,320	1,320	2,200
	Power Requirements (kVA)*2		28	38	53	57	127
	Breaker Capacity (A)*3		50	75	100	100	225
Vibration Generator	Model*8		J230	J240	J250	J250	J260S
	Armature Mass (lbs)		37.5	57.3	99.2	99.2	139
	Armature Diameter (φin)		7.9	11.4	17.3	17.3	17
	Allowable Eccentric Moment (lbf•in)		6,200	7,530	13,730	13,730	13,730
	Dimensions (in) W × H × D		45 × 43 × 34	49 × 45 × 35	58 × 51 × 44	58 × 51 × 44	60 × 52 × 44
	Shaker Body Diameter (φin)		25	29	34	34	36
	Mass (lbs)		3,970	5,295	7,720	7,720	9,040
Power Amplifier	Model*8		2□GH3-J230	2□GH4-J240	2□GH5-J250	2□AGH6-J250	2□GH16-J260S
	Maximum Output (kVA)		23	34	50	57	76
	Amplifier Bay (s)		1	1	2	2	3
	Dimensions (in) W × H × D		23 × 69 × 34	23 × 69 × 34	46 × 77 × 34	46 × 77 × 34	69 × 77 × 34
	Mass (lbs)		840	1,080	2,050	2,120	7,000
Controller	Vibration Controller		See Vibration Controller K2				
Cooling	Cooling Method		Air cooling				
	Blower	Dimensions (in) W × H × D*5	28 × 56 × 31	28 × 61 × 37	51 × 84 × 33	51 × 84 × 33	52 × 89 × 43
		Mass (lbs)	309	474	644	644	816
		Wattage (kw)	3.7	5.5	11	11	15
		Duct Hose Diameter (φ)	7.87	7.87	9.84	9.84	9.84

*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 220/480 V, 60 Hz. A transformer is required for other supply voltages.
*3 Breaker capacity for 480 V
*4 Above 2,000Hz, the force rolls-of f at a rate of -12 dB/oct.
*5 Specification above applies to 60 Hz. Dimensions change for 50 Hz.
*6 An export license is requqired for exporting a shaker system of over 11,240 lbf sine force.
*7 For high-velocity option
*8 The alphabet of A, B, or C can be entered in □. A: Voltage AC200V system (200 to 230), B: Voltage AC400V system (380A to 440V), C: 480V system (480V to 520V)
*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 sensor and vibration controller.
*Armature mass and acceleration may change when a chamber is added.
*Mass and dimensions may change for CE-marked systems.

K-series

High-Excitation-Force Water-Cooled Range

IMV-Smart™
ECO-Shaker

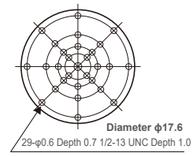
K350
(With a slip table)

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

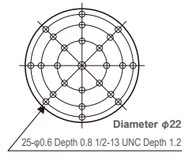
K-series, the high-excitation-force water-cooled vibration-simulating test systems fully developed by IMV.
Advanced performance from the K-series will significantly improve your test environment.

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

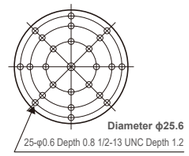
Table Insert Pattern (Unit: inch)



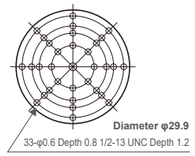
K080



K125/K125LS



K200



K350

System Model			K080/EM10HAG*6	K125A/EM18HAG*6	K125LS/EM20HAG*6	K200/EM24HAG*6	K350/EM36HAG*6
System Specifications	Frequency Range (Hz)		0–2,500	0–2,500	0–2,000	0–2,000	0–2,000
	Rated Force	Sine (lbf)	18,000	28,100	28,100	45,000	78,700
		Random (lbf rms)*1	18,000	28,100	28,100	45,000	70,800
		Shock (lbf)	36,000	56,200	56,200	90,000	157,300
		High Velocity Shock (lbf)	24,730	37,100	37,100	58450	-
	Maximum Acc.	Sine (g)	102	102	102	102	102
		Random (g rms)	71	71	71	71	71
		Shock (g peak)	204	204	204	204	204
		High Velocity Shock (g peak)	187	204	168	133	-
	Maximum Vel.	Sine (in/s)*3	79	79	79	79	79
		Shock (in/s peak)	79	79	79	94	138
		High Velocity Shock (in/s peak)	138	138	138	138	-
	Maximum Disp.	Sine (inp-p)	2.0	2.0	4.0	3.0	3.0
	Maximum Travel (inp-p)		2.3	2.4	4.56	3.4	3.7
	Maximum Load (lbs)		2,200	4,400	4,400	4,400	6,615
	Power Requirements (kVA)*2		100	170	190	300	325
	Breaker Capacity (A)*4		150	250	300	500	630(total)
Vibration Generator	Model		K080	K125A	K125LS	K200	K350
	Armature Mass (lbs)		132	177	221	441	772
	Armature Diameter (φin)		17.6	22	22	25.6	29.9
	Allowable Eccentric Moment (lbf-in)		13,700	21,700	21,700	43,400	43,400
	Dimensions (in) W × H × D		63 × 48 × 41	70 × 54 × 51	78 × 61 × 54	97 × 75 × 69	119 × 91 × 82
	Shaker Body Diameter (φin)		39	43	43	50	64
	Mass (lbs)		11,025	15,435	17,640	41,890	88,185
	Model*7		2□GH10-K080	2□GH18-K125A	2□GH20-K125LS	2□GJ24-K200	2□GH36-K350
	Maximum Output (kVA)		100	124	155	320	400
Power Amplifier	Amplifier Bay (s)		2	3	3	5	7
	Dimensions (in) W × H × D		46 × 77 × 34	69 × 77 × 34	69 × 77 × 34	114 × 77 × 34	161 × 77 × 34
	Mass (lbs)		3,310	5,730	7,275	11,020	12,015
Controller	Vibration Controller		See Vibration Controller K2				
Cooling	Cooling Method		Shaker: Water Cooling/Amp: Air Cooling				
	Required Cooling Water Flow Rate (gal/min)	Δt = 9°F	103	103*5	103*5	172*5	169*5
		Δt = 18°F	52	53*5	53*5	87*5	87*5
	Heat Exchanger	Dimensions (in) W × H × D*6	23 × 67 × 34	23 × 67 × 34	23 × 67 × 34	41 × 75 × 32	47 × 77 × 55
		Mass (lbs)	885	885	885	1,325	1,325

*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 220/480 V, 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 5.5 in/s.
*4 Breaker capacity for 480 V
*5 Bypass circuit is needed. Please contact IMV or your local distributor for further information.
*6 An export license is required for exporting a shaker system of over 11,240 lbf sine force.
*7 The alphabet of A, B, or C can be entered in □. A: Voltage AC200V system (200 to 230), B: Voltage AC400V system (380A to 440V), C: 480V system (480V to 520V)
* 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 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

Silent model suitable for abnormal noise inspection

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

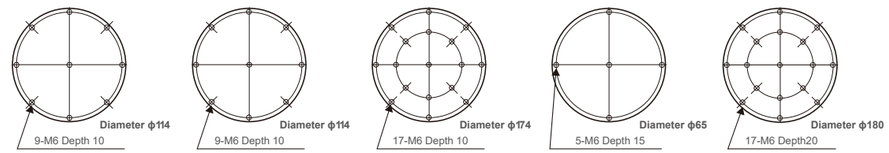
[Silent design employing a built-in cooling fan] DC-powered cooling fan is built into the shaker. Natural air-cooling is also used when the cooling fan is stopped for silent operation (with a reduction in performance).

Specifications

System Model			m030/MA1-CE	m060/MA1-CE	m120/MA1-CE	m030H/MA1	m130LS/MA1-CE
System Specifications	Frequency Range (Hz)		0 – 3,000	0 – 3,000	0 – 2,000	1,000 – 10,000	2 – 1,000
	Rated force	Sine (lbf)	67	135	270	85	292
		Random (lbf rms)	47	94	189	60	146
		Shock (lbf)	67	135	270	85	292
	Maximum Acc.	No Load (g)	51	51	51	20	13
		0.5kg Load (g)	28	35	42	16	12
		1.0kg Load (g)	19	27	36	13	11
	Maximum Velocity (in/s)		63	63	63	— *1	39
	Maximum Displacement (in-p)		1.0	1.2	1.2	— *1	2.0
	Maximum Load (lbs)		33	33	265	33	220
	Power Requirements (kVA)*2		0.4	0.7	1.1	0.5	1.1
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 (lbs)		1.3	2.7	5.3	4.2	22
	Armature Diameter (φin)		4.5	4.5	6.9	2.6	7.1
	Dimensions (in)		φ7.5 × H10	φ9 × H11	φ12.6 × H12.9*3	φ7.5 × H11	W16.1 × H23.3 × D18.1
	Mass (lbs)		49	90	245	66	550
Power Amplifier	Model		MA1-CE	MA1-CE	MA1-CE	MA1-CE	MA1-CE
	Maximum Output (kVA)		1.0	1.0	1.0	1.0	1.0
	Dimensions (in) W × H × D		17 × 6 × 17	17 × 6 × 17	17 × 6 × 17	17 × 6 × 17	17 × 6 × 17
	Mass (lbs)		55	55	55	55	55
	Cooling Method		Air cooling				
Cooling	Blower		Housed in vibration generator				

*1) The displacement at the lower limit of frequency (1,000 Hz) and maximum acceleration (20 g) 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 (W16.1 x H1.8 x D16.2 in) is standard equipment.
* The specifications show 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.

Table Insert Pattern (Unit: mm)



Accessories

A pair of carrying handles

Safely and easily carried by one or two operators.
*Removable for m030 and m060 only

Air pump

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

Option

Head expander

Model	Dimensions (in)	Mass (lbs)	Maximum frequency (Hz)	m030-CE	m060-CE	m120-CE
TBV-125-□-A	4.9 × 4.9 × t0.8	2.0	2,000	○	○	
TBV-200-□-A	7.9 × 7.9 × t0.8	5.5	1,500	○*	○	○
TBV-315-□-A	12.4 × 12.4 × t1.2	18.7	1,000		○*	○
*TBV-400-□-A	15.7 × 15.7 × t1.4	31.7	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.

Head expander

Supplementary guidance system (GDP)

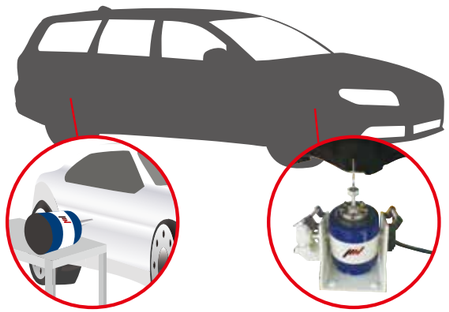
Slip table

Model	Dimensions (in)	Maximum frequency (Hz)	Mass (lbs)			
			m030-CE	m060-CE	m120-CE	m130LS-CE
TBH-200	7.9 × 7.9	500	8.8	8.8	12.1	-
TBH-315	12.4 × 12.4	500	16.5	16.5	19.8	-
TBH-400	15.7 × 15.7	500	-	27.1	30.1	-
TBH-500	19.6 × 19.6	500	-	-	-	61.1

* Slip plate material is aluminum alloy.

Slip table

Example of excitation of any selected point



Excitation at body　　Excitation at drive shaft

Modal analysis is possible by applying vibration to the car body, etc.

Emergency stop switch

It is possible to stop the system in an emergency.

Moving device

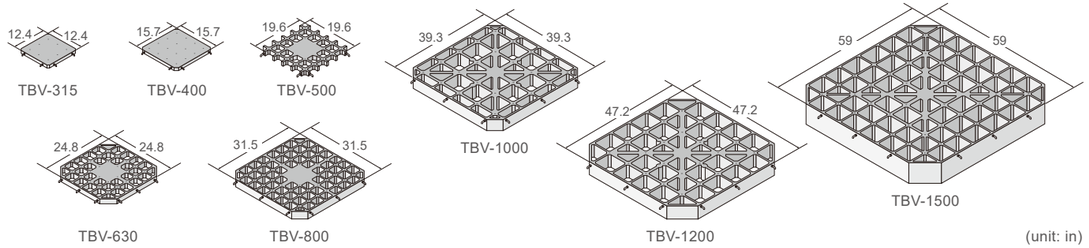
Eliminates the hassle of moving the machine and enables tests to be performed in any available space.

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 the 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.



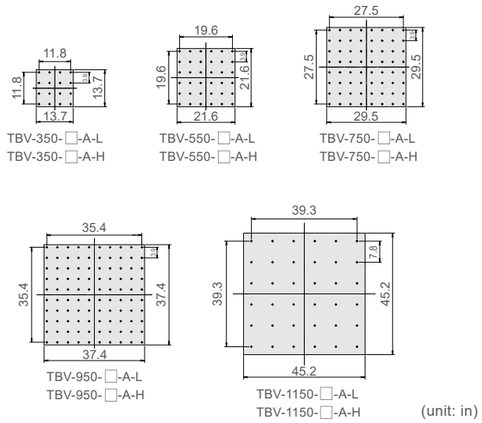
(unit: in)

Model	Dimensions (in)	Mass (lbs)	Maximum frequency (Hz)	A-series						i-series	
				A11	A22	A30	A45	A65	A74	i210	i220
TBV-125-□-A	4.9 × 4.9 t 0.8	1.9	2,000	—	—	—	—	—	—	○	—
TBV-125-□-M		1.3		—	—	—	—	—	—	○	—
TBV-315-□-A	12.4 × 12.4 t 1.2	18.7	1,000	○	○	○	—	—	—	○	○
TBV-315-□-M		12.8		○	○	○	—	—	—	○	○
TBV-400-□-A	15.7 × 15.7 t 1.2	28.6	600	○	○	○	—	—	—	○	○
TBV-400-□-M		19.8		○	○	○	—	—	—	○	○
TBV-500-□-A	19.6 × 19.6 t 1.6	33	500	○	○	○	○	○	○	○	○
TBV-500-□-M		22.9		○	○	○	○	○	○	○	○
TBV-630-□-A	24.8 × 24.8 t 1.8	41.9	360	○	○	○	○	○	○	○	○
TBV-630-□-M		27.5		○	○	○	○	○	○	○	○
TBV-800-□-A	31.5 × 31.5 t 2.8	99.2	350	○	○	○	○	○	○	—	○
TBV-800-□-M		66.1		○	○	○	○	○	○	—	○
TBV-1000-□ -A	39.3 × 39.3 t 4.3	242.5	350	○	○	○	○	○	○	—	—
TBV-1000-□ -M		171.9		○	○	○	○	○	○	—	—
TBV-1200-□ -A	47.2 × 47.2 t 4.9	396.8	200	—	○	○	○	○	○	—	—
TBV-1500-□ -A	59 × 59 t 7.9	661.3	200	—	—	—	○	○	○	—	—

Model	Dimensions (in)	Mass (lbs)	Maximum frequency (Hz)	J-series				K-series						
				J230	J240	J250	J260	K030	K060	K080	K125	K125LS	K200	K350
TBV-125-□-A	4.9 × 4.9 t 0.8	1.9	2,000	—	—	—	—	—	—	—	—	—	—	—
TBV-125-□-M		1.3		—	—	—	—	—	—	—	—	—	—	—
TBV-315-□-A	12.4 × 12.4 t 1.2	18.7	1,000	○	○	—	—	—	—	—	—	—	—	—
TBV-315-□-M		12.8		○	○	—	—	—	—	—	—	—	—	—
TBV-400-□-A	15.7 × 15.7 t 1.2	28.6	600	○	○	—	—	○	—	—	—	—	—	—
TBV-400-□-M		19.8		○	○	—	—	○	—	—	—	—	—	—
TBV-500-□-A	19.6 × 19.6 t 1.6	33	500	○	○	○	○	○	○	○	—	—	—	—
TBV-500-□-M		22.9		○	○	○	○	○	○	○	—	—	—	—
TBV-630-□-A	24.8 × 24.8 t 1.8	41.9	360	○	○	○	○	○	○	○	○	○	—	—
TBV-630-□-M		27.5		○	○	○	○	○	○	○	○	○	—	—
TBV-800-□-A	31.5 × 31.5 t 2.8	99.2	350	○	○	○	○	○	○	○	○	○	○	○
TBV-800-□-M		66.1		○	○	○	○	○	○	○	○	○	○	○
TBV-1000-□-A	39.3 × 39.3 t 4.3	242.5	350	○	○	○	○	○	○	○	○	○	○	○
TBV-1000-□-M		171.9		○	○	○	○	○	○	○	○	○	○	○
TBV-1200-□-A	47.2 × 47.2 t 4.9	396.8	200	—	○	○	○	○	○	○	○	○	○	○
TBV-1500-□-A	59 × 59 t 7.9	661.3	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-expanders (flat-surface model)



(unit: in)

Model	Dimensions (in)	Mass (lbs)	Maximum frequency (Hz)	Specimen mounting screw	Screw pitch
TBV-350-□-A-L	13.7 × 13.7 × t 33	13.2	750	M10 Depth25	□ 3.9 in Pitch
TBV-350-□-A-H	13.7 × 13.7 × t 65	24.2	1,500	M10 Depth25	□ 3.9 in Pitch
TBV-550-□-A-L	21.6 × 21.6 × t 30	37.4	300	M10 Depth25	□ 3.9 in Pitch
TBV-550-□-A-H	21.6 × 21.6 × t 60	66.1	600	M10 Depth25	□ 3.9 in Pitch
TBV-750-□-A-L	29.5 × 29.5 × t 38	66.1	200	M10 Depth25	□ 3.9 in Pitch
TBV-750-□-A-H	29.5 × 29.5 × t 75	121.2	400	M10 Depth25	□ 3.9 in Pitch
TBV-950-□-A-L	37.4 × 37.4 × t 45	99.2	150	M10 Depth25	□ 3.9 in Pitch
TBV-950-□-A-H	37.4 × 37.4 × t 90	176.3	300	M10 Depth25	□ 3.9 in Pitch
TBV-1150-□-A-L	45.2 × 45.2 × t 60	198.4	120	M10 Depth25	□ 7.8 in Pitch
TBV-1150-□-A-H	45.2 × 45.2 × t 120	352.7	240	M10 Depth25	□ 7.8 in Pitch

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

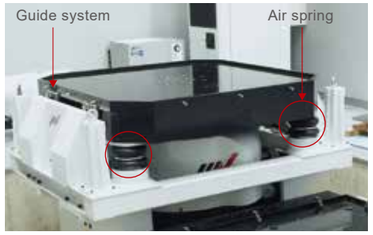
Options for use with vertical tables

Guide system, additional air spring

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

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

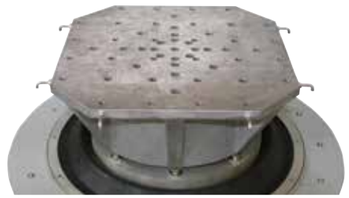
*Some models do not support the options above



Vibration generator

High-frequency model

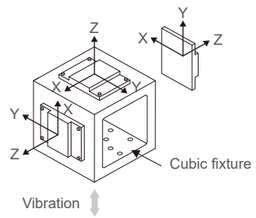
A head-expander with exceptionally low mass and special dual conical shape, providing excellent damping.



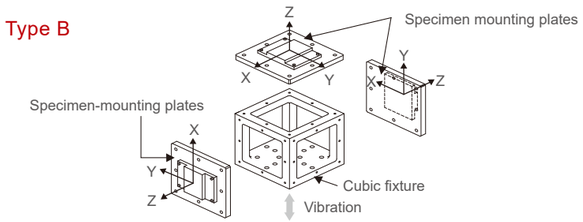
Cubic fixture

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)			
Model	Dimensions (in)	Mass (lbs)	Maximum frequency (Hz)
TCJ-A150-□-A	5.9 × 5.9 × 5.9	12.1	2,000
TCJ-A150-□-M		8.8	
TCJ-A160-□-A	6.2 × 6.2 × 6.2	14.3	2,000
TCJ-A160-□-M		4.6	
TCJ-A200-□-A	7.8 × 7.8 × 7.8	10.1	1,000
TCJ-A200-□-M		12.3	
TCJ-A250-□-A	9.8 × 9.8 × 9.8	29.7	650
TCJ-A250-□-M		20.9	
TCJ-A300-□-A	11.8 × 11.8 × 11.8	44	400
TCJ-A300-□-M		30.8	

Cubic fixture (Type B)				specimen mounting plates	
Model	Dimensions (in)	Mass (lbs)	Maximum frequency (Hz)	Model	Mass (lbs)
TCJ-B150-□-A	5.9 × 5.9 × 5.9	7.7	2,000	TCJ-B150-P-A	3.3
TCJ-B150-□-M		5.5		TCJ-B150-P-M	2.4
TCJ-B160-□-A	6.2 × 6.2 × 6.2	8.8	2,000	TCJ-B160-P-A	3.7
TCJ-B160-□-M		6.1		TCJ-B160-P-M	2.8
TCJ-B200-□-A	7.8 × 7.8 × 7.8	22	2,000	TCJ-B200-P-A	7.7
TCJ-B200-□-M		15.4		TCJ-B200-P-M	5.5
TCJ-B250-□-A	9.8 × 9.8 × 9.8	44	1,000	TCJ-B250-P-A	9.9
TCJ-B250-□-M		30.8		TCJ-B250-P-M	7
TCJ-B300-□-A	11.8 × 11.8 × 11.8	44	600	TCJ-B300-P-A	14.3
TCJ-B300-□-M		30.8		TCJ-B300-P-M	9.9

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

Optional Units

Slip table

Slip table

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



Type and features of slip table

MB: Mechanical Bearing

The mechanical bearing employs a linear motion guide which utilizes a component with a linear rolling motion. It significantly contributes to the high performance of tables which have high rigidity and high load and have long stroke motion. Another strong feature of the mechanical bearing is its easy operability, since it is lightweight and has no need for a hydraulic unit.

Model	TBH-550-□-A-MB		
Table Size (in)	21.6 × 21.6		
Moment (lbf·in)	82,311		
Maximum Load (lbs)	2,204		
Vibration Generator	Moving Mass*(lbs)	Frequency (Hz)	Thickness (in)
A11	101	2,000	1.2
A22	104		

Model	TBH-550-□-A-MB			TBH-750-□-A-MB			TBH-950-□-A-MB			TBH-1150-□-A-MB		
Table Size (in)	21.6 × 21.6			29.5 × 29.5			37.4 × 37.4			45.2 × 45.2		
Moment (lbf·in)	82,311			112,404			174,359			455,813		
Maximum Load (lbs)	2,204			4,409			4,409			4,409		
Vibration Generator	Moving Mass*(lbs)	Frequency (Hz)	Thickness (in)	Moving Mass*(lbs)	Frequency (Hz)	Thickness (in)	Moving Mass*(lbs)	Frequency (Hz)	Thickness (in)	Moving Mass*(lbs)	Frequency (Hz)	Thickness (in)
A30	104	2,000	1.2	165	2,000	1.2	233	2,000	1.2	332	2,000	1.5
A45	119			191			251			352		
A65/A74		2,000*1			2,000*1			2,000*1			2,000*1	

*1 Above 1,600 Hz, the force rolls-off at a rate of -6db/oct. *The weight applies to a plate made of aluminum. *□ is the model number of the vibration generator.
*Please contact us about table sizes over 45.2 × 51.

ST: Oil Film Type

This version is supported by an oil film. It creates a constant oil film at the opposite side of the table, letting the table slide with low friction. The oil pump unit is located in the slip table base. Since the amount of moving mass is small, it has become one of the most well-known slip tables in the industry and has a substantial sales record.

Model	TBH-500-□-A-ST			TBH-630-□-A-ST			TBH-800-□-A-ST			TBH-1000-□-A-ST		
Table Size (in)	19.6 × 19.6			24.8 × 24.8			31.5 × 31.5			39.3 × 39.3		
Moment (lbf·in)	1,770			3,540			7,080			11,505		
Maximum Load (lbs)	441			661			882			1,102		
Vibration Generator	Moving Mass*(lbs)	Frequency (Hz)	Thickness (in)	Moving Mass*(lbs)	Frequency (Hz)	Thickness (in)	Moving Mass*(lbs)	Frequency (Hz)	Thickness (in)	Moving Mass*(lbs)	Frequency (Hz)	Thickness (in)
i210	73	2,500	1.2	99	2,000	1.2	—	—	—	—	—	—
i220							143	2,000	1.2	220	1,250	1.2
K030		2,000										
K060	132		1.9	176		1.9	254		1.9	375		1.9
K080	—	—	—									

*The weight applies to a plate made of aluminum.
*□ is the model number of the vibration generator.

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

Features multiple hydrostatic bearings on a high, rigid base to support the slip table. The hydrostatic bearings are uniquely designed to support a high load and high 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. Moreover, the structure does not require elastic rubber to connect the 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 (in)	19.6 × 19.6			24.8 × 24.8			31.5 × 31.5			39.3 × 39.3			47.2 × 47.2			59 × 59			70.8 × 70.8			78.7 × 78.7		
Moment (lbf·in)	9,735			9,735			19,471			19,471			40,713			57,530			88,507			88,507		
Maximum Load (lbs)	1,543			2,204			2,204			3,307			4,409			4,409			5,501			5,501		
Vibration Generator	Moving Mass*(lbs)	Frequency (Hz)	Thickness (in)	Moving Mass*(lbs)	Frequency (Hz)	Thickness (in)	Moving Mass*(lbs)	Frequency (Hz)	Thickness (in)	Moving Mass*(lbs)	Frequency (Hz)	Thickness (in)	Moving Mass*(lbs)	Frequency (Hz)	Thickness (in)	Moving Mass*(lbs)	Frequency (Hz)	Thickness (in)	Moving Mass*(lbs)	Frequency (Hz)	Thickness (in)	Moving Mass*(lbs)	Frequency (Hz)	Thickness (in)
i210	88	2,000	1.2	117	2,000	1.2	165	1,600	1.2	231	1,000	1.2	617	900	1.9	992	800	1.9	1,433	600	1.9	1,764	500	1.9
i220	95			121			172			238														
J230	110	1,600		139	1,600		187	1,250		260														
J240																								
J250	154		1.5	187		1.5	253		1.5	342		1.5												
J260																								

Model	TBH-550-□-A-TTL			TBH-750-□-A-TTL			TBH-950-□-A-TTL		
Table Size (in)	21.6 × 21.6			29.5 × 29.5			37.4 × 37.4		
Moment (lbf·in)	9,735			19,471			19,471		
Maximum Load (lbs)	2,204			3,306			3,306		
Vibration Generator	Moving Mass*(lbs)	Frequency (Hz)	Thickness (in)	Moving Mass*(lbs)	Frequency (Hz)	Thickness (in)	Moving Mass*(lbs)	Frequency (Hz)	Thickness (in)
A11	114	2,000	1.2	-	-	-	-	-	-
A22	116			171	1,600	1.2	231	1,000	1.2
A30									
A45	141			196			253		
A65/A74		2,000*							

*The weight applies to a plate made of aluminum. *Above 1600 Hz, the force rolls-off at a rate of -6db/oct. *□ is the model number of the vibration generator. *Please contact us for more information.

TT-H: Hydrostatic Bearing (High Pressure)

Model	TBH-500-□-A-TTH			TBH-630-□-A-TTH			TBH-800-□-A-TTH			TBH-1000-□-A-TTH			TBH-1200-□-A-TTH			TBH-1500-□-A-TTH			TBH-1800-□-A-TTH			TBH-2000-□-A-TTH		
Table Size (in)	19.6 × 19.6			24.8 × 24.8			31.5 × 31.5			39.3 × 39.3			47.2 × 47.2			59 × 59			70.8 × 70.8			78.7 × 78.7		
Moment (lbf·in)	35,403			35,403			68,151			68,151			141,612			194,716			424,836			424,836		
Maximum Load (lbs)	1,764			2,645			3,527			4,409			4,409			4,409			6,614			6,614		
Vibration Generator	Moving Mass*(lbs)	Frequency (Hz)	Thickness (in)	Moving Mass*(lbs)	Frequency (Hz)	Thickness (in)	Moving Mass*(lbs)	Frequency (Hz)	Thickness (in)	Moving Mass*(lbs)	Frequency (Hz)	Thickness (in)	Moving Mass*(lbs)	Frequency (Hz)	Thickness (in)	Moving Mass*(lbs)	Frequency (Hz)	Thickness (in)	Moving Mass*(lbs)	Frequency (Hz)	Thickness (in)	Moving Mass*(lbs)	Frequency (Hz)	Thickness (in)
i210	132	2,000	1.9	154	2,000	1.9	253	2,000	1.9	364	1,250	1.9	617	900	1.9	992	800	1.9	1,433	600	1.9	1,764	500	1.9
i220	139			183			260			370														
J230	150	1,600		194	1,600		275	1,250		386	1,000													
J240	154			198			287			392														
J250	183			220			315			414														
J260																								
K030	150	2,000		194	2,000		271	2,000		381	1,250													
K060	205			238			320			425														
K080	172			209			293			397														
K125A	227			260			342			452														
K125LS	249	1,600		282	1,600		375	1,250		485	1,000													

Model	TBH-550-□-A-TTH			TBH-750-□-A-TTH			TBH-950-□-A-TTH		
Table Size (in)	21.6 × 21.6			29.5 × 29.5			37.4 × 37.4		
Moment (lbf·in)	35,403			68,151			68,151		
Maximum Load (lbs)	2,645			4,850			4,850		
Vibration Generator	Moving Mass*(lbs)	Frequency (Hz)	Thickness (in)	Moving Mass*(lbs)	Frequency (Hz)	Thickness (in)	Moving Mass*(lbs)	Frequency (Hz)	Thickness (in)
A11	114	2,000	1.2	-	-	-	-	-	-
A22	116			171	1,600	1.2	231	1,000	1.2
A30									
A45	145			196			253		
A65/A74		2,000*							

*The weight applies to a plate made of aluminum. *Above 1600 Hz, the force rolls-off at a rate of -6db/oct. *□ is the model number of the vibration generator. *Please contact us for more information.

Optional Units

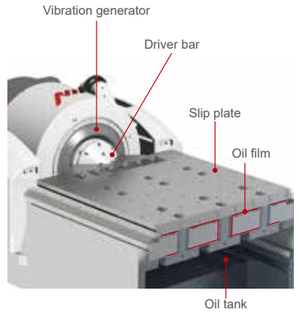
Slip table

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

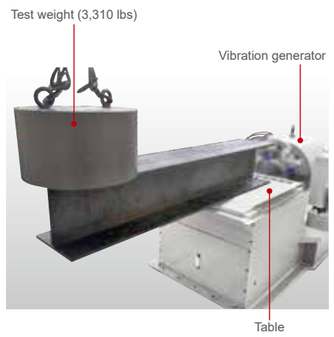
Slip table for A-series provides the following features with a newly developed hydrostatic and hydraulic bearing and new structure.

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 (in)	21.6 × 21.6		29.5 × 29.5		37.4 × 37.4		45.2 × 45.2		57 × 57	
Table Thickness (in)	1.9		1.9		1.9		1.9		1.9	
Pitch Moment (lbf·in)	53,104		584,149		752,313		752,313		1,752,447	
Maximum Load (lbs)	3,306		19,841		19,841		19,841		19,841	
Vibration Generator	Moving Mass* (lbs)	Frequency (Hz)	Moving Mass* (lbs)	Frequency (Hz)	Moving Mass* (lbs)	Frequency (Hz)	Moving Mass* (lbs)	Frequency (Hz)	Moving Mass* (lbs)	Frequency (Hz)
A11	187	2,000	350	2,000	473	1,250	656	800	996	500
A22										
A30										
A45	—	—	396		520		701		1,042	
A65										
A74										

*The slip plate material is aluminum alloy. It can be changed to magnesium. Please contact us for more information.

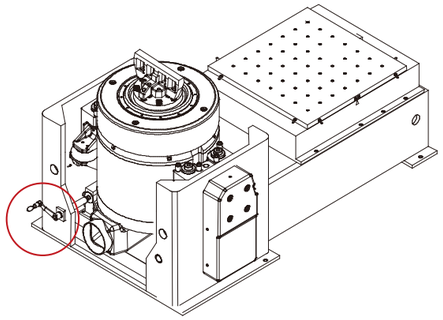
T-Film bearing range

The T-Film bearing from Team Corporation is probably the most advanced design of linear bearing available in the vibration test industry. The slip table employs a number of bearings, each consisting of a U.S.-patented bearing element and hydrostatic 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.

Slip table options

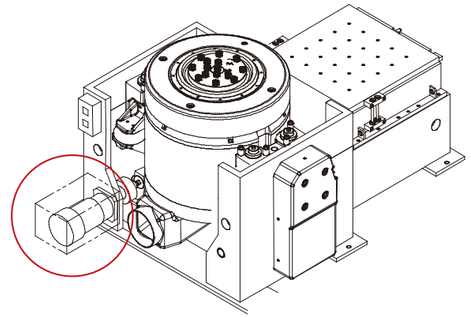
Rotation-reduction gearing

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



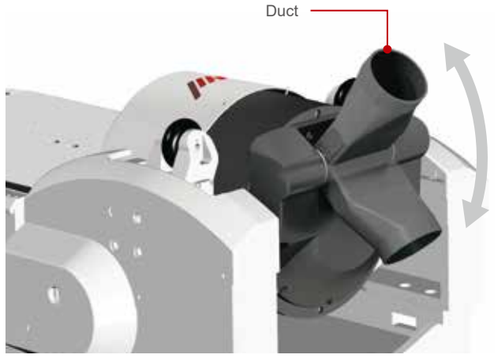
Motor drive rotation

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



Duct

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



Drive bar adapter with diagonal bolt access

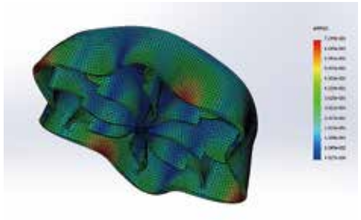
The method of fastening a drive bar to a slip table was simplified in response to customer feedback. Usability has been improved and torque adjustment for bolts made easier.
*Standard for MB/MS

Optional Units

Fixture, Vibration Isolation, Reinforcement

Fixture

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

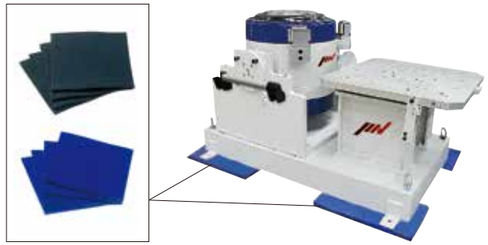


Vibration Isolation

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

Insulation pad

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



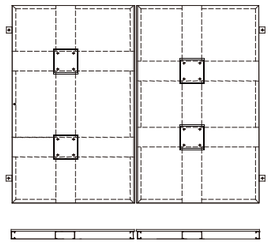
Air spring

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

Reinforcement

Load-spreader base

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



Optional Units

Soundproof enclosure, cooling ducting, flexible duct

Soundproof enclosure

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

inside

Cooling ducting

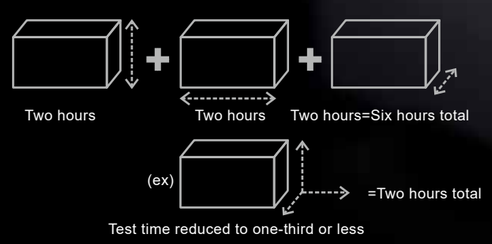
The standard arrangement for air-cooled systems is to install the blower outside the work area.
Ducting the input air from outside eliminates the changes in ambient pressure and temperature caused by the cooling air flow.

Vibration Test Systems

Multi-axis systems

Reduced test time

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



Reproduction of failure modes

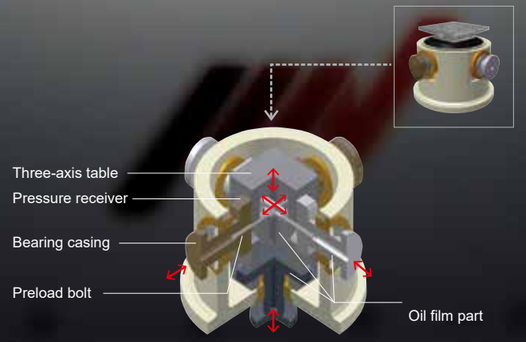
Three-axis simultaneous vibration testing reproduces real environments more accurately than sequential single-axis tests can.

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.

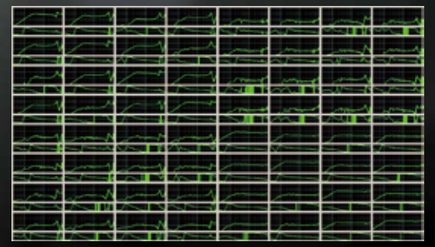
ICCU (Integrated Cross-Coupling Bearing Unit)

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 (in)		□15.7	□23.6	□31.5	□39.3	□19.6	□31.5	□39.3	□ 59	□19.6	□31.5
	Rated Force	Sine (lbf)	2,200	2,200	2,200	2,200	4,400	4,400	4,400	4,400	6,600	6,600
		Random (lbf)	1,100	1,100	1,100	1,100	2,200	2,200	2,200	2,200	3,300	3,300
		Shock (lbf)	3,300	3,300	3,300	3,300	6,600	6,600	6,600	6,600	9,900	9,900
	Maximum Acceleration (g)		11.0	7.6	5.5	3.3	15.3	8.3	6.8	2.9	20.0	14.2
	Maximum Velocity (in/s)		39.4	39.4	39.4	39.4	39.4	39.4	39.4	35.4	39.4	39.4
	Maximum Displacement (inp-p)		2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0
	Armature Mass (lbs)		200	290	400	660	290	530	640	1,500	330	460
	Maximum Frequency	Horizontal (Hz)	1,000	800	700	350	800	500	350	250	800	500
		Vertical (Hz)	1,000	1,000	700	500	800	800	500	350	800	800
	Maximum Load (lbs)		220	220	440	440	440	660	1,100	1,100	440	660
	Power Requirements (kVA)		25	25	25	25	43	43	43	43	52	52
	Primary Cooling Water (gal/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 (in)		□39.3	□ 59	□23.6	□31.5	□39.3	□ 59	□23.6	□31.5	□39.3	□ 59
	Rated Force	Sine (lbf)	6,600	6,600	11,000	11,000	11,000	11,000	13,870	13,870	13,870	13,870
		Random (lbf)	3,300	3,300	6,600	6,600	5,500	5,500	8,300	8,300	6,900	6,900
		Shock (lbf)	9,900	9,900	16,500	16,500	13,200	13,200	20,800	20,800	16,600	16,600
	Maximum Acceleration (g)		9.3	4.8	35.7	20.8	16.6	6.0	39.3	27.3	10.4	7.6
	Maximum Velocity (in/s)		39.4	35.4	39.4	39.4	35.4	35.4	39.4	39.4	35.4	35.4
	Maximum Displacement (inp-p)		2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0
	Armature Mass (lbs)		700	1,370	310	530	660	1,810	350	510	1,320	1,810
	Maximum Frequency	Horizontal (Hz)	350	250	800	700	350	250	800	700	350	250
		Vertical(Hz)	500	350	1,000	800	500	350	1,000	800	500	350
	Maximum Load (lbs)		1,100	1,100	660	660	1,100	1,540	660	300	1,100	1,540
	Power Requirements (kVA)		52	52	75	75	73	73	93	93	91	91
	Primary Cooling Water (gal/min)		–	–	52	52	50	50	61	61	59	59

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

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 (in)		□15.7	□23.6	□31.5	□39.3	□19.6	□31.5	□39.3	□ 59	□19.6	□31.5
	Rated Force	Sine (lbf)	2,200	2,200	2,200	2,200	4,400	4,400	4,400	4,400	6,600	6,600
		Random (lbf)	1,100	1,100	1,100	1,100	2,200	2,200	2,200	2,200	3,300	3,300
		Shock (lbf)	3,300	3,300	3,300	3,300	6,600	6,600	6,600	6,600	9,900	9,900
	Maximum Acceleration (g)		10.0	6.6	4.3	3.4	16.6	10.0	6.6	3.1	20.0	11.5
	Maximum Velocity (in/s)		39.4	39.4	39.4	39.4	39.4	39.4	39.4	35.4	39.4	39.4
	Maximum Displacement (inp-p)		2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0
	Armature Mass (lbs)		220	330	510	640	270	440	660	1410	330	570
	Maximum Frequency	Horizontal (Hz)	1,000	800	700	350	800	500	350	250	800	500
		Vertical (Hz)	1,000	1,000	700	500	800	800	500	350	800	800
	Maximum Load (lbs)		220	220	440	440	440	660	1,100	1,100	440	660
	Power Requirements (kVA)		27	27	27	27	43	43	43	43	52	52
	Primary Cooling Water (gal/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 (in)		□39.3	□ 59	□23.6	□31.5	□39.3	□ 59	□23.6	□31.5	□39.3	□ 59
	Rated Force	Sine (lbf)	6,600	6,600	11,000	11,000	11,000	11,000	13,870	13,870	13,870	13,870
		Random (lbf)	3,300	3,300	6,600	6,600	5,500	5,500	8,300	8,300	6,900	6,900
		Shock (lbf)	9,900	9,900	16,500	16,500	13,200	13,200	20,800	20,800	16,600	16,600
	Maximum Acceleration (g)		7.4	4.4	31.2	22.6	16.1	6.8	34.9	26.2	20.2	8.6
	Maximum Velocity (in/s)		39.4	35.4	39.4	39.4	35.4	35.4	39.4	39.4	35.4	35.4
	Maximum Displacement (inp-p)		2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0
	Armature Mass (lbs)		880	1,500	350	485	680	1,610	400	530	680	1,610
	Maximum Frequency	Horizontal (Hz)	350	250	800	700	350	250	800	700	350	250
		Vertical (Hz)	500	350	1,000	800	500	350	1,000	800	500	350
	Maximum Load (lbs)		1,100	1,100	660	660	1,100	1,540	660	660	1,100	1,540
	Power Requirements (kVA)		52	52	77	77	75	75	93	93	91	91
	Primary Cooling Water (gal/min)		–	–	52	52	50	50	61	61	59	59

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

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 (in)	□15.7	□23.6	□31.5	□39.3	□500	□31.5	□39.3	□59	□19.6	□31.5
	Rated Force Sine (lbf)	2,200	2,200	2,200	2,200	4,400	4,400	4,400	4,400	6,600	6,600
	Rated Force Random (lbf)	1,100	1,100	1,100	1,100	2,200	2,200	2,200	2,200	3,300	3,300
	Rated Force Shock (lbf)	3,300	3,300	3,300	3,300	6,600	6,600	6,600	6,600	9,900	9,900
	Maximum Acceleration (g)	11	7.6	5.5	3.3	15.3	8.3	6.8	2.9	20.0	14.2
	Maximum Velocity (in/s)	39.4	39.4	39.4	39.4	39.4	39.4	39.4	35.4	39.4	39.4
	Maximum Displacement (inp-p)	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0
	Armature Mass (lbs)	200	290	400	660	290	530	640	1,500	330	460
	Maximum Frequency Horizontal (Hz)	1,000	800	700	350	800	500	350	250	800	500
	Maximum Frequency Vertical (Hz)	1,000	1,000	700	500	800	800	500	350	800	800
	Maximum Load (lbs)	220	220	440	440	440	660	1,100	1,100	220	660
	Power Requirements (kVA)	30	30	30	30	66	66	66	66	76	76
	Primary Cooling Water (gal/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 (in)	□39.3	□59	□23.6	□31.5	□39.3	□59	□23.6	□31.5	□39.3	□59
	Rated Force Sine (lbf)	6,600	6,600	11,000	11,000	11,000	11,000	13,870	13,870	13,870	13,870
	Rated Force Random (lbf)	3,300	3,300	6,600	6,600	5,500	5,500	8,300	8,300	6,900	6,900
	Rated Force Shock (lbf)	9,900	9,900	16,500	16,500	13,200	13,200	20,800	20,800	16,600	16,600
	Maximum Acceleration (g)	9.3	4.8	35.7	20.8	16.6	6.0	39.3	27.3	10.4	7.6
	Maximum Velocity (in/s)	39.4	35.4	39.4	39.4	35.4	35.4	39.4	39.4	35.4	35.4
	Maximum Displacement (inp-p)	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0
	Armature Mass (lbs)	700	1,370	310	530	660	1,810	350	510	1,320	1,810
	Maximum Frequency Horizontal (Hz)	350	250	800	700	350	250	800	700	350	250
	Maximum Frequency Vertical (Hz)	500	350	1,000	800	500	350	1,000	800	500	350
	Maximum Load (lbs)	1,100	1,100	660	660	1,100	1,540	660	660	1,100	1,540
	Power Requirements (kVA)	76	76	104	104	106	106	126	126	128	128
	Primary Cooling Water (gal/min)	–	–	98	98	95	95	116	116	110	110

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

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 (in)	□15.7	□23.6	□31.5	□39.3	□19.6	□31.5	□39.3	□59	□19.6	□31.5
	Rated Force Sine (lbf)	2,200	2,200	2,200	2,200	4,410	4,400	4,400	4,400	6,600	6,600
	Rated Force Random (lbf)	1,100	1,100	1,100	1,100	2,200	2,200	2,200	2,200	3,300	3,300
	Rated Force Shock (lbf)	3,300	3,300	3,300	3,300	6,600	6,600	6,600	6,600	9,960	9,960
	Maximum Acceleration (g)	10.0	6.6	4.3	3.4	16.6	10.0	6.6	3.1	20.0	11.5
	Maximum Velocity (in/s)	39.4	39.4	39.4	39.4	39.4	39.4	39.4	35.4	39.4	39.4
	Maximum Displacement (inp-p)	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0
	Armature Mass (lbs)	220	330	510	640	270	440	660	1,410	330	570
	Maximum Frequency Horizontal (Hz)	1,000	800	700	350	800	500	350	250	800	500
	Maximum Frequency Vertical (Hz)	1,000	1,000	700	500	800	800	500	350	800	800
	Maximum Load (lbs)	220	220	440	440	440	660	1,100	1,100	440	660
	Power Requirements (kVA)	41	41	41	41	94	94	94	94	110	110
	Primary Cooling Water (gal/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 (in)	□39.3	□59	□23.6	□31.5	□39.3	□59	□23.6	□31.5	□39.3	□59
	Rated Force Sine (lbf)	6,600	6,600	11,000	11,000	11,000	11,000	13,870	13,870	13,870	13,870
	Rated Force Random (lbf)	3,300	3,300	6,600	6,600	5,500	5,500	8,300	8,300	6,900	6,900
	Rated Force Shock (lbf)	9,960	9,960	16,500	16,500	13,200	13,200	20,800	20,800	16,60 0	16,600
	Maximum Acceleration (g)	7.4	4.4	31.2	22.6	16.1	6.8	34.9	26.5	20.2	8.6
	Maximum Velocity (in/s)	39.4	35.4	39.4	39.4	35.4	35.4	39.4	39.4	35.4	35.4
	Maximum Displacement (inp-p)	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0
	Armature Mass (lbs)	880	1,500	350	485	680	1,610	400	530	680	1,610
	Maximum Frequency Horizontal (Hz)	350	250	800	700	350	250	800	700	350	250
	Maximum Frequency Vertical (Hz)	500	350	1,000	800	500	350	1,000	800	500	350
	Maximum Load (lbs)	1,100	1,100	660	660	1,100	1,540	660	660	1,100	1,540
	Power Requirements (kVA)	110	110	149	149	153	153	182	182	182	186
	Primary Cooling Water (gal/min)	–	–	145	145	140	140	170	170	170	170

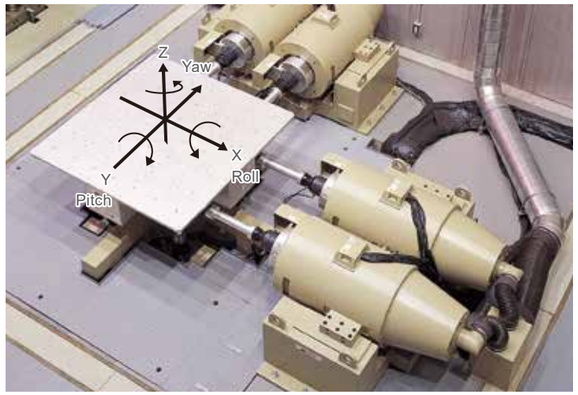
*Depending on the reference PSD or other conditions such as the characteristics of the specimen, one part of the controlled response may deviate from the reference PSD.
*The above is just an example. Specifications may be changed depending on test conditions. Please contact us for more information.

TTS-series

6 Degrees of Freedom Systems

6 degrees of freedom systems

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



Ride comfort evaluation system

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

Excitation direction	X axis	Y axis	Z axis
Rated Force (lbf)	877	1,754	3,597
Maximum displacement (inp-p)	5.9	4.0	4.0
Frequency Range (Hz)	1 - 100		
Table Size (in)	71 × 71		
Vibration Generator	1	2	4

(Per 1 system)

Watch the YouTube video

Large-scale 6 DOF vibration test system

A total of 10 vibration generators (6 vertical and 4 horizontal) and a large size 157- by 138-inch table allow 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 (lbf)	17,985	10,791	21,582
Maximum displacement (inp-p)	2.0		
Frequency Range (Hz)	2 - 150		
Table Size (in)	157 × 138		
Vibration Generator	2	2	6

(Per 1 system)

6 DOF simultaneous squeak and rattle test system for vehicle seats

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

Excitation direction	X axis	Y axis	Z axis
Rated Force (N)	360	360	719
Maximum displacement (inp-p)	1.2		
Frequency Range (Hz)	5 - 100		
Table Size (in)	59 × 138		
Vibration Generator	2	2	4

(Per 1 system)

Vibration Controller K2+

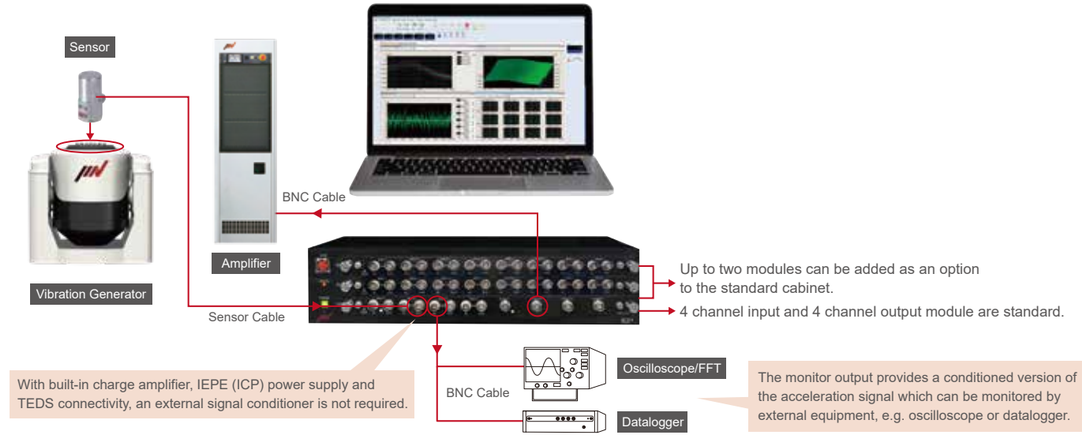
Common hardware supports all types of vibration tests.

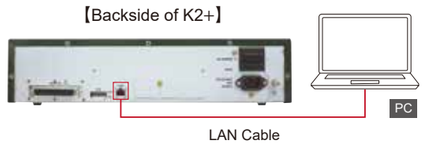
The K2+ controller provides the precision and repeatability required to test with confidence during both product development and series production. The K2+ hardware and software has been developed in-house, giving IMV full design control of this important part of a vibration system.

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 Specifications

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

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

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

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

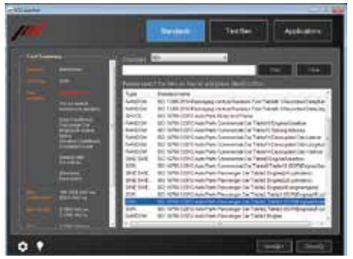
		4-channel Input and 4-channel Output Module (standard)		8-channel Input Module (option)
Input Section	Number of Channels	4		8
	Input Connector	BNC		
	Input Signal	Charge, Voltage, IEPE		
	Charge Amplifier Sensitivity	1.0 mV/pC or 10 mV/pC		
	Charge Amplifier Cut-off	0.32 Hz		
	Maximum Input	Charge Input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

Intuitive Operation

Launcher

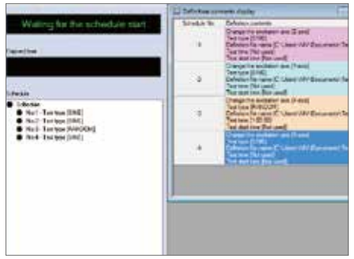
Easily-recognised icons are used for file management.

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



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

Scheduler



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

Optional Test Standards

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

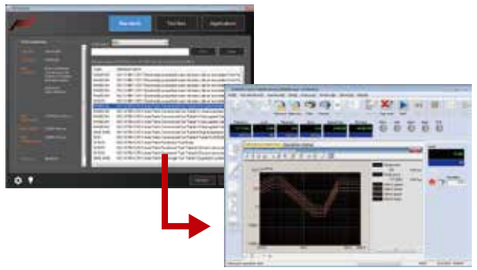
JIS C 60068	Sine, Random, Shock
JIS D 1601	Automotive parts simulated long-life test
JIS E 4031	Railway vehicle parts functional test, Simulated long-life test
JIS Z 0200	Transportation test
JIS Z 0232	Transportation test（Random）
JASO D 014	Automotive parts functional test
ASTM	Transportation test
UN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

*Version upgrade will incur an additional cost.

Option

LAUNCHER

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



Built-in "Quick Help" provides guidance for each operation.

SYSTEM MONITOR

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

Home screen

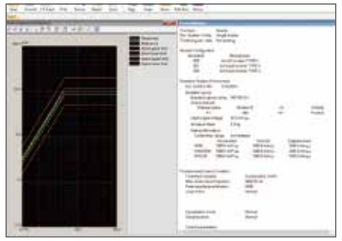
Home screen (error)

Eco screen

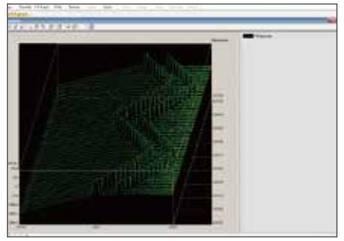
Camera screen

K2 DataViewer Free software

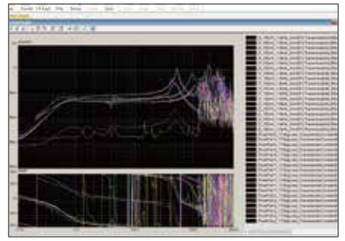
Software for displaying results in data files saved after SINE, RANDOM and SHOCK tests. It can be used for display of test conditions, graphed results, or for comparison between past test data (overlapping display) and generation of reports.



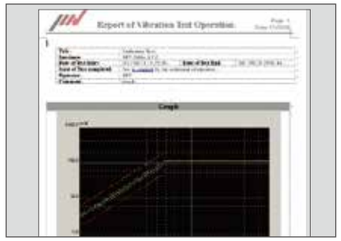
Test conditions, graph of results



3D graph



Overlapping display



Report

System Requirements

[Supported OS]

Windows 10（64 bit）, Windows 7（32 bit/64 bit）

[Memory]

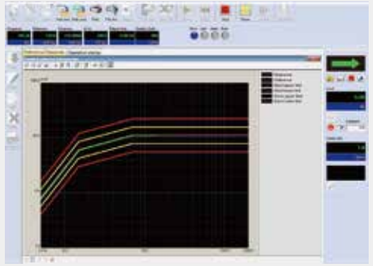
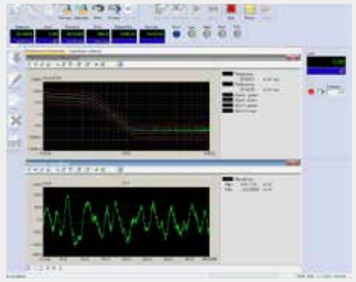
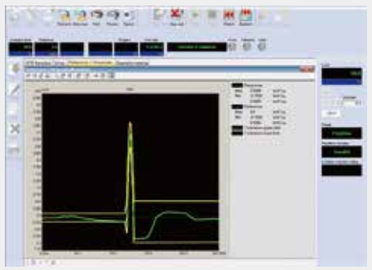
More than 512 MB of RAM is recommended

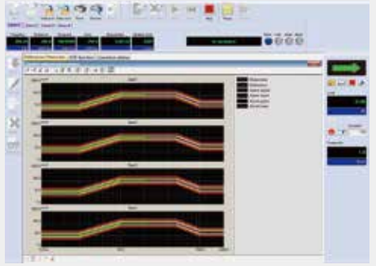
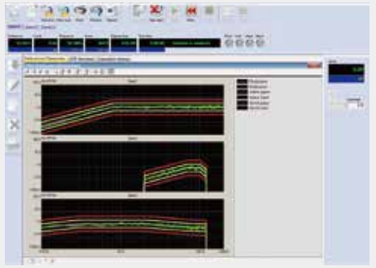
[Hard Disk]

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 120 dB • **Operation Modes** 1) Continuous sweep, Spot, Manual 2) Closed-loop, Open-loop • **Measurement Method** Average, RMS, Tracking • **Multiple-Channel Control Modes** Average control, Maximum control, Minimum control • **Input Channels** Maximum 20 *Specifications may be affected by other conditions	• **R_DWELL: Resonance Dwell** Resonance is detected by measuring the phase difference between the control point and the response signal from a resonant part of the item under test. The test frequency is controlled in order to maintain resonance as the structure fatigues. After holding at the same resonance for a pre-defined duration, sweeping can be resumed until the next resonance is detected. • **A_DWELL: Amplitude Dwell** A transmissibility plot is taken from two points on the structure under test and resonances listed. A sine test can then be run at each resonant frequency, with tracking of the resonance by either amplitude or phase. • **LIMIT CONTROL** Response channels can be specified as limit control channels. If the level on a limit control channel would exceed its limit, the test level is reduced accordingly. • **Multi Sweep Sine** A traditional wide-band sine sweep is divided into several narrower-band sine sweeps, which when added together combine to cover the original wide band. Running the narrow band sweeps in parallel significantly reduces the test time required.
RANDOM 	• **Control Algorithm** Closed-loop control of PSD within each spectral line • **Control Frequency Range** Maximum 20000 Hz • **Number of Control Lines** Maximum 25600 lines • **Control Dynamic Range** More than 98 dB • **Loop Time** 200 ms (fmas = 2000 Hz, at L = 400 line) • **Multiple-Channel Control Modes** Average control, Maximum control, Minimum control • **Input Channels** Maximum 20 *Specifications may be affected by other conditions	• **SOR: Sine on Random** 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** 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 98 dB • **Type of Reference Waveform** Classical shock waveform (Half-sine, Haversine, Saw-tooth, Triangle, Trapezoid, etc.), Sine beat waveform, Measured waveform etc. • **Input Channels** Maximum 20 *Specifications may be affected by other conditions	• **LONG WAVEFORM** The length of a reference waveform is a standard 16 K points. This can be increased to 200 K points by adding the LONG WAVEFORM option. At a sampling frequency of 512 Hz for example, this produces approximately 6.5 minutes of waveform, compared to the standard length of approximately 30 seconds. • **MEGAPOINT** A further increase in waveform duration can be obtained by adding the MEGAPOINT option to the LONG WAVEFORM option. This increases the record length to 5000 K points, about 163 minutes at 512 Hz sampling rate. • **SRS: Shock Response Spectrum** SRS (Shock Response Spectrum) can execute a test in which the test conditions and evaluation are conducted not based on waveform itself, but on SRS analysis. With a standard shock test selected, SRS analysis of response waveform is also possible.

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

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

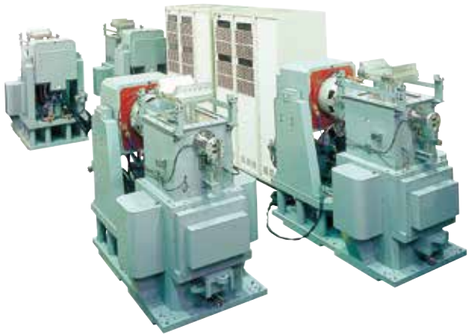
With IMV's approach to a more realistic reproduction of the vibration environment, IMV is focused on making products that are customized to the specific needs of our customers. IMV is proud of our tireless contributions to improving product safety and comfort for society as a whole through increasing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

Customized Products [Case Studies]

Customized Products

Automotive Parts

Case Studies



Electrodynamic multi-axis 4 poster system

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

Torsion vibration test system

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

3-axis simultaneous vibration test system

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

Low cross-axis motion vibration test system

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

Customized Products

Automotive Parts

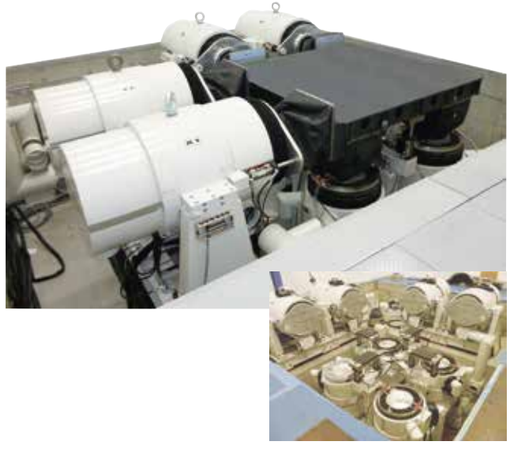
Case Studies

6-DOF vibration test system

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

7.9 in peak-to-peak displacement vibration test system

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



6-DOF large vibration test system

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

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

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

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)

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

Exhaust system durability testing

Durability testing with hot air and vibration. Air temperature range is 392°F to 1652°F and airflow from 79 to 394 in³/min is channeled into the exhaust system from a hot air generator.

Customized 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 2,000 Hz.

Low-acoustic-noise 3-axis vibration test system

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

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

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

Vertical/Horizontal changeover chamber combined with 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 with vibration test system

A double-sided door makes it easy to reach the specimen. This system is equipped with a temperature alarm meter for surface temperature monitoring and CO_2 automatic fire extinguisher. Sine: 1,000 Hz, Random: 2,000 Hz

Ultra-high temperature (1652°F) chamber combined with single-axis vibration test system

Applicable to temperature and humidity environmental testing for products which may be exposed to ultra-high temperatures of up to 1652ºF. Employs the virtual point control method to control acceleration of the specimen in the chamber without accelerometers mounted.

3-axis simultaneous vibration test system

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

Compact chamber combined with vibration test system

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

Customized 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 (-104°F to 230°F) is provided for checking the specimen inside the chamber during a combined test. To reduce the required installation space, a guide rail system is used with the vibration test system and horizontal slip table.

Crimping terminal evaluation system

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

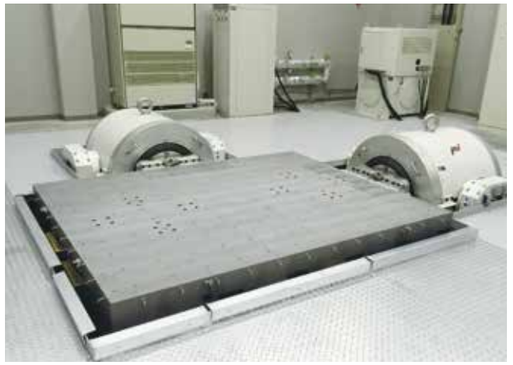
Customized Products

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 157 by 138 in 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 118 in × 79 in composed of 2 off 28,100 lbf shakers for the X and Y axes and 2 off 13,490 lbf 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 into a railway container. Data is subsequently used for a real waveform 3-axis simultaneous vibration test.

2-axis large vibration test system

Table size 79 x 98 in, Maximum load 4,410 lbs
Transportation test for large specimens or vibration durability test

Customized Products

Construction Machinery

Case Studies

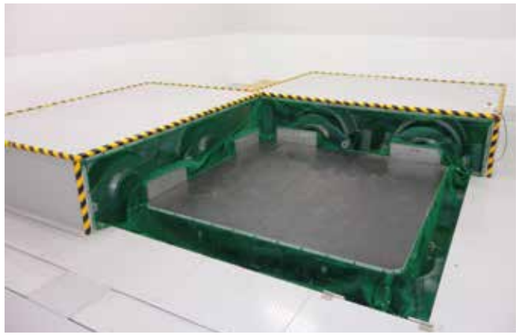
GDP
(Guide system with air spring load support)

Energy-saving vibration test system with large slip table

Maximum load is 4,410 lbs (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 systems

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

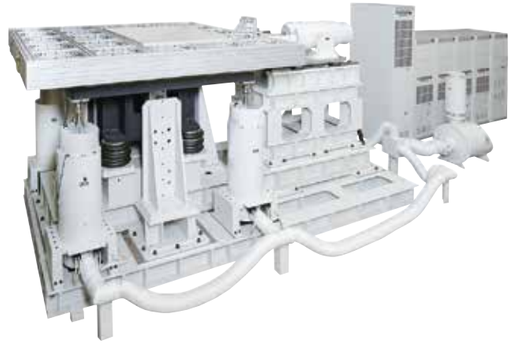
Large vibration test system for high-frequency testing (up to 5000 Hz)

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.

Customized Products

Earthquake Resistance

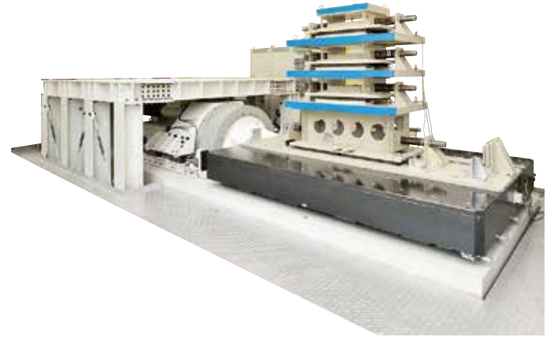
Case Studies



Large-scale earthquake-resistance vibration test systems

Watch the YouTube video

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



Large-scale earthquake resistance vibration test systems

Watch the YouTube video

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

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

Large vibration test system with a table size of 177 in × 177 in.
Rated displacement: 16 in peak-to-peak horizontal,
8 in peak-to-peak vertical. Maximum load of 44,000 lbs.

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：5.9 inp-p Frequency range：0.5–20 Hz

Customized Products

Aerospace

Case Studies

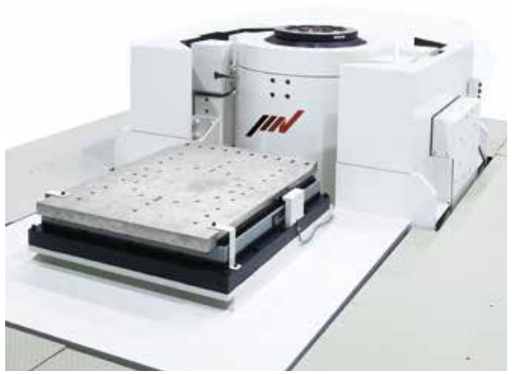
78,700 lbf large water-cooled vibration test system

Watch the YouTube video

One of the world's largest excitation force systems, with a distinctive 3.0 inp-p alternative displacement rating. High-velocity shock tests of 138 in/s are also possible.

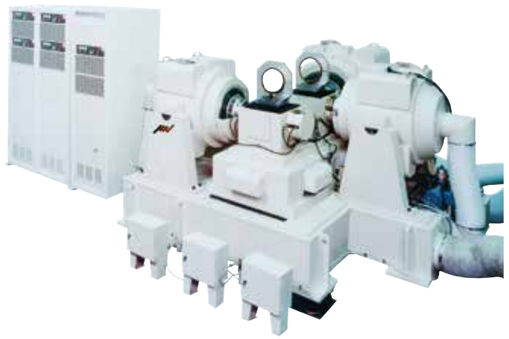
Vibration test systems for clean rooms

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 45,000 lbf 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.

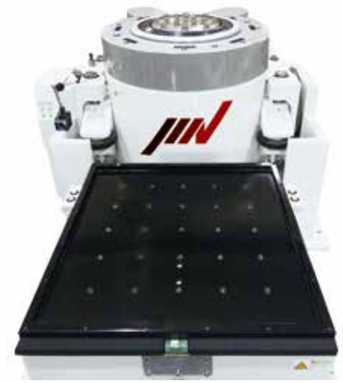
Customized Products

Other Applications

Case Studies

Vibration test system for fatigue testing of copper plating

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.



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.

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.

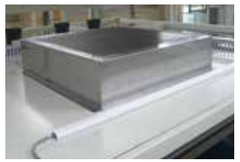
Pressure-proof flexible duct

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

Vibration Test Systems
Environmental Test Systems

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

Chamber for Vertical Excitation

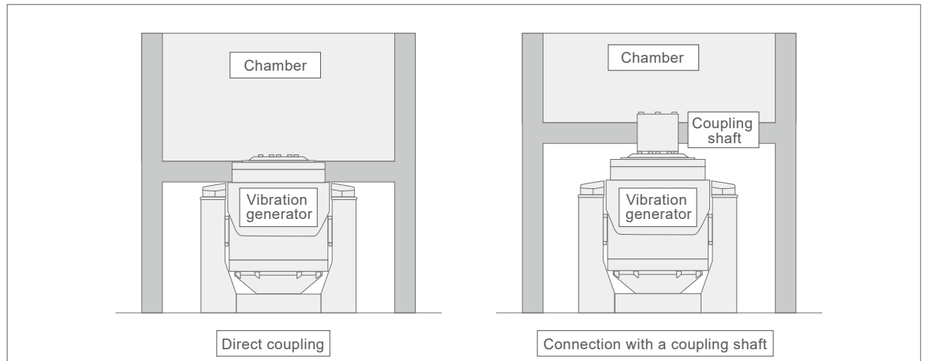


Inner pressure regulator: Reduces internal pressure fluctuation caused by vibration (standard equipment)

Model: Syn-3HA-40-V

Internal dimensions	W 39.3 x D 39.3 x H 43.3 in
Temperature range	-40°C to + 150°C
Humidity range	20% to 95% RH
Temperature pull-down time	+20°C => -40°C In 60 minutes (Curve gradient)
Temperature heat-up time	-40°C => +150°C In 90 minutes (Curve gradient)

Docking image of combined systems



Model: Syn-6HW-30-V

Internal dimensions	W 70.9 x D 74.8 x H 59.0 in
Temperature range	-30°C to + 80°C
Humidity range	30% to 95% RH
Temperature pull-down time	+45°C => -30°C In 35 minutes (Curve gradient)
Temperature heat-up time	-30°C => +80°C In 25 minutes (Curve gradient)

Chamber for both Vertical and Horizontal Excitation

Horizontal slip table combined with vibration test system.
Combining a rail support for horizontal movement and a lift support for vertical movement, this chamber allows combined tests for both vertical and horizontal axes.

Vertical use

Horizontal use

Rail and lift support

Model: Syn-3HA-70-VH

Internal dimensions	W 39.3 x D 39.3 x H 39.3 in
Temperature range	-70°C to + 180°C
Humidity range	20% to 98% RH
Temperature pull-down time	1°C/minutes or more (Curve gradient)
Temperature heat-up time	2°C/minutes or more (Curve gradient)

Watch the YouTube video

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 features are equipped, such as an observation door, body-suspension automatic-adjustment mechanism, etc.

Side window

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

Cable bear

Cables and water pipes put together with the cable carrier promote a safe work environment.

Chamber for Multi-Axis Excitation

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

2-axis

Model: Syn-4HA-40-M

Internal dimensions	W 47.2 x D 47.2 x H 39.3 in
Temperature range	-40˚C to + 150˚C
Humidity range	20% to 98% RH
Temperature pull-down time	+20˚C => -40˚C In 80 minutes (Load condition:combined + aluminum 132 lbs)
Temperature heat-up time	-40˚C => +150˚C In 80 minutes (Load condition:combined + aluminum 132 lbs)

3-axis

Model: Syn-3HA-40-M

Internal dimensions	W 39.3 x D 39.3 x H39.3 in
Temperature range	-70˚C to + 180˚C
Humidity range	20% to 98% RH
Temperature pull-down time	+20˚C => -70˚C In 40 minutes (Curve gradient)
Temperature heat-up time	-70˚C => +180˚C In 40 minutes (Curve gradient)

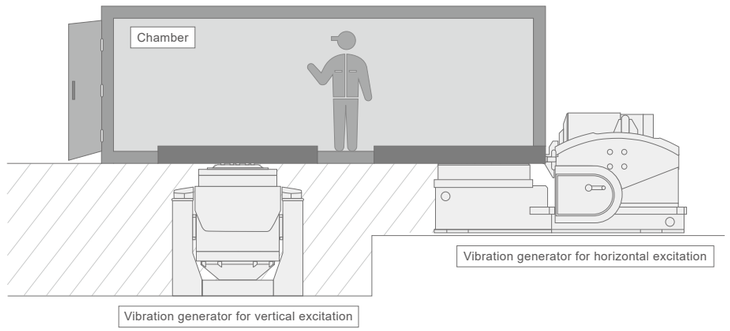
Prefabricated Chamber for Large Specimens

Large-sized specimens can be tested with a chamber combined test in both the vertical and horizontal axes.

Model: Syn-6HA-40-VH

Internal dimensions	W 157.4 x D78.7 x H98.4 in
Temperature range	-40˚C to + 120˚C
Humidity range	30% to 95% RH
Temperature pull-down time	+20˚C => -40˚C In 120 minutes (Curve gradient)
Temperature heat-up time	-40˚C => +150˚C In 150 minutes (Curve gradient)

Docking image of combined systems



Technical Guidance

For installation of vibration test systems

Basic units used for vibration test

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

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

$F=mA$

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

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

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

We have an object moving in a sine wave.

The displacement is:

$D = D0 \sin\omega t$

The velocity is obtained by differentiation of the displacement. Therefore

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

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

The acceleration is obtained by differentiation of the velocity. Therefore

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

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

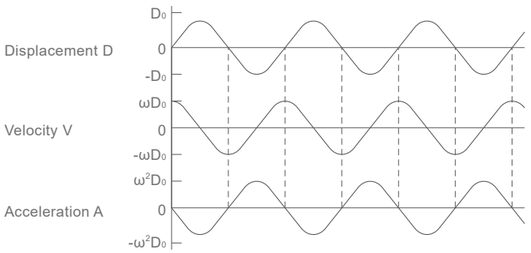
As we substitute

$\omega = 2\pi ft$

We have formulae indicated only in amplitude:

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

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



We get the formulae below by transforming the above formulae.

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

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

$V = 2\pi fD$

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

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

Therefore

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

is substituted into all of the above formulae

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

The following is an example

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

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

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

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

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

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

Please see the conversion chart (exchange table) on page 66 for calculations.

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 it 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”.

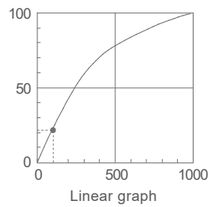
The following is a conversion table for “dB” and multiples.

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

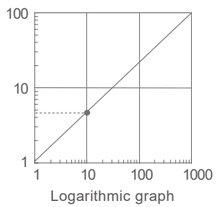
dB	0	-0.1	-1	-3	-6	-10	-20	-30	-40	-60
Multiple	1	0.99	0.891	0.709	0.501	0.316	0.1	0.0316	0.01	0.001

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 a 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:

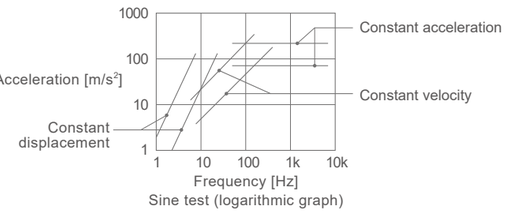
$A = 2\pi fV$ A: Acceleration, f: Frequency, V: Velocity

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.

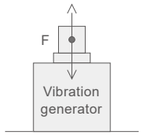
Technical Guidance

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

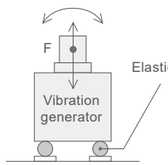
All the force generated by the vibration system is transmitted into the floor. This may excite resonances in the building and adjacent facilities. The vibration generator itself may sometimes jump up and down.

2) Body suspension

Air springs

IMV uses this method of vibration isolation except in the case of 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"

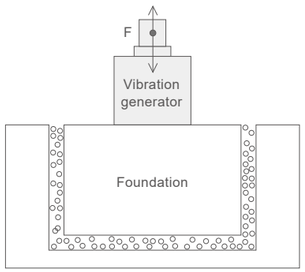
3) Bottom suspension



Elastic objects or air springs

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

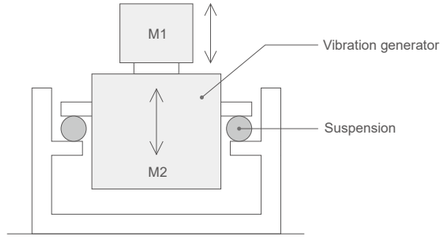
4) Isolated foundation



This is the best method 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 create limitations in maximum displacement.
In body isolation, the vibration generator body reacts against the movement of the specimen.

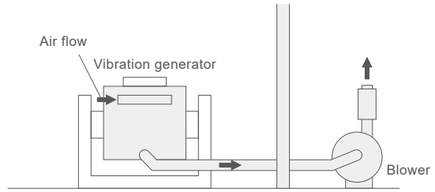


This will cause the vibration generator body to be excited by the reaction force. If the shaker excitation frequency is 2-7 Hz, this may coincide with the resonant frequency of the armature suspension system and the body suspension system. The armature and body motion could be almost in "anti-phase", 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, 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.

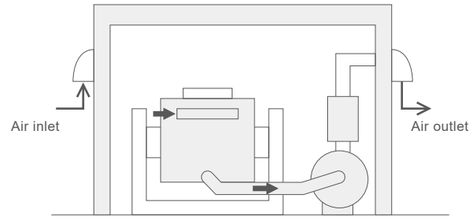
1) Installing the blower outside the room



This is a common and straightforward 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.

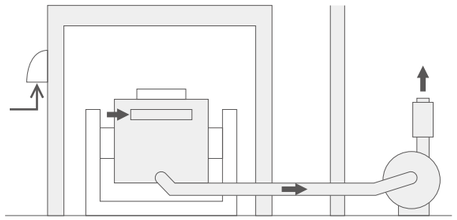
2) Soundproof box

A. Vibration generator and blower



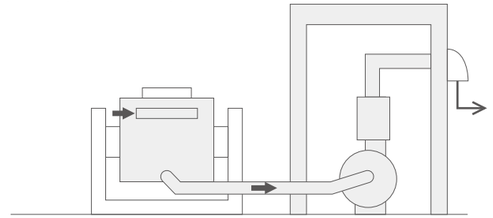
This method reduces the excitation noise and the blower noise.
*While the blower is stopped, taking measures to prevent air backflow is recommended.

B. Vibration generator only (blower outside the room)



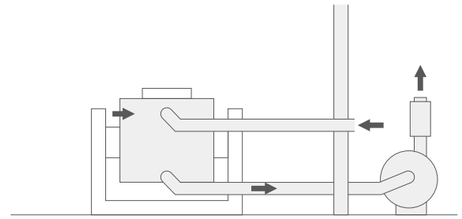
The excitation noise and the air inlet noise are lowered.
Placing the blower outside the room is recommended.
*The blower cannot be installed outdoors.

C. Soundproof 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.
*While the blower is stopped, taking measures to prevent air backflow is recommended.

3) Concentrated suction type



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

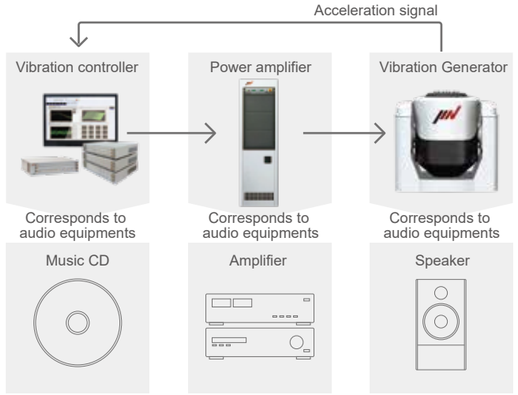
Technical Guidance

Mechanism of vibration test systems

Mechanism of vibration test systems

Electrodynamic vibration test systems

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



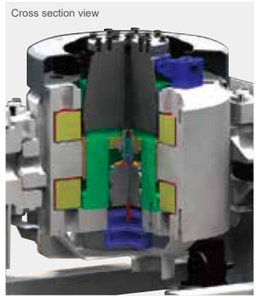
Vibration controller

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

Complex tests are professionally programmed and executed.

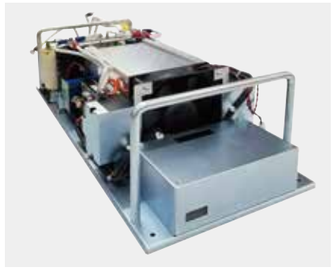
Vibration generator

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



Power amplifier

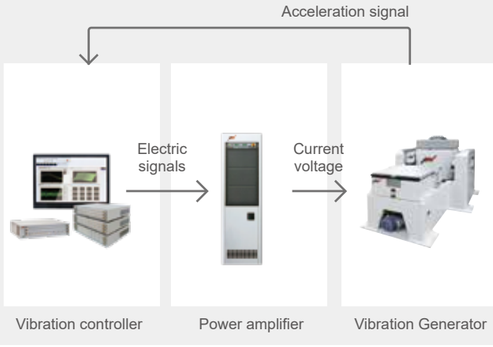
The role of the power amplifier is to feed driving current to the vibration generator, converting the small electrical signal generated in the vibration controller to the large current of higher voltage. IMV’s power amplifiers employ the switching amplifier system. They use mainly the compact and highly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



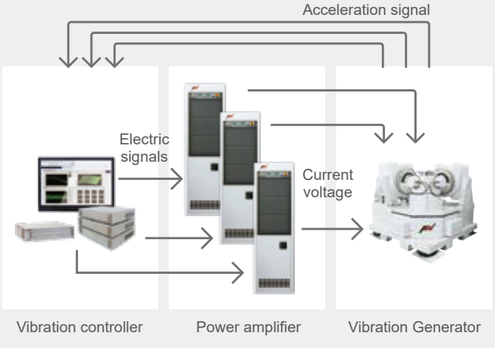
Power module SA-320

Principles of operation

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



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



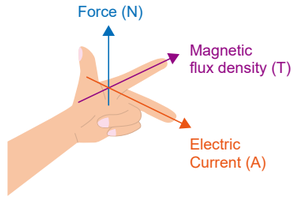
Vibration generator

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

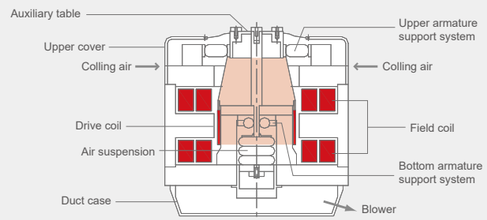
The formula below represents Fleming’s “left hand rule”.

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

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



Inside of vibration generator (air-cooling method)



Cooling method of vibration generator

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

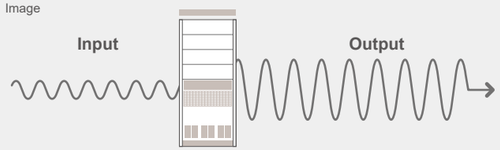
Cooling method	Air cooling	Water cooling
How it works	Cools the coils by using air from outside. Forces exhaust by blower.	The coils are made of pipe and distilled water is circulated to cool the coils using a heat exchanger and a cooling water.
Key features	Employs only a blower as cooling equipment.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

Power amplifier

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

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

Image



Technical Guidance

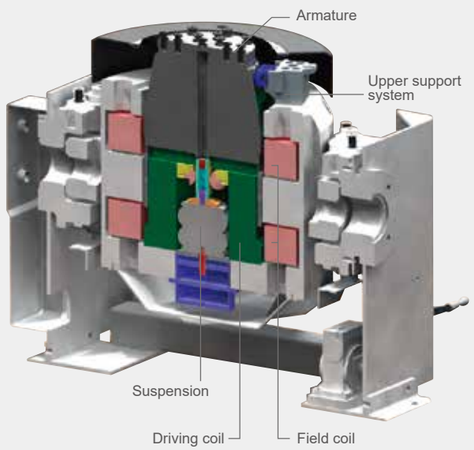
Invention with IMV's originality

Original technology utilized to improve durability and performance of vibration generators

Upper (armature) support system PS guide

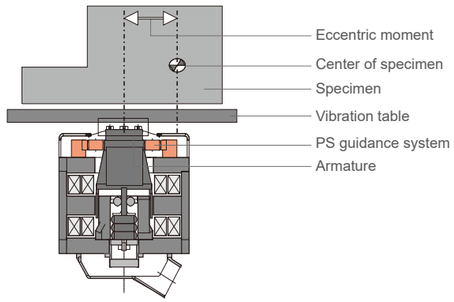
The vibration generator receives dynamic stress from its own vibration. The patented Parallel Support Guide (PSG) design can support the armature. PSG significantly improves durability, reliability of the system, and quality of vibration at the same time. This compact design provides enough stiffness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

Vibration generator cross section view (image)



Large allowance for eccentric moment

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



Compatibility of lateral rigidity and waveform regeneration accuracy

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

Improvement of durability

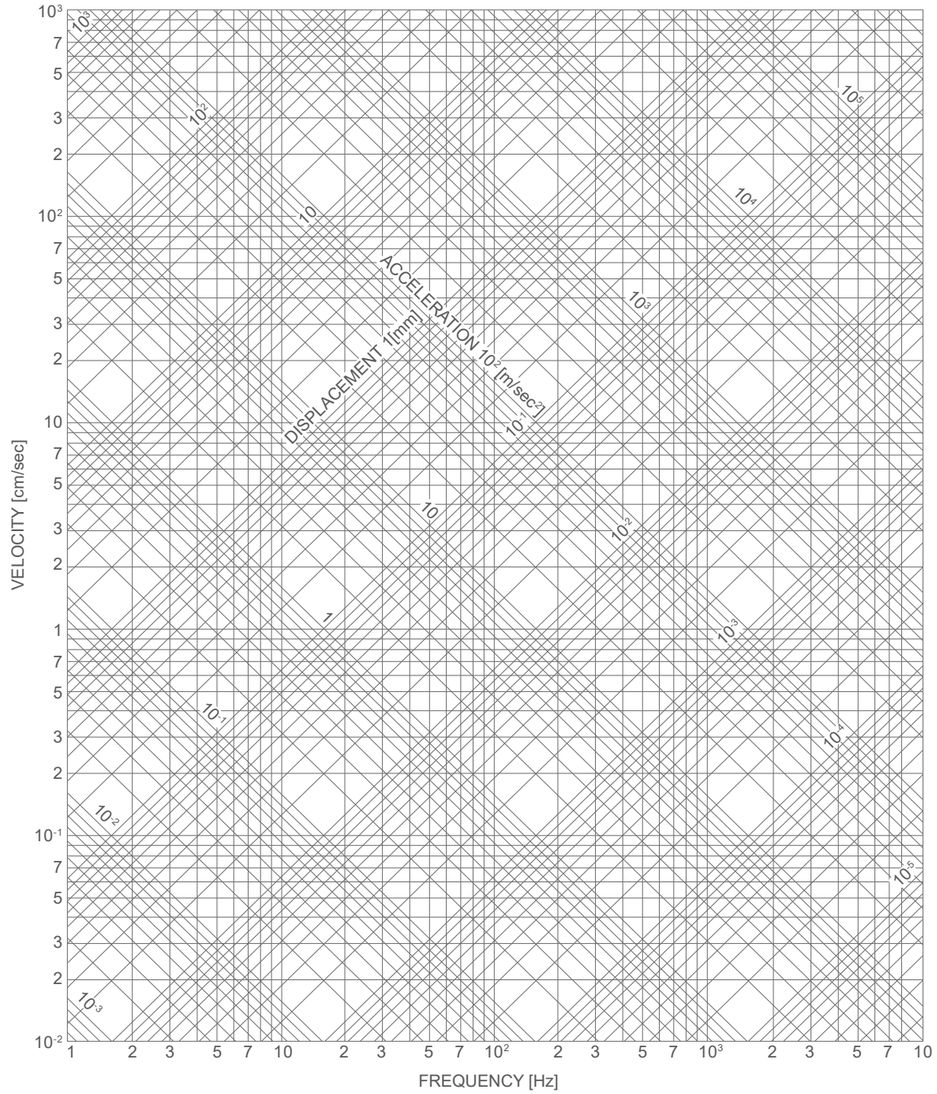
System lifespan has been increased by 10 times (compared to conventional systems), lengthening intervals between maintenance.

Flexibility to respond to demand for large displacement tests

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

Conversion Table

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



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

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

IMV Test Laboratory Network

IMV's test laboratory network provides full support to customers

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

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

Certified to ISO/IEC 17025

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

【Outline of Japanese laboratory】
① Certification number : RTL04240
② Authorization organisation : Public Interest Incorporated Association the Japan Accreditation Board
③ Authorization date : March 15th, 2016
④ Authorized 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 Authorization organisation : A2LA
③ Authorization date : June 26th, 2018
④ Authorized 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 Authorized 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

e-TCJ e-Test Centre Japan

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

- Reliability evaluation test for e-mobility parts such as large-sized motor or inverter of EV/HEV
- Evaluation of large parts (e.g. 220 lbf); 1m is possible while the part is in operation
- Various environmental tests such as high-stress temperature cycle test or salt spray test
- Ultra-high temperature (1652°F) chamber combined vibration test is available
- EMC testing by dedicated engineers
- Full security system

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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

e-TCJ site

Advanced Technology Centre for Environmental Testing

In order to meet future needs, we installed a full range of vibration test systems for battery 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, 78,700 lbf
- 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

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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

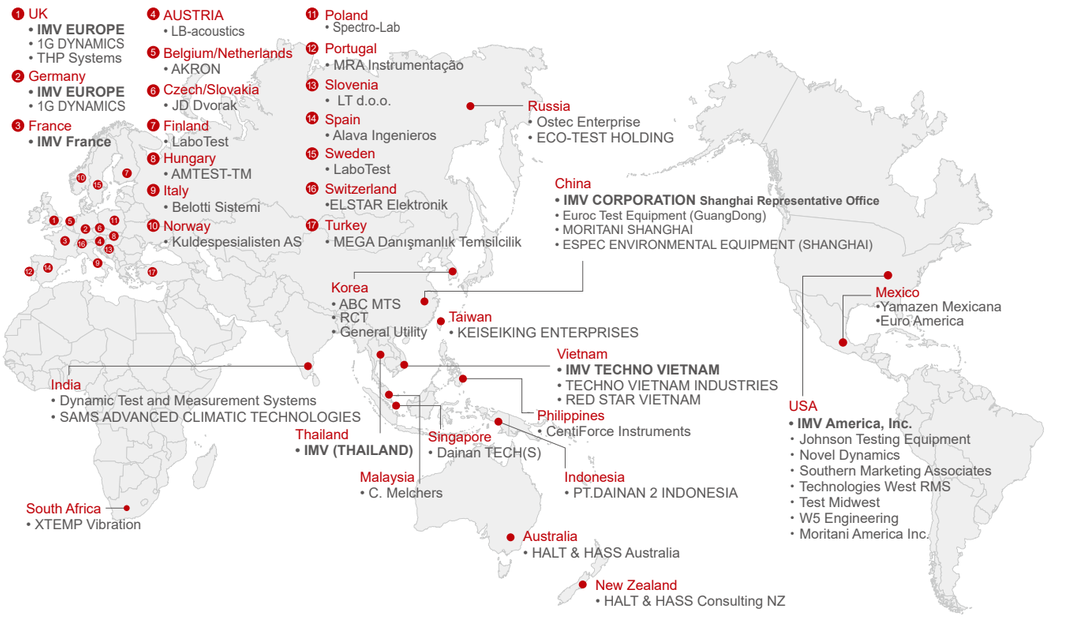
Uenohara site

Coverage

Service area

Service network

Global Network



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•Manufacturing and Demonstration Centre

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•IMV America, Inc (MI)

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Vietnam

IMV TECHNO VIETNAM COMPANY LIMITED

France

IMV France

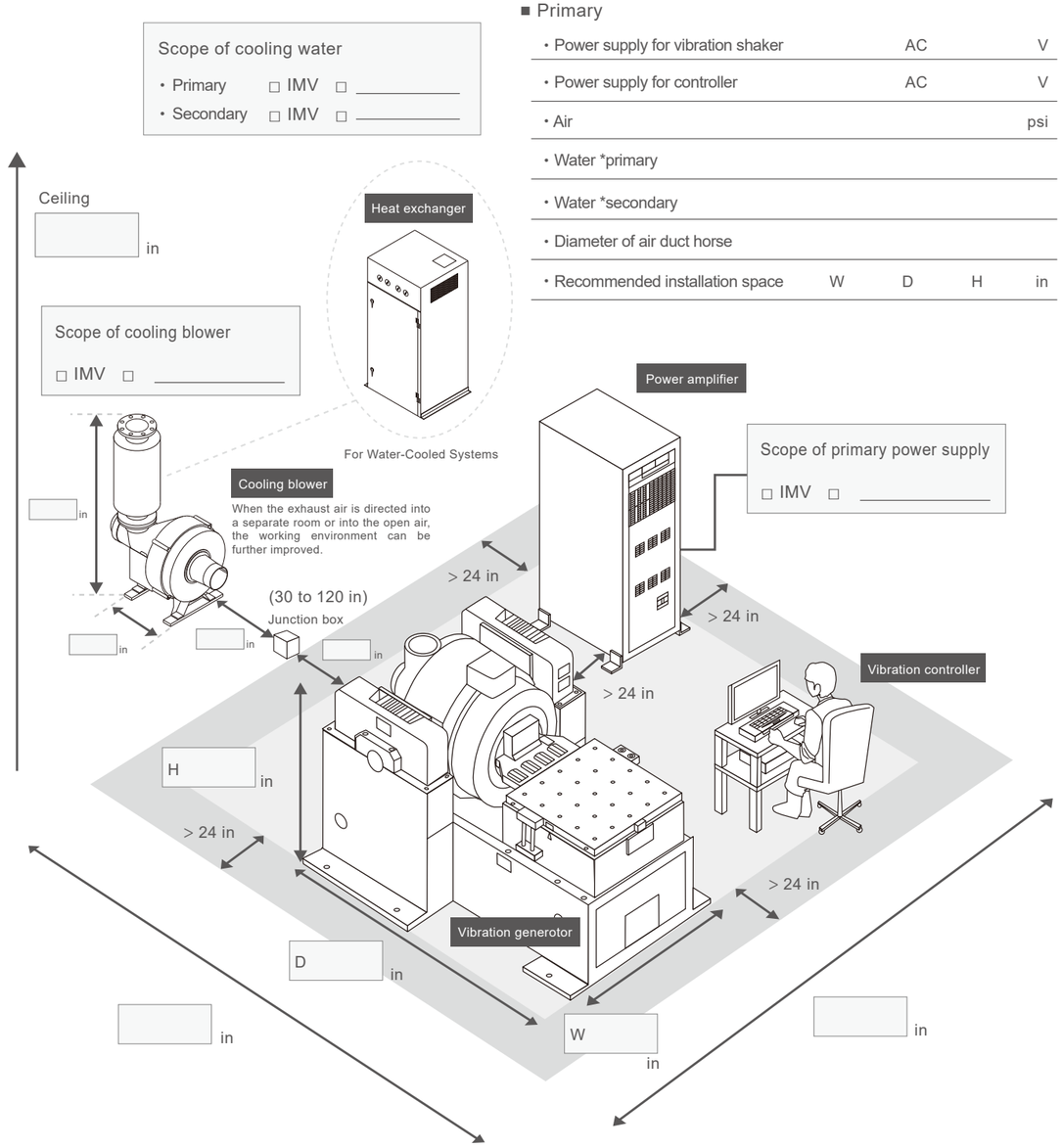
System Layout

Installation Example

■ Model

■ Primary

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



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