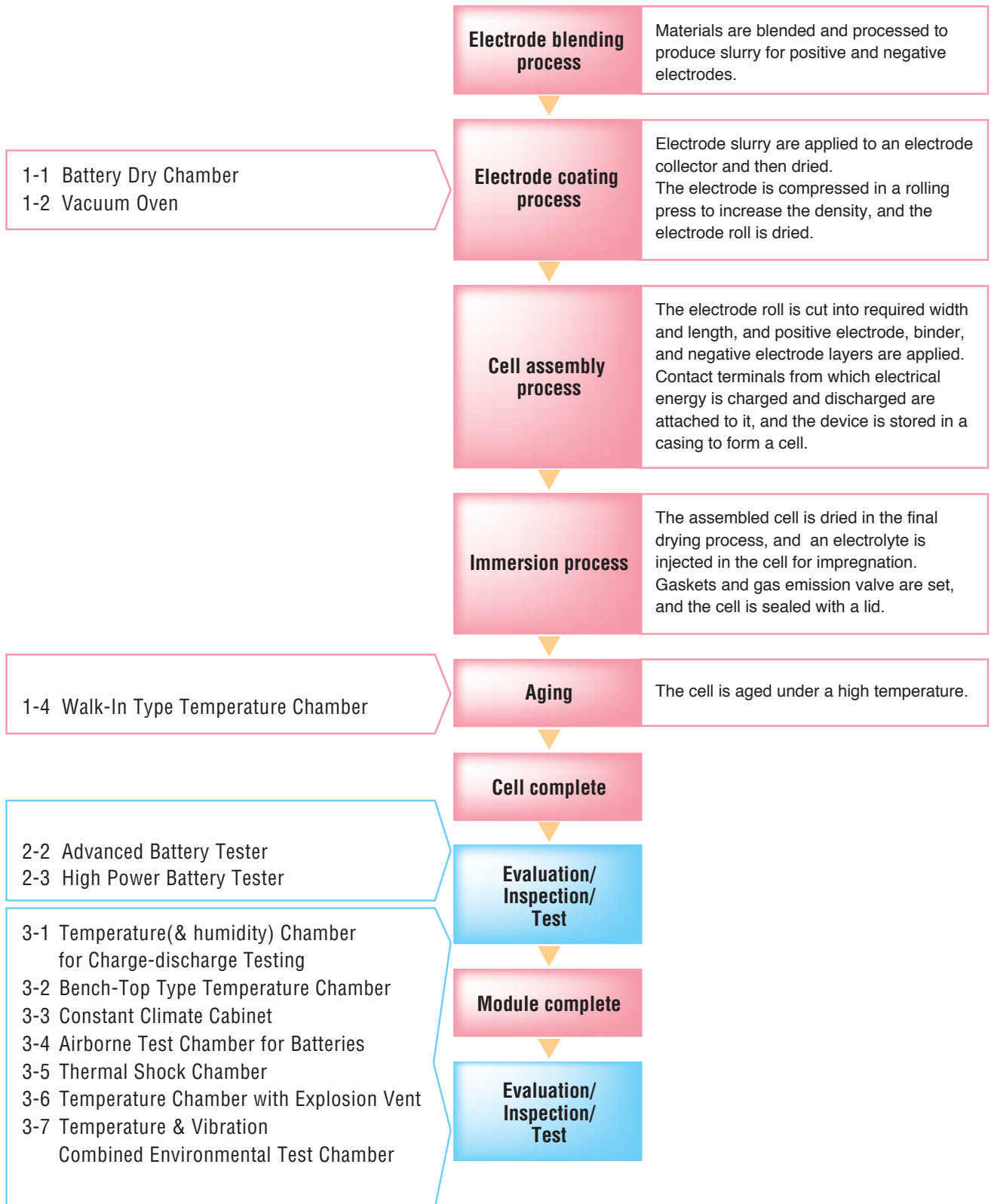


Quality is more than a word



# Products for Secondary Battery Market



# Test method for Secondary Battery

Test method	Standard	Conditions	Compliant product
Altitude (low-pressure) test	IEC/JIS/UN/PSE	Pressure: 11.6 kPa or less Temperature: 20°C (±5°C) Duration: 6 hours	Vacuum Oven
	UL	Pressure: 11.6 kPa or less Temperature: 20°C.( ±3°C) Duration: 6 hours	
Temperature test	IEC/UN	Temperature: 6 hours at 75°C (±2°C), then temperature pull down to -40°C (±2°C) within 30 minutes. Hold the specimen for 6 hours. Repeat the cycle 10 times, then let the specimen hold for 24 hours at 20°C (±5°C).	Faster Temperature Chamber Rapid-Rate Thermal Cycle Chamber Thermal Shock Chamber
	UL	Temperature: to 150°C (±2°C) at a gradient of 5°C/min. (±2°C)), then hold for 10 minutes.	Temperature Chamber Environmental Stress Chamber Faster Temperature Chamber Rapid-Rate Thermal Cycle Chamber
		Cycle: To 70°C (±3°C ) within 30 minutes. Hold for 4 hours. Pull the temperature down to 20°C (±3 C) within 30 minutes, hold for 2 hours. Pull the temperature down to -40°C (±3°C) within 30 minutes, hold for 4 hours. Heat the temperature up to 20°C (±3°C) within 30 minutes hold for 4 hours. Repeat the above cycle 9 times, and then let the specimen hold for 7 days.	Environmental Stress Chamber Faster Temperature Chamber Rapid-Rate Thermal Cycle Chamber Thermal Shock Chamber
	JIS/PSE	Keep the product for 7 hours at 70°C (±2°C). Remove from the chamber, and leave in an environment of 20°C (±5°C)..	Temperature Chamber Large Volume Temperature Chamber Constant Climate Cabinet
		Cycle: Hold for 4 hours at 75°C (±2°C). Pull the temperature down to 20°C (±5°C) within 30 minutes, hold for 2 hours. Pull the temperature down to -20°C (±2°C) within 30 minutes, hold for 4 hours. Heat the temperature up to 20°C (±5°C) within 30 minutes, hold for 2 hours. Repeat the above cycle 4 times, then let the specimen hold for 7 days.	Platinous Series Temperature Chamber Free Access Temperature Chamber Environmental Stress Chamber Faster Temperature Chamber Bench-Top Type Temperature Chamber Rapid-Rate Thermal Cycle Chamber Thermal Shock Chamber
		Heat the temperature up to 130°C (±2°C) at a gradient of 5°C/min. (±2°C) , hold for 10 minutes.	Temperature Chamber Environmental Stress Chamber Faster Temperature Chamber Rapid-Rate Thermal Cycle Chamber
Vibration test	IEC/UN	Make the specimen vibrate within the frequency range from 7 to 200 Hz, 12 times in 3 hours. Vibration shall occur in 3 directions perpendicular to each other.	Temperature & Vibration Combined Environmental Test Chamber
	JIS/UL/PSE	Vary the frequency within 10 to 55 Hz range, at a rate of 1 Hz/min. Vibration shall occur in 3 directions perpendicular to each other.	

Test method	Standard	Conditions	Compliant product
External short circuit	IEC/ UN	Connect the specimen at 55°C (±2°C) with a resistance of 0.1 Ω to make a short circuit.	Temperature Chamber Large Volume Temperature Chamber Constant Climate Cabinet
	UL	Connect the specimen at 60°C (±2°C) with a resistance of 0.1 Ω to make a short circuit.	
	JIS/ PSE	Electrical cell: Connect the specimen at 55°C (±5°C) with a resistance of 80mΩ (±20 mΩ) to make a short circuit, and hold the specimen for 24 hours or until the difference between the cell surface and ambient temperature reaches 20% or less.	
		Battery pack: Connect the product at 20°C (±5°C) with a resistance of 80mΩ (±20 mΩ) to make a short circuit, and hold the specimen for 24 hours or until the difference between the cell surface and ambient temperature reaches 20% or less.	
Impact test	IEC/ UN	Drop a rod (diameter of 15.8 mm and weight of 9.1kg) to the center of a cell from a height of 61cm (±2.5 cm), and hold the specimen for 6 hours. Ensure that the cell does not break at 170°C or lower during the period.	Temperature Chamber Walk-In Type Temperature Chamber Large Volume Temperature Chamber
	UL	Drop a rod (diameter of 15.8 mm and weight of 9.1kg) to the center of a cell from a height of 61 cm (±2.5 cm). Ensure that the cell does not explode or burst into flames.	
Crush test	UL	Between 2 flat plates, apply pressure at 13 kN (hydraulically) under 17.2 MPa or less, and ensure that the specimen does not ignite or burst.	Temperature Chamber Large Volume Temperature Chamber Walk-In Type Temperature Chamber
	JIS/ PSE	Between 2 flat plates, apply pressure at 13kN (±1kN) and ensure that the specimen does not ignite or burst.	
Overcharge test	JIS/ PSE	Temperature: at 20°C (±5°C). Ensure that the product does not ignite or burst when current is applied until the cell is charged to 250% of rated capacity or testing voltage is reached.	Constant Climate Cabinet Platinous Series Temperature Chamber Free Access Temperature Chamber Environmental Stress Chamber Faster Temperature Chamber Walk-In Type Temperature Chamber Bench-Top Type Temperature Chamber
Over discharge test	JIS/ PSE	Temperature: at 20°C (±5°C). Ensure that the product does not ignite or burst when reverse charge is applied for 90 minutes.	
High-rate charge test	JIS/ PSE	Temperature: at 20°C (±5°C). Ensure that the product does not ignite or burst when it is charged with a current 3 times higher than the maximum charging current.	
Forced internal short circuit test	JIS/ PSE	Implant a nickel platelet into a battery. Apply pressure to the embedded area at 10°C and 45°C (±2°C), and ensure that the specimen does not ignite.	

# Test method for Secondary Battery

Test method	Standard	Conditions	Compliant product
Continuous and stable voltage charge test	JIS/ PSE	Charge the product at 20°C (±5°C) for 28 days under designed constant-voltage charge condition, and ensure that the specimen does not ignite or burst, or liquid does not leak.	Constant Climate Cabinet Platinous Series Temperature Chamber Free Access Temperature Chamber Environmental Stress Chamber Faster Temperature Chamber Walk-In Type Temperature Chamber Bench-Top Type Temperature Chamber
Overcharge protection function test	JIS/ PSE	Perform the test at 20°C (±5°C) according to stipulated method, and ensure that the battery block in the assembled battery does not exceed the prescribed maximum charge voltage.	
Charge-discharge cycle test	UL	Cell should be charged-discharged continuously for 90 days at 25°C. (or 25% of the nominal cycle life, whichever is shorter)	
Drop test	JIS/ PSE	Drop the specimen from a height of 1 m at 20°C (±5°C), and ensure that the specimen does not ignite or burst.	Walk-In Type Temperature Chamber
Device drop test	JIS/ PSE	Drop the product from a prescribed height at 20°C (±5°C), and ensure that short circuit does not occur inside the battery pack.	

## Organizations

- IEC: International Electrotechnical Commission (IEC 62281: Safety of primary and secondary lithium cells and batteries during transport / IEC 62133: Safety requirements for portable sealed secondary cells)
- JIS: Safety requirements for portable sealed secondary cells (JIS C8712/C8714)
- UN: UN Manual of Test and Criteria (UN Manual of Test and Criteria, Part III)
- UL: UL Standard (UL 1642: Standard for Lithium Batteries / UL 2054: Household and Commercial Batteries)
- PSE (Electrical Appliances and Material Safety Law) :  
Conformity assessment of lithium-ion battery under the Electrical Appliances and Material Safety Law

Test method	Standard	Conditions	Compliant product
High temperature test	IEC62660-2	130°C, 30 minutes (heat-up 5°C/min)	Temperature Chamber Bench-Top Type Temperature Chamber Constant Climate Cabinet
Thermal cycle	ISO12405-1 IEC62660-2	-40°C/85°C (1°C/min) 30 cycles	Platinous Series Temperature Chamber Bench-Top Type Temperature Chamber Constant Climate Cabinet
External short circuit test	UL2054 ISO12405-1 IEC62660-2	Room temperature, short circuit with external resistance	Temperature Chamber Large Volume Temperature Chamber Constant Climate Cabinet
Overcharge test	UL2054 ISO12405-1 IEC62660-2	Room temperature, 5C current	Advanced Battery Tester
Forced discharge test	ISO12405-1 IEC62660-2	1 It(A), 90 minutes 1 It: cell rated capacity (Ah)/1h	
Vibration/impact test	ISO12405-1 IEC62660-2	Vibration: 2 kHz, 28 m/s <sup>2</sup> , 8 h Impact: 50 G, 10 times/direction	Temperature & Vibration - Combined Environmental Test Chamber
	UL2054	Vibration: 10 Hz to 55 Hz Impact: Minimum 75 G, peak 125 G to 175 G	
Crush test	UL2054 IEC62660-2	φ150 mm dome, crush	Crush Test Chamber
Impact test	UL2054	Drop a 15.8 mm diameter, 9.1 kg rod on the center of the battery from a height of 61±2.5 cm, no explosion or fire	Temperature Chamber Large Volume Temperature Chamber Walk-In Type Temperature Chamber
Drop test	UL2054	Drop from a point 1 m high, no fire or rupture	Walk-In Type Temperature Chamber
Output test	IEC62660-1	-20°C, 0°C, 25°C, 40°C Voltage measurements after specified charge/ discharge	Advanced Battery Tester
Storage test	IEC62660-1	45°C, 28 or 42 days	Platinous Series Temperature Chamber (PU) Bench-Top Type Temperature Chamber Compact Ultra Low Temperature Chamber
Cycle life test	IEC62660-1	45°C charge/discharge cycle	Advanced Battery Tester
	ISO12405-1	-18°C, 0°C, 40°C charge/discharge cycle	
Charge/discharge tests	ISO12405-1	Run charge/discharge tests via various methods between -18°C and 45°C. Power measurements at high and low temperatures, calculate internal resistance and energy efficiency	
Dew condensation test	ISO12405-1	Run 5 cycles of dew condensation and drying that conforms to IEC standards	Platinous Series Temperature Chamber Free Access Temperature Chamber Environmental Stress Chamber Faster Temperature Chamber

# Test method for Vehicle Secondary Battery

Test method	Standard	Conditions	Compliant product
Temperature test	UL2054	Temperature: Expose to 70°C environment for 7 hours	Temperature Chamber Large Volume Temperature Chamber Constant Climate Cabinet
	UL2054	Temperature rise gradient 5±2°C/min, heat up to 150±2°C, maintain for 10 minutes	Temperature Chamber Environmental Stress Chamber Faster Temperature Chamber Rapid-Rate Thermal Cycle Chamber
	UL2054	Heat up to 70±3°C within 30 min, maintain for 4 hours. Afterward, decrease temperature to 20±3°C within 30 min and maintain for 2 hours. Afterward, decrease temperature to -40±3°C within 30 min and maintain for 4 hours. Afterward, heat up to 20±3°C within 30 min and maintain for 4 hours. Perform 9 cycles, expose for 7 days"	Environmental Stress Chamber Faster Temperature Chamber Rapid-Rate Thermal Cycle Chamber Thermal Shock Chamber

IEC-62660-1 : Cell performance test

IEC-62660-2 : Cell reliability test

# 1-1 Battery Dry Chamber

Rechargeable Li-ion batteries are classified as non-aqueous electrolyte batteries.

During the production process, a solvent of active material is applied to the collector and then dried. However, moisture in the anode and cathode of the rechargeable battery affects its quality.

The Battery Dry Chamber makes it possible to shorten the time required for solution drying and moisture removal.

High-temperature treatment performed under vacuum or inert gas conditions avoids workpiece oxidation while achieving superior drying performance. Processing is performed at a temperature that is suitable for drying of cathode roll, anode roll, and separator workpieces.

Special specifications can be provided to suit workpiece size and processing volume requirements, and jigs are available for workpiece support, etc.



Battery Dry Chamber

## Features

### ● Shorter drying time

Equipment performance has been improved to shorten the time required for workpiece heat-up and cool-down.

For example a cooling function is equipped to lower the workpiece to normal temperature so it can be removed.

### ● Improved temperature control

More uniform workpiece heat distribution improves heat distribution performance during temperature exposure even in a vacuum, which further improves workpiece drying quality.

### ● Workpiece oxidation prevention

To prevent workpiece oxidation during high-temperature treatment, inert gas is introduced into a vacuum to prevent oxidation of the collector.



Test area

## Specifications

Performance	Temp. range	+ 30°C to + 250°C
	Pressure range	933×10 <sup>2</sup> to 1×10 <sup>2</sup> Pa
Inside capacity		500 to 2000 L
Operating mode		Program 20 patterns 99-steps Constant



# 1-2 Vacuum Oven

Under low pressure environment, specimens dry at lower temperature and boiling point is also lower, which reduces stress on specimens.

Furthermore, the vacuum and N<sub>2</sub> gas exchange modes enable drying of oxidation-averse specimens, as well as drying and heat treatment within a clean environment by eliminating impurities in the chamber through repeated heat treatments or gas exchanges.



Vacuum Oven

## Features

- The vacuum chamber features doublelayered construction. A heater on the exterior of the test area minimizes heat loss and improves temperature uniformity.
- There are five operation ion modes available to select the pressure control. A wide variety of programs can be designed by combining constant-temperature operation and programmed operations.
- Oxygen inside the chamber can be eliminated by replacing it with N<sub>2</sub> gas, preventing oxidation

during the drying operation. In addition, a high-precision environment can be created by repeatedly performing the exchanges.

This mode also removes organic substances in addition to preventing oxidation, reducing the impact on specimens.

- Air-tightness and insulation capacity have a significant impact not only on temperature control but also on pressure control. Through improvement of these properties, the VAC-101 achieves up to 40% energy savings.

## Specifications

Model		VAC-101P	VAC-201P	VAC-301P
performance	Temperature range	+ 40 to + 200°C		
	Pressure range	933×10 <sup>2</sup> to 1×10 <sup>2</sup> Pa		
	Ambient pressure *1	Less than 133 Pa		
	Pull-down time *1	From atmospheric pressure to 133 Pa		
	Atmospheric pressure recovery time *2	Within 7 min.	Within 15 min.	Within 30 min.
Effective internal volume	91L	216L	512L	
Effective internal dimensions	W450×H450×D450 mm	W600×H600×D600 mm	W800×H800×D800 mm	
Outside dimensions *3	W902×H1392×D780 mm	W1052×H1532×D930 mm	W1252×H1772×D1130 mm	
Pressure operation modes	Automated, Continuous, Open to atmosphere, Gas exchange, Ventilation			

\*1 Fixed temperature inside the chamber, vacuum pump connected with exhaust speed of more than 200L/min. and ultimate pressure of 13×10<sup>-2</sup> Pa or less, no gases emitted from specimen.

\*2 Recovery time to atmospheric pressure (10<sup>13</sup>×10<sup>2</sup> Pa) to 10<sup>10</sup>×10<sup>2</sup> Pa, recovery time may fluctuate depending on atmospheric pressure.

\*3 Excluding protrusions.

# 1-4 Walk-In Type Temperature Chamber with Safety Devices

The need for large-volume production of rechargeable batteries has grown along with the increase in the use of hybrid automobiles. This makes it necessary to find ways to perform time-consuming processes in a way that treats a large number of units with a single operation.

The Walk-in Type Temperature Chamber with Safety Devices enables one-step large-volume processing of even large rechargeable EV batteries. This chamber really shines when it comes to charge-discharge testing and aging processing.

In addition, a number of safety mechanisms are built in for safe charge-discharge evaluation and other testing that presents the risk of fire due to gas leaking from a rechargeable battery.



Walk-In Type Temperature Chamber with Safety Devices

## Features

- A walk-in configuration makes it possible to wheel specimens directly into and out of the chamber without removing them from the cart. This capability is especially useful when testing large, heavy rechargeable EV batteries.
- Gas leaking from a rechargeable battery is detected by a gas detector. When gas is detected, outside air is introduced through a ventilation damper to reduce gas concentration. This device consists of a two-step detection and alarm system. Stage 1 is triggered whenever gas density reaches a preset alert point, and Stage 2 is triggered whenever gas density exceeds that point.
- Whenever flame is emitted from a rechargeable battery (due to abnormal overheating), a CO<sub>2</sub> fire extinguisher can be activated to automatically extinguish it. Operation is also shut down at the same time.
- Whenever pressure rises above explosion level, the ceiling comes off to release pressure. A punching metal frame prevents thermal insulation from scattering in the case of explosion.

## Safety devices

- Pressure relief vent
- H<sub>2</sub> & CO<sub>2</sub> gas detection alarm circuit
- Air intake/exhaust damper
- Reinforced door
- CO<sub>2</sub> fire extinguisher
- External alarm input/output terminal

## Example of customized specifications

System		Balanced Temp. Control System (BTC System)
Performance	Temp. range	-40 to +80°C
	Temp. fluctuation	± 0.3°C
	Temp. heat up time	-40°C to +80°C within 60 min. (with no load, no specimen)
	Temp. pull down time	+20°C to -40°C within 180 min. +20°C to -30°C within 120 min. (with no load, no specimen)
Inside dimensions		W2500 × H2100 × D1970 mm
Outside dimensions		W4095 × H2675 × D2783 mm (excluding protrusions)

\* Contact ESPEC concerning test space, specifications, etc.

\* This chamber can be customized to meet customers' testing requirements.

## 2-2 Advanced Battery Tester

Combining charge-discharge power supplies and a test area within a single structure, the Advanced Battery Tester marks a new style in charge-discharge testing.

Select an optimal system based on battery capacity, shape, number, and other requirements.

### Features

#### ● Card edge connectors

Power supply to battery connection is completed simply by setting batteries in a battery holder equipped with a card edge connector, and inserting the connector into the slot at the back of the inner chamber.

#### ● Even temperature distribution with batteries in position

Taking into consideration factors like battery holder position and battery arrangement, the test area is designed to create an even temperature environment with air circulating horizontally - air blows in from the side in stacked-chamber models and from the back in single-chamber models.

#### ● Battery holders match battery shapes for easy setup

Battery holders are available for coin, cylindrical, rectangular, and laminated cells, as well as to suit charge-discharge conditions.

#### ● Parallel control supports high-rate testing

By increasing current using the power supply's parallel control function, high-rate tests can be performed with a single piece of equipment. Using dedicated battery holders for parallel control, the tester can be expanded to support 2- or 4-unit parallel connections.

#### ● Impedance measurement (option)

When the tester is in a standby state during the charge-discharge cycle, it is possible to perform impedance measurement (sweep measurement/ fixed point measurement).

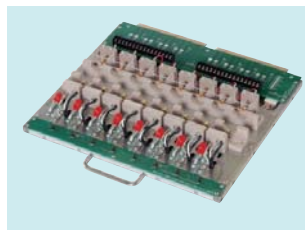
As it is possible to make continuous measurements without moving batteries, highly reliable data can be obtained.



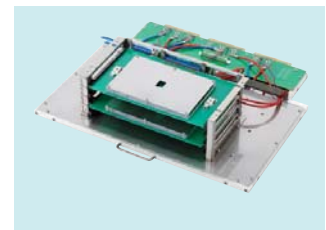
Single-chamber type

Three-chamber type

Advanced Battery Tester

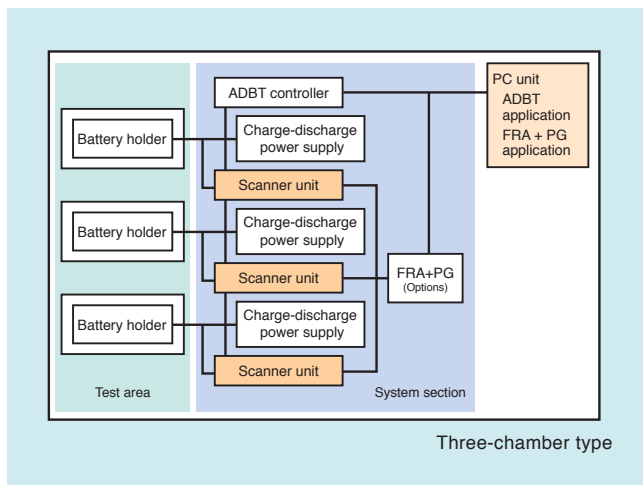


Battery holder for cylindrical cells



Battery holder for laminated cells





### System configuration



### Options

- Test area safety specifications
  - Heat detector
  - Smoke detector
  - Signal tower
  - CO<sub>2</sub> fire extinguisher
  - Pressure discharge vent, etc.
- Impedance measurement function
- Auto calibration board

## System types

Type		Three-chamber	Two-chamber	Single-chamber	Wide single-chamber
					
Interior dimensions (mm)		W 510 H 400 x3 chambers D 400	W 510 H 400 x2 chambers D 400	W 640 H 850 D 660	W 1110 H 850 D 660
ADBT-5-1	5V, 1A	72ch (24ch/chamber)	48ch (24ch/chamber)	72ch	144ch
ADBT-5-10	5V, 10A	72ch (24ch/chamber)	48ch (24ch/chamber)	72ch	144ch
	5V, 16A (2-unit parallel control)	36ch (12ch/chamber)	24ch (12ch/chamber)	36ch	72ch
	5V, 32A (4-unit parallel control)	18ch (6ch/chamber)	12ch (6ch/chamber)	18ch	36ch
ADBT-5-50	5V, 50A	24ch (8ch/chamber)	16ch (8ch/chamber)	24ch	48ch
	5V, 80A (2-unit parallel control)	12ch (4ch/chamber)	8ch (4ch/chamber)	12ch	24ch
	5V, 160A (4-unit parallel control)	6ch (2ch/chamber)	4ch (2ch/chamber)	6ch	12ch
	5V, 320A (8-unit parallel control)	3ch (1ch/chamber)	2ch (1ch/chamber)	3ch	6ch

## Example of customized specifications

Model		ADBT-5-1	ADBT-5-10	ADBT-5-50
Test area	Control range	-40°C to +100°C		
	Temperature distribution	±1.5°C		
Output voltage	Setting range	0 to 5000mV		
	Output accuracy	±0.1% of F.S.		
Output current	Setting range	0 to 1mA/0.001mA 1 to 10mA/0.01mA 10 to 100mA/0.1mA 100 to 1000mA/1mA	0 to 100mA/0.1mA 100 to 1000mA/1mA 1000 to 10000mA/10mA	500 to 5000mA/1mA 5000 to 50000mA/10mA
	Output accuracy	±0.1% of F.S.		
Output power	Setting range	0 to 5W	0 to 50W	0 to 250W
	Output accuracy	±0.2% of F.S.		
Parallel connection function	2 units/4 units/8 units	—	16A / 32A / —	80A / 160A / 320A
Measurement points	Current/Voltage	Current: 1 point per channel / Voltage (specimen edge): 1 point per channel		
	Temperature	1 point per channel		2 points per channel

\* Requires separate battery holder for use with parallel connection.

\* Consult ESPEC regarding applications over 320A.

\* High-power battery testers for modules/pack batteries are also available.

## 2-3 High Power Battery Tester

In recent years, the variety of lithium-ion battery applications has expanded to include the automotive and electric power fields. In conjunction with this expansion, lithium-ion battery modules are being manufactured with larger capacities and higher voltages through the use of combinations of electrical cells. ESPEC provides charge-discharge evaluation systems for these kinds of large battery modules.

Up to three channels can be assigned per control rack allowing parallel control of up to four control racks (maximum of 12 channels).

The flexible system allows the number of parallel controls to be changed to match battery capacity and test items.

Moreover, synchronized operation with the test area makes it possible to implement standards tests with ease.

### Features

- High power delivered through parallel operation of up to 12 channels
  - 1 channel: 120V/200A
    - When charging: 8kW/
    - When discharging: 12kW
  - 12 channels: 120V/2400A
    - When charging: 96kW/
    - When discharging: 144kW
- As an evaluation system, synchronized operation of the test area and charge-discharge power supplies is possible. This makes it easy to implement standards tests combining temperature and charge-discharge conditions.
- Power regeneration function reduces heat generated during discharge, which in turn reduces the load on the installation environment.
- Operations programmed using a touch-panel controller.  
A LAN port and a function that enables the creation of programs of up to 1,000 steps allow the tester to be connected to an external host computer.
- All-in-one system provides everything from power supply systems to test areas and jigs.



High-power Battery Tester J series (Example System)



Large Thermal Shock Chamber (Example System)



Walk-In Type Chamber (Example System)



## Example of customized specifications

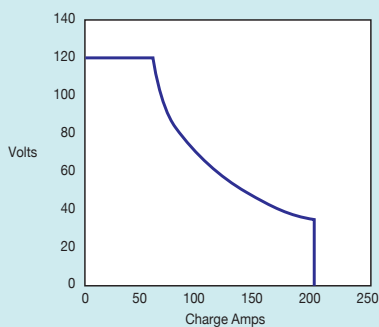
Model		HPBT-120-200	HPBT-600-40	HPBT-40-600	
Power supply unit	Operating environment	0 to 35°C			
	No. of power supplies	Max. 3 channels per control rack			
	Charging range	8kW(0 to 120V, 200A)	8kW(0 to 600V, 40A)	8kW(0 to 40V, 600A)	
	Discharging range	12kW(4 to 120V, 200A)	12kW(20 to 600V, 40A)	12kW(2 to 40V, 600A)	
	Output power	Setting range	0 to 12kW		
		Output accuracy	0.4-0.8% *1		
	Output voltage	Setting range	0 to 120V	0 to 600V	0 to 40V
		Output accuracy	0.05-0.1% *1		
		Noise	500mVrms		
	Output current	Setting range	0 to ±200A	0 to ±40A	0 to ±600A
		Output accuracy	0.1-0.2% *1		
		Noise	500mArms		
	Sampling rate	0.1sec			
	No. of parallel controls	Max. 12 channels *2			
Safety functions	Overvoltage, overcurrent, overpower, overheat				
Other functions	Power regeneration function, battery emulation function				
Control rack dimensions	W711×H1830×D762mm				
Weight	Approximately 500kg (with 3 channels loaded)				
Test area	Control range	-40°C to +100°C			
	Temperature distribution	±1.5°C			
	Inside capacity	408L			
	Interior dimensions	W600×H850×D600mm			
	Exterior dimensions	W1010×H1690×D1273mm			

\*1 May differ according to set values.

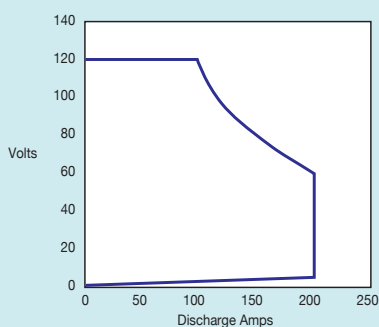
\*2 Consult ESPEC regarding applications involving parallel controls of 13 channels or more.

## Example configurable range Model: HPBT-120-200

### ■ Configurable charge range (8kW)



### ■ Configurable discharge range (12kW)



## Safety functions

- Power supply section has voltage-, current-, and power-limit alarms that can be set individually for each channel.
- Power supply section and test area both have interlock safety function for peace-of-mind.
- Test area options include pressure discharge vent, CO<sub>2</sub> fire extinguisher, H<sub>2</sub> gas meter, and CO gas meter.

## 3-1 Temperature (& Humidity) Chamber for Charge-Discharge Testing

The Temperature (& Humidity) Chamber for Charge-Discharge Testing provides easy access to specimens and features various safety functions.

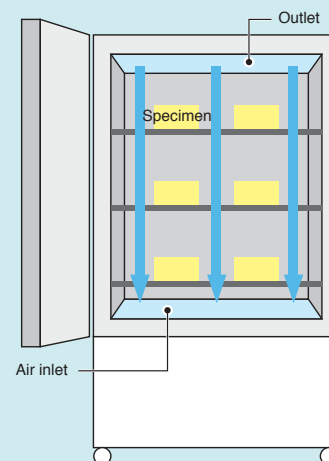
### Features

- Capacity of vertical airflow from the top is increased so that the air reaches every corner of the test area, realizing more uniform temperature distribution in the test area.
- Includes frost-free function to enable long-term continuous operation under a temperature setting of +15°C or higher, without the need to interrupt for defrosting.
- Two different supply circuits are provided. In case of failure, the temperature indicator-controller continuously monitors the temperature in the test area even if the machinery part stops operation.
- The chamber comes standard with safety features such as pressure relief vent, emergency stop button, and hand-tighten bolt door lock. In addition, you can select optional features like various detectors, fire extinguisher and cable ports to suit your application.
- The chamber will be shipped with three  $\phi 100\text{mm}$  cable ports on the right side (one for Type 2) as a standard. You can add or have them relocated as necessary.



Temperature Chamber for Charge-Discharge Testing

### ● Airflow in vertical direction



## Specifications

Model	BPU-2	BPU-3	BPU-4	BPL-2	BPL-3	BPL-4
Temperature range	-40 to +100°C					
Humidity range	—————			20 to 98%rh		
Temp. Heat up time	+20 to +100°C within 35min.					
Temp. Pull down time	+20 to -40°C within 60min.					
Capacity	225L	408L	800L	225L	408L	800L
Inside dimensions (W×H×Dmm)	500×750×600	600×850×800	1000×1000×800	500×750×600	600×850×800	1000×1000×800
Outside dimensions (W×H×Dmm)	700×1760×1343	800×1860×1543	1200×2010×1543	700×1760×1343	800×1860×1543	1200×2010×1543

## Accessories

- Door lock (hand-tighten bolt)
- Pressure relief vent (φ100 mm)
- External input/output terminal
- Emergency stop pushbutton
- 3-colored light tower
- RS-485
- φ100 mm Cable port on the right side (with rubber plug)  
Type 2: ×1, Type 3&4: ×3
- Floor load capacity of 100 kg
- Shelf support (M5-tapped)
- Analysis certificate

## Options

- 300×300 mm-pressure relief vent (replaces the standard vent)
- Automatic CO<sub>2</sub> fire extinguisher (with cylinder)
- Automatic N<sub>2</sub> fire extinguisher (jet circuit, starting valve)
- Smoke detector (with suction circuit)
- Thermal detector (specifications of thermocouple, analog setter)
- H<sub>2</sub> detector (suction circuit, detector, indicator)
- CO detector (suction circuit, detector, indicator)
- Organic solvent detector (suction circuit, detector, indicator)
- Forced air supply/exhaust damper
- Cable port position alteration
- Additional cable port (φ50/φ100 mm)
- Heavy-duty shelf & shelf bracket

## Configuration



Model : BPU-3



## 3-2 Bench-top Type Temperature (& Humidity) Chamber

In charge-discharge tests, specimens are repeatedly charged and discharged while undergoing prolonged exposure to a uniform temperature environment.

SU/SH Series bench-top chambers are capable of maintaining a stable temperature environment for long periods of time.

These compact test chambers are available with an interior volume of either 22.5L or 60L. They also come in three types that can precisely control temperature range from  $-60^{\circ}\text{C}/-40^{\circ}\text{C}/-20^{\circ}\text{C}$  to  $+150^{\circ}\text{C}$ . This allows you to select the optimal test chamber based on the shape and number of batteries.



Bench-top Type Temperature (& Humidity) Chamber

### Features

- Special movable stand with vibration-damping brackets allows two bench-top chambers to be stacked one on top of the other for effective use of space.
- High-performance temperature distribution of  $\pm 0.5^{\circ}\text{C}$  at temperatures up to  $100^{\circ}\text{C}$  and of  $\pm 0.8^{\circ}\text{C}$  at temperatures between  $100^{\circ}\text{C}$  and  $150^{\circ}\text{C}$ .
- Single phase power.

\* Temperature and humidity models also available.

### Specifications

Model		SU-221	SU-241	SU-261	SU-641	SU-661
System		Balanced Temperature Control system (BTC system)				
Temp. performance *1	Temp. range	$-20$ to $+150^{\circ}\text{C}$	$-40$ to $+150^{\circ}\text{C}$	$-60$ to $+150^{\circ}\text{C}$	$-40$ to $+150^{\circ}\text{C}$	$-60$ to $+150^{\circ}\text{C}$
	Temp. fluctuation	$\pm 0.3^{\circ}\text{C}$ ( $-20$ to $+100^{\circ}\text{C}$ )	$\pm 0.3^{\circ}\text{C}$ ( $-40$ to $+100^{\circ}\text{C}$ )	$\pm 0.3^{\circ}\text{C}$ ( $-60$ to $+100^{\circ}\text{C}$ )	$\pm 0.3^{\circ}\text{C}$ ( $-40$ to $+100^{\circ}\text{C}$ )	$\pm 0.3^{\circ}\text{C}$ ( $-60$ to $+100^{\circ}\text{C}$ )
		$\pm 0.5^{\circ}\text{C}$ ( $+100.1$ to $+150^{\circ}\text{C}$ )	$\pm 0.5^{\circ}\text{C}$ ( $+100.1$ to $+150^{\circ}\text{C}$ )	$\pm 0.5^{\circ}\text{C}$ ( $+100.1$ to $+150^{\circ}\text{C}$ )	$\pm 0.5^{\circ}\text{C}$ ( $+100.1$ to $+150^{\circ}\text{C}$ )	$\pm 0.5^{\circ}\text{C}$ ( $+100.1$ to $+150^{\circ}\text{C}$ )
	Temp. rate of change	Heat up rate	$3.2^{\circ}\text{C}/\text{min.}$	$3.2^{\circ}\text{C}/\text{min.}$	$3.2^{\circ}\text{C}/\text{min.}$	$2.9^{\circ}\text{C}/\text{min.}$
Pull down rate		$2.1^{\circ}\text{C}/\text{min.}$	$2.1^{\circ}\text{C}/\text{min.}$	$2.1^{\circ}\text{C}/\text{min.}$	$1.7^{\circ}\text{C}/\text{min.}$	$1.7^{\circ}\text{C}/\text{min.}$
Capacity		22.5L			64L	
Inside dimensions *2		W300×H300×D250mm			W400×H400×D400mm	

\*1 The performance values are based on IEC 60068-3-5:2001, JTM K07:2007 for the temperature chamber. Performance figures are given for a  $+23^{\circ}\text{C}$  ambient temperature, 65%rh, rated power supply and no specimens inside the test area. However, the lowest attainable temperature is given for a max. ambient temperature of  $+30^{\circ}\text{C}$ .

Heat-up time is the achieved time from lowest temperature to highest temperature within temperature range.

\*2 Excluding protrusions.

## 3-3 Constant Climate Cabinet

In charge-discharge tests, specimens are repeatedly charged and discharged while undergoing prolonged exposure to a uniform temperature environment.

These constant climate cabinets are capable of maintaining a stable temperature environment for long periods of time.

They are available with an interior volume of either 105L or 206L and can create a stable temperature environment of between  $-20^{\circ}\text{C}$  and  $+85^{\circ}\text{C}$  with a temperature distribution of  $\pm 2.0^{\circ}\text{C}$ .



Constant Climate Cabinet

### Features

- To enable installation in a lab or testing center, all models run on a single phase power.
- Program operation with up to nine steps of constant operation.

\* Temperature and humidity models also available.

### Specifications

Model		LU-113	LU-123
System		Balanced Temperature Control system (BTC system)	
Performance *1	Temperature control range	$-20$ to $+85^{\circ}\text{C}$	
	Temperature fluctuation	$\pm 1.0^{\circ}\text{C}$	
	Temp. extreme achievement time (Pull down time)	$+20$ to $-20^{\circ}\text{C}$ Within 130min.	
Capacity		105L	206L
Inside dimensions *2		W500×H600×D390mm	W500×H750×D590mm

\*1 The temperature chamber conforms to IEC60068-3-5:2001, JTM K07:2007 and the humidity chamber conforms to IEC60068-3-6:2001, JTM K09:2009 under the conditions of an ambient temperature of  $+23^{\circ}\text{C}$ , rated voltage, and no specimen.

\*2 Excluding protrusions.

# 3-4 Airborne Test Chamber for Batteries (Low Pressure Low Temperature Chamber)

Airborne test recreates supposed conditions of low pressure during air transportation of devices. This equipment can perform tests according to below standards.

## Features

- Magnetic coupling airflow system.
- Thorough safety chamber thanks to various safety measures such as specimen temperature protection, refrigeration circuit protection, etc.

## Test standards

- **IEC 62133 (JIS C8712)**  
Safety requirements for portable sealed secondary cells
- **IEC 62281**  
Safety of primary and secondary lithium cells and batteries during transport
- **UL 1642 Lithium Batteries**

## Specifications

Model	VLC-300
System	Mechanical cascade refrigeration system (water-cooled condenser)
Temperature range	-20°C to +80°C
Temp. fluctuation	±0.5°C
Temp. heat up time	+20°C to +80°C within 60 min.
Temp. pull down time*	+20°C to -20°C within 90 min.
Temp. uniformity	+5°C (at +20°C, 11.6kPa)
Pressure control range	93.3kPa to 10.1kPa
Attainment pressure	Below 10kPa
Inside dimensions	W800 × H800 × D700 mm
Capacity	448 L

\* With no load, no specimen, under atmospheric pressure conditions.

\* Please ask us for CE-marked product.



Airborne Test Chamber for Batteries

# 3-5 Thermal Shock Chamber TSA Series

There are various different standards for rechargeable battery temperature testing, and testing must be performed under severe conditions.

In the case of two-zone test between +125°C and -40°C, the temperature recovery time can be controlled within five minutes. These chambers comply with the temperature test standards for Li-ion batteries.



Thermal Shock Chamber

## Features

- Wide temperature control range from a high of +200°C to a low of -65°C
- Side-flow type air circulator for outstanding workpiece temperature distribution.
- Eco Mode configures setup operation time automatically, which contributes to minimum operation time. This shortens the testing time and reduces power consumption.

## Test standards

- **IEC 62133 (JIS C8712)**  
Safety requirements for portable sealed secondary cells
- **IEC62281**  
Transport tests(T-2:Thermal cycling)
- **IEC62133**  
Specific requirements and tests/Intended use/  
Temperature cycling
- **UN Manual of Test and Criteria Test T.2:  
Thermal test**
- **UL1642**  
ENVIRONMENTAL TESTS / Temperature Cycling Test
- **UL2054**  
ENVIRONMENTAL TESTS / Temperature Cycling Test
- **SAE J2464**  
Thermal shock
- **PSE**  
Safety under fluctuating temperatures

## Specifications

Model		TSA-102EL-A	TSA-202EL-W
System		Two-zone test by means of damper switching	
Performance*1	Test area	High temp. exposure range	Ambient temp. +50 to +200°C
		Low temp. exposure range	-65 to 0°C
		Temp. fluctuation*2	±0.5°C
Performance*1	Hot chamber	Temp. heat up time	Ambient temp. to +200°C Within 15 min.
		Cold chamber	Temp. pull down time
	Temp. recovery time*3		Within 5 min.
Performance*1	Temp. recovery conditions	Two-zone: High temp. exposure: +125°C 30 min. Low temp. exposure: -40°C 30 min. Power supply voltage: Rated voltage Sensor position: Upstream	
		Specimen/ specimen basket 7.5 kg	Specimen/ specimen basket 16 kg
Inside dimensions W x H x D mm		650x460x370	650x460x670
Outside dimensions W x H x D mm		1550x1900x1470	1550x1900x1770
Weight		1050 kg	1200 kg

\*1 Air-cooled: Ambient temperature of +23°C  
Water-cooled: Ambient temperature of +10 to +30°C and a cooling water temperature of +25°C

\*2 Performance shown above conforms to IEC 60068-3-5: 2001

\*3 Tolerance in temperature recovery time is based on IEC60068-2-1 and IEC60068-2-2

## 3-6 Temperature Chamber with Explosion Vent

ESPEC's temperature chamber is used in a wide range of applications from temperature tests, and drying, to heat processing in production lines.

The Temperature Chamber with Explosion Vent is equipped as standard with a pressure relief vent, acting as a precaution against explosion. This chamber is suitable for evaluation and manufacturing purpose of Li-ion batteries.

This model also features various options and full-scale safety mechanisms.

### Features

- Standard instrumentation including constant operation mode and programmed operation. Allows operation settings such as automatic start-up/automatic stop.
- Interactive setting method for easy and simple setting.
- As a precaution against explosion, the chamber is equipped with an explosion vent and a door-lock mechanism that will release the pressure from the top of the unit to the outside, ensuring safe operation.



Temperature Chamber with Explosion Vent

### Test standards

- **IEC 62133 (JIS C8712)**  
Safety requirements for portable sealed secondary cells
- **UL 1642 Lithium Batteries**
- **UN Manual of Test and Criteria, Part III**

### Specifications

Model		SPHH-102	SPHH-202	SPHH-302	SPHH-402
System		Forced hot-air circulation / ventilation system			
Performance *1	Temperature range *2	Ambient temp. +20°C to +300°C			
	Temperature fluctuation	±0.1°C at +100°C ±0.2°C at +200°C, +300°C		±0.2°C at +100°C ±0.4°C at +200°C ±0.6°C at +300°C	
	Temp. heat up time	Ambient temp. to +300°C within 60 min.			within 70 min.
Inside dimensions		W450×H450×D450 mm	W600×H600×D600 mm	W800×H800×D800 mm	W1000×H1000×D1000 mm
Capacity		91 L	216 L	512 L	1000 L

\*1 At ambient temperature +23°C (±5°C), with no specimen, forced hot-air circulation in operation.

\*2 Performance shown above conforms to JTM K05:2000.

# 3-7 Temperature & Vibration Combined Environmental Test Chamber

This combined test chamber accurately recreates usage conditions of various industrial products such as mobile electronic devices, precision machinery, automotive components, or aircraft, to evaluate the product reliability.

The Temperature & Vibration Combined Environmental Test Chamber carries out tests complying with lithium batteries safety standards. The product lineup offers great variations to be selected according to the test purpose and installation environment.

## Features

- Capable of performing vibration testing conform to IEC, UN, UL and Electrical Appliances and Material Safety Act standards relating to Li-ion batteries.
- ESPEC suggests system combination of temperature chamber and shaker according to the test purpose, installation environment, and mounting method of specimen.
- The system comes in two models with optimized test space, featuring a large viewing window and a programmed instrumentation with interactive input.

## Test standards

- **IEC 62133 (JIS C8712)**  
Safety requirements for portable sealed secondary cells
- **Table 9: Li-ion batteries, Technical Standards for Electrical Appliances and Material Safety Law**
- **UL 1642 Lithium Batteries**
- **UN Manual of Test and Criteria, Part III**
- **IEC 62281**  
Safety of primary and secondary lithium cells and batteries during transport



Temperature & Vibration Combined Environmental Test Chamber

## Specifications

### Chamber

Model	Temp. range	Inside dimensions (W×H×D mm)
PVU-3KP(H)	-40 to +100 (150) °C	600×850×600
PVU-5KP(H)		1000×1000×1000
PVG-3KP(H)	-70 to +100 (150) °C	600×850×600
PVG-5KP(H)		1000×1000×1000

### Shaker

Model	Force magnitude	Frequency	Max. load capacity*
V1	120kgf	5 to 4500Hz	66kg
V2	200kgf		
V3	300kgf	5 to 4000Hz	116kg
V4		2 to 2000Hz	122kg
V5S	600kgf	5 to 3000Hz	192kg
V6S	1000kgf		5 to 2000Hz
V7S		1500kgf	5 to 3000Hz
V8S	2000kgf		
V9S	3000kgf	5 to 2500Hz	492kg
V10S	100kgf		
S1S	200kgf	5 to 4000Hz	116kg
S2S	300kgf		
S3S	300kgf	2 to 2000Hz	292kg
S4S			
S5S	500kgf	5 to 4000Hz	196kg
S6S	1000kgf	5 to 3000Hz	192kg
S7S		5 to 2000Hz	292kg
S8S	1500kgf	5 to 3000Hz	
S9S	2000kgf	5 to 2500Hz	492kg
S10S	3000kgf		

\* For a shaft of φ125xH180mm

\* Please ask us for CE-marked product.

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