Photovoltaic Modules:
ESPEC Solutions for the Solar Market

ESPEC CORP.

The solar energy market, and specifically the solar modules sector, needs ESPEC solutions.
To conduct your quality tests with high accuracy and performance, you need the best, you need ESPEC.
Because environment is your business, and our concern.

Content

Why work with us?

✓We can meet all testing for solar modules (wide product line)

✓Our keywords are: Reliability and Top Quality

✓We have a global service network

✓We are ISO certified (9001-14001)

✓We are an eco-conscious company

1-1 Humidity Freeze Test

To determine the ability of the module to withstand the effects of high Temperature and Humidity followed by sub-zero temperatures.

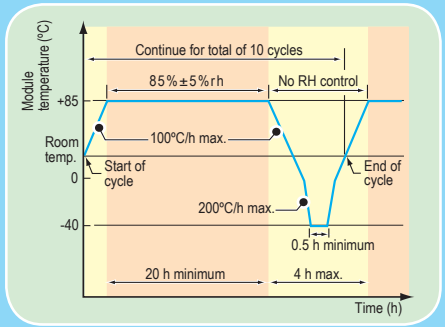
IEC61215, 10.12 (JIS C-8990)
Silicon terrestrial PV modules
-Design qualification and type approval

IEC61646, 10.12 (JIS C-8991)
Thin-film terrestrial PV modules
-Design qualification and type approval

✓+85ºC±2ºC, 85%±5%rh, <20 h ⇄ -40ºC, >0.5 h max. 4h incl.
Temperature heat-up & pull-down
✓Temperature change rate in the temperature range of 0ºC or more : <1.67ºC/min.
✓Temperature change rate in minus temperature range : <3.3ºC/min.
✓No. of cycles : 10 cycles

Tested item: Silicon terrestrial PV module

Tested item: Thin-film terrestrial PV module



1-2 Thermal Cycling Test

To make an assessment of the module's ability to withstand exposure to several environmental conditions during transportation/storage.

JIS C-8917

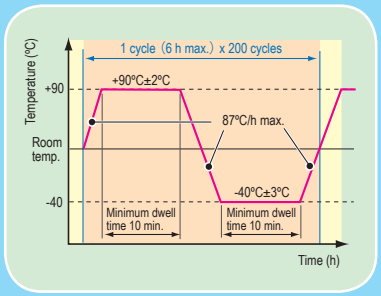
Environmental and endurance test methods for crystalline solar PV modules

Tested item: Non-light gathering type crystalline terrestrial solar PV module

JIS C-8938

Environmental and endurance test methods for amorphous solar cell modules

Tested item: Non-light gathering type amorphous terrestrial solar cell module



To determine the ability of the module to withstand thermal mismatch, fatigue and other stress caused by repeated changes of Temperature.

IEC61215, 10.11 (JIS C-8990)

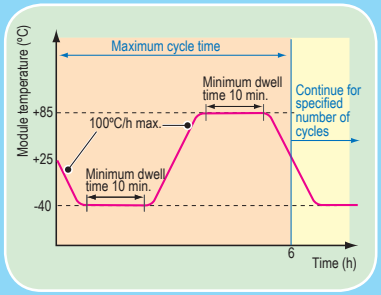
Silicon terrestrial PV modules
-Design qualification and type approval

Tested item: Silicon terrestrial PV module

IEC61646, 10.11 (JIS C-8991)

Thin-film terrestrial PV modules
-Design qualification and type approval

Tested item: Thin-film terrestrial PV module







1-3 Temperature and Humidity Cyclic Test

To determine the deterioration level for use/storage in short time under condition of temperature change in high relative Humidity

JIS C-8917

Environmental and endurance test methods for crystalline solar PV modules

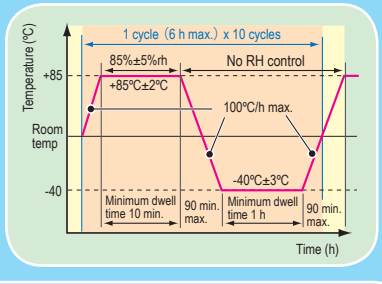
Tested item: Non-light gathering type crystalline terrestrial solar PV module

JIS C-8938

Environmental and endurance test methods for amorphous solar cell modules

Tested item: Non-light gathering type amorphous terrestrial solar cell module

- ✓+85ºC±2ºC, 85%±5%rh ⇄ -20ºC±3ºC or -40ºC±3ºC
- ✓Dwell time : high>2.5 h (-20ºC) or >10 min. (-40ºC) ⇄ low>1 h
- ✓T. change time : <90 min.
- ✓Cycle time : <6 h
- ✓No. of cycles : 10 cycles






IEC60068-2-38 6.3.1 (JIS C-8962)

Testing procedure of power conditioner for small PV power generating systems

- ✓No. of cycles : 5 cycles including low Temperature sub-cycle
- ✓Test Temperature : +25ºC±2ºC → +65ºC±2ºC → +25ºC±2ºC → +65ºC±2ºC → +25ºC±2ºC (→ -10ºC±2ºC → +25ºC±2ºC)
- ✓Test Humidity : 93%±3%rh at +65ºC±2ºC, 80% to 96%rh at +25ºC±2ºC
- ✓Temperature change time : 1.5 to 2.5h
- ✓Dwell time : 5.5 h (high) → 8 h (room temp.) → Start to 13.5 h (high) → 1 to 2 h (room temp.) (→ 3 h (low) → Start to 24 h (high))

1-4 Damp Heat Test (Temperature and Humidity Test)

To evaluate the ability of the module for use/storage under high Temperature and Humidity

IEC60068-2-78
Environmental testing - Part 2-78 :
Tests - Test Cab : Damp heat, steady state

JIS C-8917
Environmental and endurance test methods for crystalline solar PV modules

IEC60068-2-78
Environmental testing - Part 2-78 :
Tests - Test Cab : Damp heat, steady state

JIS C-8938
Environmental and endurance test methods for amorphous solar cell modules

+85ºC ± 2ºC / 85% ± 5%rh
1000 ± 12 Hours

Tested item : Non-light gathering type crystalline terrestrial solar PV module

Tested item : Non-light gathering type amorphous terrestrial solar cell module

To determine the ability of the module to withstand the effects of long-term penetration of humidity

IEC61215, 10.13 (JIS C-8990)
Silicon terrestrial PV modules -
Design qualification and type approval

IEC61646, 10.13 (JIS C-8991)
Thin-film terrestrial PV modules -
Design qualification and type approval

+85ºC ± 2ºC / 85% ± 5%rh
1000 Hours

Tested item : Silicon terrestrial PV module

Tested item : Thin-film terrestrial PV module




1-5 Temperature Test

To evaluate the ability of the module for use/storage under high Temperature

IEC60068-2-2
Environmental testing - Part 2-2 :
Tests - Test B : Dry heat

JIS C-8917
Environmental and endurance test methods for crystalline solar PV modules

IEC60068-2-2
Environmental testing - Part 2-2 :
Tests - Test B : Dry heat

JIS C-8938
Environmental and endurance test methods for amorphous solar cell modules

+85ºC ± 2ºC
1000 ± 12 Hours

Tested item : Non-light gathering type crystalline terrestrial solar PV module

Tested item : Non-light gathering type amorphous terrestrial solar cell module





2-1. Solid Walk-in Chamber

Solid walk-in chambers with higher temperature range

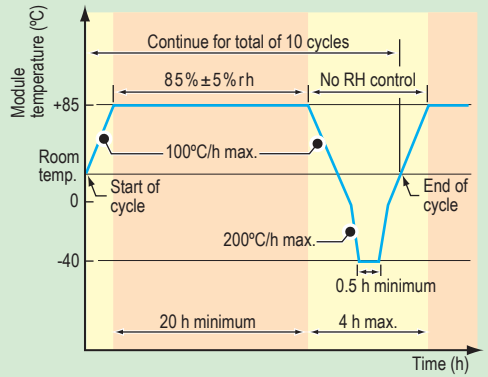
Most walk-in chambers are limited to 85°C or less, but EWS models can go to 150°C to accommodate extreme simulations for solar panel equipment. EWS chambers are solid, one-piece construction, using high-temperature fiberglass. Conventional chambers are built using panels with foam insulation that cannot withstand higher temperatures and may cause leaks where the panels attach, especially under extreme conditions.
The strength of a solid chamber allows a full-opening door for easy loading of large arrays without restriction.
Temperature and humidity performance can be configured for your test application.

Standards

Humidity Freeze Test

- IEC61215, 10.12 (JIS C-8990)
- IEC61646, 10.12 (JIS C-8991)

IEC61215 / IEC61646, 10.12



Thermal Cycling Test

- IEC61215, 10.11 (JIS C-8990)
- IEC61646, 10.11 (JIS C-8991)
- JIS C-8917
- JIS C-8938

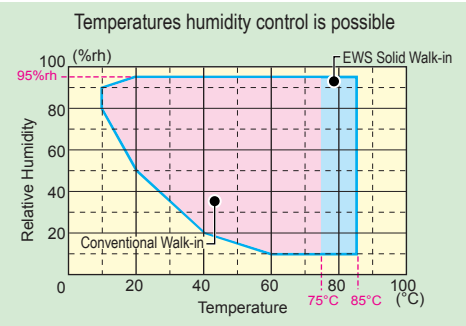
Damp Heat Test

- IEC60068-2-78 (JIS C-8917, C-8938, C-60068-2-3)
- IEC61215, 10.13 (JIS C-8990)
- IEC61646, 10.13 (JIS C-8991)

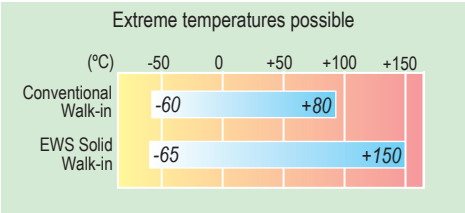
Features

- **High temperature to +150°C**
- **Low temperature to -35°C or -65°C**
- **Optional humidity control with extended range over conventional chambers**
- **Fast temperature cycling, up to 15°C/min.**
- **High volume airflow of 110 m³/minute**
- **Size can be built to your needs**

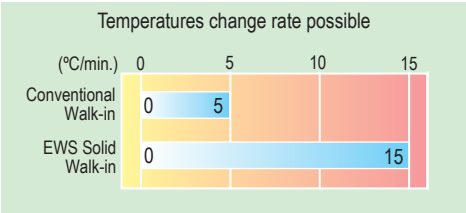
Humidity Comparison



Temperature Comparison



Change Rate Comparison



Specifications

Standard Size Examples

	EWS183	EWS364	EWS499
Interior volume	5000 L	10000 L	14000 L
Inside dimensions (W x H x D mm)	1210 x 2380 x 1770	1570 x 2380 x 2740	2150 x 2380 x 2740

Capabilities

Temperature range	-35°C or -65°C to +150°C
Humidity range	Optional
	10% to 95%rh
Change rate	1°C to 15°C/min. (Per your requirement)

System Options

Low humidity control
Distributed airflow
Rain/mist simulation
Heavy-duty floor
Separate personnel door

2-2. Large Capacity Temperature & Humidity Chamber - SM series

* Computer graphic

3570 L, Large capacity temperature & humidity chamber for various solar module tests

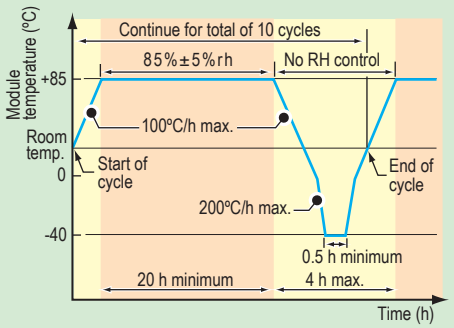
A large capacity temperature & humidity chamber SM series are used for full size of solar module evaluation. Maximum size of solar panel can be tested is 1600mm x 1600mm (without fixture).
This chamber accommodates various kinds of IEC test standards for solar module evaluation.
We promise always strong support to your test with this high reliable chamber.

Standards

Humidity Freeze Test

- IEC61215, 10.12 (JIS C-8990)
- IEC61646, 10.12 (JIS C-8991)

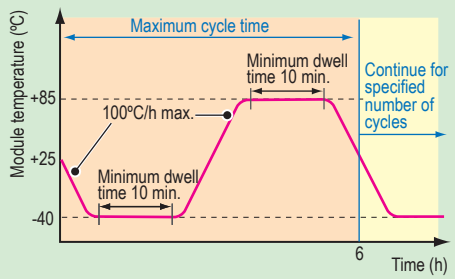
IEC61215 / IEC61646, 10.12



Thermal Cycling Test

- IEC61215, 10.11 (JIS C-8990)
- IEC61646, 10.11 (JIS C-8991)
- JIS C-8917
- JIS C-8938

IEC61215 / IEC61646, 10.11



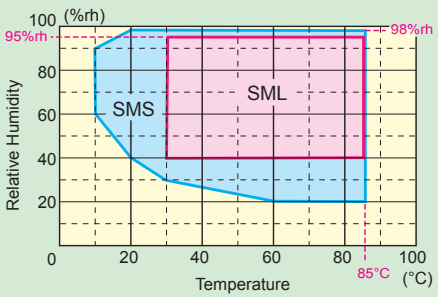
Damp Heat Test

- IEC60068-2-78 (JIS C-8917, C-8938, C-60068-2-3)
- IEC61215, 10.13 (JIS C-8990)
- IEC61646, 10.13 (JIS C-8991)

Features

- Large size interior
  3570 L, W1200 x H1750 x D1700mm
- Maximum 3°C/min. temperature pull-down rate with load (225kg, Only for SMS model)
- Optional fixture for easy handling and uniformed stress
- Highly accurate temperature and humidity control

Humidity control range



Specifications

Model	Large capacity temperature & humidity chamber	
	SML-2	SMS-2
Performance		
Temperature range	-40°C to +90°C	-60°C to +180°C
Humidity range	40% to 95%rh	20% to 98%rh
Temperature & Humidity fluctuation	±0.5°C / ±3%rh*	
Temperature & Humidity uniformity	±1.5°C / ±5%rh	
Temperature heat-up time	-40°C to +90°C within 40 min.	-60°C to +180°C within 80 min.
Temperature pull-down time	+90°C to -40°C within 90 min.	+180°C to -60°C within 80 min.
Inside dimensions (W x H x Dmm)	1200 x 1750 x 1700	1200 x 1750 x 1700
Outside dimensions (W x H x Dmm)	1810 x 2700 x 2926	1810 x 2700 x 3842
Interior volume	3570 L	

*Temperature fluctuation of SMS model will be ±0.7°C at above 101°C .

2-3. Climatic Chamber - Platinous Series

Top Quality and Reliability

ESPEC Platinous models are a great choice for basic temperature or Temperature & humidity testing, either steady-state or cycling conditions.

Features

- Environmentally friendly design
- Stainless steel exterior construction for long life
- Extremely accurate and very reliable
- Standard features : clear view window, cable - port, adjustable shelves and casters
- From 120 L to 800 L

Standards

Thermal CyclingTest

- IEC61215, 10.11 (JIS C-8990)
- IEC61646, 10.11 (JIS C-8991)
- JIS C-8917
- JIS C-8938

Temperature/Humidity Cyclic Test

- JIS C-8917
- JIS C-8938

Low Temperature Sub-Cycle Test

- IEC60068-2-38, 6.3.1 (JIS C-8962)

Damp Heat Test

- IEC60068-2-78 (JIS C-8917, C-8938, C-60068-2-3)
- IEC61215, 10.13 (JIS C-8990)
- IEC61646, 10.13 (JIS C-8991)

Temperature Test

- IEC60068-2-2 (JIS C-8917, C 60068-2-2)
- IEC60068-2-2 (JIS C-8938, C 60068-2-2)

Specifications

Temperature & Humidity Chamber

Model		Temperature	Humidity	Interior volume	Cleanliness
PH	Temperature & Humidity Chamber	+10°C to +100°C	60% to 98%rh	120 L 225 L 408 L 800 L	none
PR	Temperature & Humidity Chamber	-20°C to +100°C -20°C to +150°C	20% to 98%rh		
PL	Low Temperature & Humidity Chamber	-40°C to +100°C -40°C to +150°C			
PWL	Ultra View Temperature & Humidity Chamber	-40°C to +120°C		225 L, 408 L, 800 L	
PSL	Ultra Low Temperature & Humidity Chamber	-70°C to +100°C -70°C to +150°C		306 L 800 L	
PDR	Low Humidity Type Temperature & Humidity Chamber	-20°C to +100°C	5% to 98%rh	408 L 800 L	
PDL	Low Humidity Type Low Temperature & Humidity Chamber	-40°C to +100°C			
PCR	Clean Temperature & Humidity Chamber	-20°C to +100°C	30% to 90%rh	312 L	Class 100

Temperature Chamber

Model		Temperature	Humidity	Interior volume
PU	Low Temperature Chamber	-40°C to +100°C -40°C to +150°C	none	120 L, 225 L, 408 L, 800 L
PWU	Ultra View Temperature Chamber	-40°C to +120°C		225 L, 408 L, 800 L
PG	Ultra Low Temperature Chamber	-70°C to +100°C -70°C to +150°C		306 L, 800 L

2-4. Ultra View Temperature (& Humidity) Chamber - Platinous Series

* Computer graphic

Highly accurate control with a large viewing window, most appropriate for solar modules and panels

Ultra View Temperature (& Humidity) Chamber is equipped with a large observation window that has been developed to satisfy our customers' wish "to see" "to touch" "to operate" and "to measure", which are fundamentals of environmental test and evaluation test.

Standards

Thermal CyclingTest

- IEC61215, 10.11 (JIS C-8990)
- IEC61646, 10.11 (JIS C-8991)
- JIS C-8917
- JIS C-8938

Temperature/Humidity Cyclic Test

- JIS C-8917
- JIS C-8938

Low Temperature Sub-Cycle Test

- IEC60068-2-38, 6.3.1 (JIS C-8962)

Damp Heat Test

- IEC60068-2-78 (JIS C-8917, C-8938, C-60068-2-3)
- IEC61215, 10.13 (JIS C-8990)
- IEC61646, 10.13 (JIS C-8991)

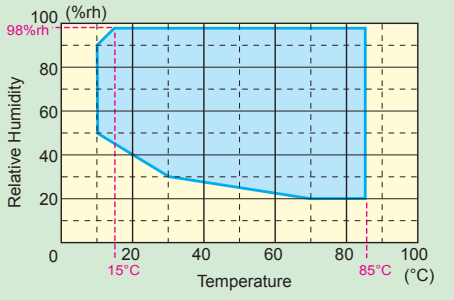
Temperature Test

- IEC60068-2-2 (JIS C-8917, C 60068-2-2)
- IEC60068-2-2 (JIS C-8938, C 60068-2-2)

Features

- High performance with a large viewing window
- Highly accurate temperature and humidity control by an unique electronic auto-expansion valve
- Large window & fluorescent lights for optimum visibility
- Clear view without dew condensation
- Optional reach-in ports on the door, clear from dew condensation

Humidity control range



Type 3 : Fluorescent light 1 set

Specifications

Model			Low temperature and humidity chamber		
			PWL-2KP	PWL-3KP	PWL-4KP
Utility requirements					
	Maximum current	200V	22.5A	23.0A	36.0A
		220V	22.0A	22.0A	34.0A
		380V	11.0A	11.0A	22.0A
		400V	10.4A	10.4A	21.0A
Performance					
	Temperature range		without reach-in ports : -40°C to +120°C / with reach-in ports : -40°C to +100°C		
	Humidity range		20% to 98%rh		
	Temperature fluctuation	-40°C to +100°C	±0.3°C		
		+100.1°C to +120°C	±0.5°C		
	Humidity fluctuation		±2.5%rh		
	Temperature uniformity	-40°C to +100°C	±0.5°C		±1.0°C
		+100.1°C to +120°C	±0.75°C		±1.5°C
	Humidity uniformity		±3.0%rh		±5.0%rh
	Temperature heat-up time		-40°C to +100°C within 45 min. / -40°C to +120°C within 50 min. (without reach-in ports)		
	Temperature pull-down time		+20°C to -40°C within 55 min.		
Equipment					
	Viewing window effective size (W×Hmm)		470×720	570×820	970×970
	Reach-in ports (Optional)		none	Inside diameter Ø130mm (2 ports or 4 ports can be chosen) Door hinges for opening and closing (The covers can be detached)	
Inside dimensions (W×H×Dmm)			500×750×600	600×850×800	1000×1000×800
Outside dimensions (W×H×Dmm)			910×1590×1039	1010×1690×1239	1410×1970×1239
Interior volume			225 L	408 L	800 L

Temperature only models are also available.

2-5. Ultra Low Temperature Chamber - Mini Subzero

Capable of ultra low temperature as low as -85°C with ESPEC unique controller

This chamber embodies the high performance, reliability, and durability of a full-size chamber. Select either the P-Instrumentation for programming temperature cycling or the T-Instrumentation for constant operation. Also choose from two very wide temperature ranges that use environmentally-friendly HFC refrigerants.

Model

MC- □ 11 □

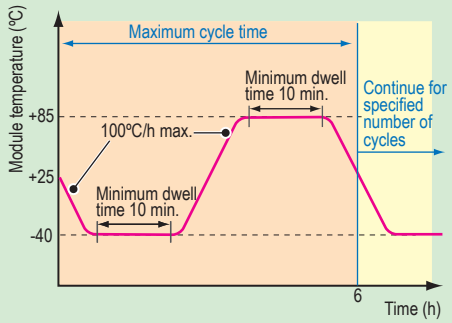
- Instrumentation
  - P : P-Instrumentation (Program operation)
  - T : T-Instrumentation (Constant operation)
- 7 : -70ºC to +100ºC
- 8 : -85ºC to +180ºC

Standards

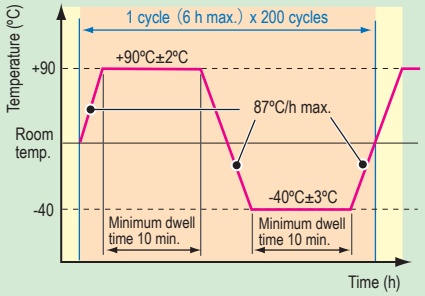
Thermal Cycling Test

- **IEC61646, 10.11 (JIS C-8991)**
- **JIS C-8917**
- **JIS C-8938**

IEC61215 / IEC61646, 10.11



JIS C-8917 / JIS C-8938



Features

- Compact type high-performance chamber with reliability and durability
- Select either controller for programming temperature cycling (P-instrumentation) or constant operation (T-instrumentation)
- Wide temperature range
- Accurate temperature control

Instrumentation panel (Programmable type)

Specifications

Model	MC-711	MC-811
Temperature range	-75ºC to +100ºC	-85ºC to +180ºC
Inside dimensions (W x H x Dmm)	400 x 400 x 400	
Outside dimensions (W x H x Dmm)	940 x 1200 x 610	
Interior volume	64 L	
Weight	155 kg	

2-6. Standard Industrial Oven & Large Capacity Oven

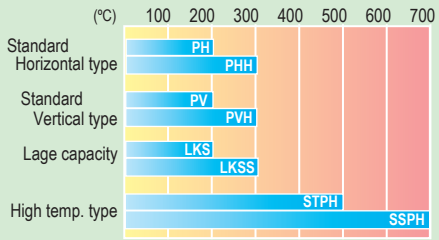
A wide variety of accurate, high quality ovens

ESPEC's precision industrial ovens are used for temperature testing, as well as heat treatment and drying during manufacturing.
For solar energy market applications, ESPEC ovens provide the suitable evaluation for modules' use/ storage under high temperature conditions.
Selection among a variety of sizes and ranges.

Features

- **Horizontal and vertical configurations**
- **From 91 L to 4050 L**
- **Temperature ranges to 200, 300, 500 or 700°C**
- **Very tight temperature control**

Temperature ranges



Standards

Temperature Test

- **IEC60068-2-2 (JIS C-8917, C 60068-2-2)**
- **IEC60068-2-2 (JIS C-8938, C 60068-2-2)**

JIS C-8917 / C-8938 B-1

Evaluation of the ability of the module for use/ storage under high temperature

+85±2°C 1000 ± 12 Hours

Specifications

Standard Industrial Oven

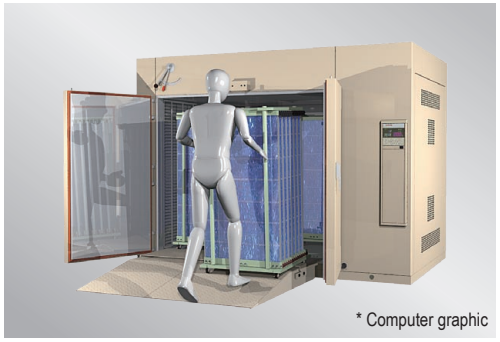
Model	Horizontal type				Vertical type			
	PH-101	PH-201	PH-301	PH-401	PV-211	PV-221	PV-231	PV-331
Power supply	200/220V AC 1Ø 50/60Hz 230/240V AC 1Ø 50/60Hz		200/220V AC 3Ø 50/60Hz		200/220V AC 1Ø 50/60Hz 230/240V AC 1Ø 50/60Hz		200/220V AC 3Ø 50/60Hz	
Temperature range	+20°C above room temperature to +200°C				+20°C above room temperature to +200°C			
Inside dimensions (W x H x Dmm)	450 x 450 x 450	600 x 600 x 600	800 x 800 x 800	1,000 x 1,000 x 1,000	600 x 600 x 600	600 x 900 x 600	600 x 1,200 x 600	800 x 1,200 x 800
Interior volume	91 L	216 L	512 L	1000 L	216 L	324 L	432 L	768 L

Horizontal type

Vertical type

Large Capacity Oven

Model	LKS-3B	LKS-4B
Power supply	200V AC 3Ø 50/60Hz 220V AC 3Ø 60Hz	
Temperature range	+40°C above room temperature to +200°C	
Inside dimensions (W x H x Dmm)	1500 x 1500 x 1000	1800 x 1500 x 1500
Interior volume	2250 L	4050 L



* Computer graphic

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