

# Vacuum Oven

VAC



# Vacuum ovens featuring six operation modes to handle a wide range of applications

This vacuum ovens have been developed with refined functions to offer greater ease of use and enhanced production-line features, offering six operation modes to suit a range of applications, including Expert Mode, which effectively adjusts the depressurization rate during high-volume processing of identical specimens, and up to nine step programming.

Such as a double-layered interior construction to provide excellent temperature uniformity and an overall design emphasis on ease-of-operation and safety, vacuum ovens have appropriate features as production-line ovens.

VAC - 100PR



VAC - 200PR





VAC - 300PR



\*Pirani vacuum gauge and temperature and pressure recorder are optional.

## Can control depressurization rate adjusting to specimens



Jog dial for fine depressurization control



Pa readout



Torr readout



Curved viewing window

- **Expert Mode demonstrates its capabilities in repeated high-volume processing**

A jog dial is provided for fine control of the depressurization rate.

The depressurization schedule used is stored and can be called up for subsequent operations to ensure accurate processing. Expert Mode eliminates the fussing with valve controls for each process, and is ideally suited for repeated high-volume processing of identical specimens.

- **Torr-Pa automatic selection function**

Display readings are given in Pa in accordance with the shift toward SI pressure units. Torr-Pa automatic selection function is equipped as a standard; however, the display panel can be switched to the previously used Torr units by touching the button on the panel.

- **Viewing window for full view of specimen**

The viewing window is curved very slightly to eliminate exterior reflections. In Expert Mode, the jog dial can be used to adjust the depressurization rate accordingly while checking the defoaming of the resin inside the oven, preventing problems in the specimen caused by rapid pressure changes.

# Control operation

## Vacuum control modes to suit a wide range of applications

### ● Six operation modes to be chosen

The ovens feature a selection of six operating modes, including constant operation, allowing timer-controlled start and stop (on/off); programs 1 and 2, allowing programmed operation of up to nine steps; gas exchange mode; vacuum gradient control mode; and expert mode, allowing repeated high-volume processing of identical specimens. These modes eliminate troublesome operations and use program controls to meet operations to particular applications.

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### Six operation modes

Program	Typical pattern	Details	Main applications
Constant value	<p>The graph shows Temperature (solid red line) starting at 0, rising to a constant level of approximately 125 (x 10<sup>3</sup>Pa), and Pressure (dashed blue line) starting at 200, falling to a constant level of approximately 25 (x 10<sup>3</sup>Pa).</p>	<ul style="list-style-type: none"> <li>• Sets the constant operation temperature and pressure.</li> <li>• Timer-controlled setting "on/off" is also possible.</li> </ul>	Vacuum drying
Program 1 Program 2	<p>The graph shows two steps. In Step 1, Temperature (solid red line) rises to a constant level and Pressure (dashed blue line) falls to a constant level. In Step 2, Temperature (solid red line) rises to a higher constant level and Pressure (dashed blue line) rises to a higher constant level.</p>	<ul style="list-style-type: none"> <li>• Two temperature and pressure program patterns can be set in up to nine steps.</li> <li>• Pressure decrease and increase time cannot be controlled (ramp operation).</li> </ul>	Vacuum hardening
Gas exchange	<p>The graph shows three pressure cycles in Step 1, where Pressure (dashed blue line) repeatedly falls and rises. In Step 2, Temperature (solid red line) rises to a constant level and Pressure (dashed blue line) remains constant.</p>	<ul style="list-style-type: none"> <li>• Gas exchange is performed three times in step one. Temperature cannot be controlled, however.</li> <li>• Temperature and pressure can be programmed and controlled from step 2 to step 9.</li> </ul>	Drying in N <sub>2</sub> gas
Vacuum gradient control	<p>The graph shows Temperature (solid red line) rising to a constant level in Step 1. In Step 2, Pressure (dashed blue line) falls to a constant level. In Step 3, Pressure (dashed blue line) rises to a constant level.</p>	<ul style="list-style-type: none"> <li>• The pressure decrease and increase times can be controlled (ramp operation).</li> <li>• Temperature can be programmed and controlled in up to step 9.</li> </ul>	Defoaming vacuum drying
Expert	<p>The graph shows Pressure (dashed blue line) falling to a constant level in Step 1. In Step 2, Temperature (solid red line) rises to a constant level and Pressure (dashed blue line) remains constant.</p>	<ul style="list-style-type: none"> <li>• The jog dial can be used to control, record, and reproduce depressurization.</li> <li>• The depressurization process can be recorded in step 1 only. (Pressure increase cannot be controlled.)</li> <li>• Temperature and pressure can be programmed and controlled in up to step 9.</li> </ul>	Defoaming

## Excellent temperature uniformity and ease of operation

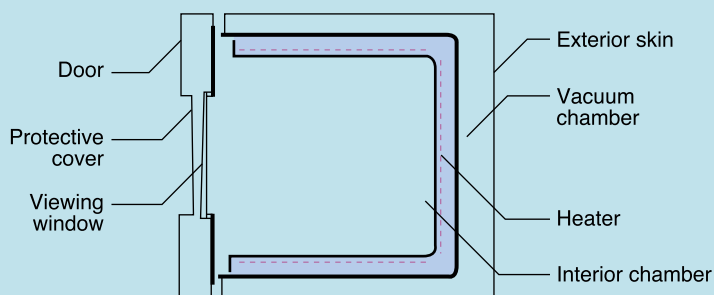


Inside chamber

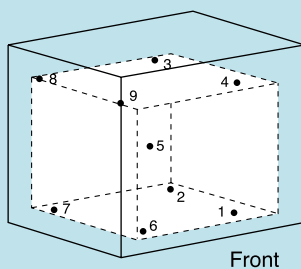
### ● Double-layered interior construction for great temperature uniformity

The vacuum chamber interior features a second chamber, forming a double-layered construction. A heater is installed on the exterior of the inner chamber to minimize heat loss and to improve temperature uniformity (−4 for VAC-300PR). This allows even more uniform heat treatment, and also improves machine efficiency by dramatically reducing the time required to heat up.

### Double-skin interior construction



### Interior chamber temperature uniformity measurement data



Front

Model: VAC-300R  
 Temperature setting: + 200°C  
 Pressure: 400 Pa vacuum  
 Ambient temperature: + 27°C

\*Temperature uniformity for interior center (point 5) and eight interior points with no specimen.

Point	Temp.
1	+ 181.7
2	+ 189.1
3	+ 188.6
4	+ 185.6
5	+ 186.6
6	+ 186.2
7	+ 190.5
8	+ 188.6
9	+ 189.7
Uniformity	± 4

The measurements above are typical values, and are presented for reference only.

### ● Design emphasizing ease of use

A space at least 110 mm high is provided underneath the stand to allow easy loading and unloading of specimens using a hand lift during high-volume processing. The design also includes ease-of-use features, such as door handles with a recoil-free locking mechanism for smooth opening and closing.

### ● Equipment range to suit production scale

Ovens are available in three types, with internal dimensions of 45cm × 45cm, 60cm × 60cm, and 80cm × 80cm. Rotary vacuum pumps are used.

### ● Suitable for a wide range of usages

The ovens are ideal for wide range of applications, particularly in electronic component production processes, including defoaming when mixing silicone rubber or resins in LED production, deaerating during various types of resin forming, hardening when injecting epoxy for hybrid ICs, and drying electronic components after washing.

# User-friendly

## ● Special safety features

A protective cover is provided on the front of the viewing window to prevent burn injuries and also to prevent damage to the window. Moreover the double-layered interior construction, which ensures that exterior surfaces remain cool.

## ● Supports a centralized control system for environmental testing (CMS-J30 sold separately)

This is a fully customizable system that provides centralized control, centralized monitoring, remote operation and specimen data management of ESPEC products (up to 32 units of which 16 are dedicated to centralized monitoring) by the use of a PC. Windows® 2000 software provides easy-to-use data processing functions, such as program editing.

## ● Environmental testing centralized control software ERC-100M/300M (sold separately)

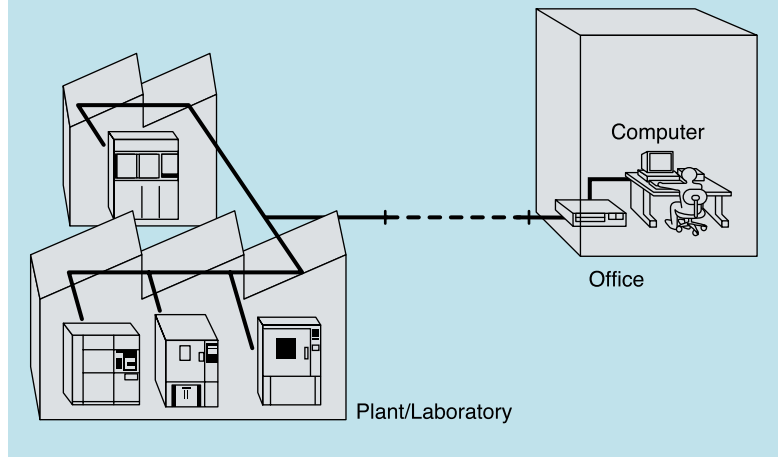
The application software allows centralized monitoring, control, and remote operation of up to 16 ESPEC chambers. (monitoring only for 300M) You can drastically save time while your PC collects data for analysis and graphing.

\*Monitoring only for vacuum oven.

\*Software: English, Chinese (in simplified characters), Japanese (English and Japanese only for ERC-300M)

\*For further inquiries, please contact your nearest ESPEC office.

**A personal computer can control and monitor test chambers, and store the test data.**



## SPECIFICATIONS

Model		VAC-100PR	VAC-200PR	VAC-300PR
Power supply *1		200V AC 1 200V AC 3 220V AC 1 230V AC 1 240V AC 1	2W 50/60Hz 3W 50/60Hz 2W 60Hz 2W 50/60Hz 2W 50/60Hz	200V AC 3 3W 50/60Hz
Maximum power consumption		2.75kVA	3.65kVA	2.75kVA
Pressure control system		Fuzzy control		
Operating temperature		+ 5 to +35 ( + 41 to + 95° F)		
Temperature control range		+ 40 to + 200 ( + 104 to + 392° F)		
Temperature fluctuations		± 0.5 (vacuum), ± 1 (atmospheric)		
Temperature heat-up rate *2		Within 50 min	Within 70 min	Within 80 min
Pressure control range		933 to 1 [ $\times 10^2$ Pa]		
Attainment pressure *3		Below 133 Pa		
Pressure pull-down rate *3		Within 7 min	From atmospheric pressure to 133 Pa Within 15 min	Within 30 min
Pressure recovery time		Within 4 min	Inlet open to atmosphere Within 8 min	Within 15 min
Construction	Exterior material	Enameled cold-rolled steel plate		
	Vacuum chamber	Stainless steel plate (SUS304)		
	Interior material	Stainless steel plate (NSS430M3)		
	Viewing window	W324 × H336 mm W13 × H13.4 inch		
	Insulation	Glass wool		
	Heater	Mica heater		
	Inlet	R 1/4 inch, max. operating pressure 0.05 MPa (0.5 kg/cm <sup>2</sup> G)		
	Outlet	28 mm external dia. rubber hose connection		
Oil rotary vacuum pump	Motor	200V AC 1 50/60Hz 550W		200V AC 3 50/60Hz 550W
	Design exhaust speed	200L/min (50Hz), 240L/min (60Hz)		
	Attainment pressure	$6.7 \times 10^{-2}$ Pa		
	Auxiliary functions	Gas ballast valve, oil mist trap		
Fittings		Adjuster feet and casters (free moving) ( × 4 each)		
Effective inside capacity (L)		91	216	512
Effective inside dimensions		W450 × H450 × D450 mm (W18 × H18 × D18 inch)	W600 × H600 × D600 mm (W24 × H24 × D24 inch)	W800 × H800 × D800 mm (W32 × H32 × D32 inch)
Outside dimensions *4		W870 × H1450 × D662 mm (W34.8 × H58 × D26.5 inch)	W1020 × H1600 × D812 mm (W40.8 × H64 × D32.5 inch)	W1220 × H1800 × D1012 mm (W48.8 × H72 × D40.5 inch)
Weight (kg)		320 (320 for 220, 230, 240V)	400 (408 for 220, 230, 240V)	610

\*1: Voltage fluctuations within ± 10% of rated voltage.

\*2: Time to attain stable temperature the center of chamber with no specimen, under vacuum with ambient temperature of +23°C and temperature setting of +200°C.

\*3: Constant temperature inside chamber with no gas generation from specimen.

\*4: Excluding protrusions.

## SAFETY DEVICES

Leakage breaker  
Overheat protector  
Thermal fuse  
Thermal relay

## ACCESSORIES

Shelves  
Stainless steel punched trays ..... 2  
 VAC-100 PR: W435 × H13.5 × D435 (mm)  
 Maximum load: 30kg per shelf  
 (evenly-distributed load)  
 VAC-200 PR: W585 × H13.5 × D585 (mm)  
 Maximum load: 30kg per shelf  
 (evenly-distributed load)  
 VAC-300 PR: W785 × H13.5 × D785 (mm)  
 Maximum load: 20kg per shelf  
 (evenly-distributed load)

\*Two shelves are included as standard, and up to five can be fitted.  
Total specimen weight must not exceed 100kg.

User's manual ..... 1  
 Vacuum pump instruction manual ..... 1  
 Warranty ..... 1

## TEMP & PRESSURE INDICATOR-CONTROLLER

Operation mode	Constant value	Constant temperature/pressure operation Auto start/stop possible
	Programs 1, 2	Program operation in up to nine steps Auto start possible
	Gas exchange	Auto gas exchange in step 1 Program operation after step 2 Up to nine steps, auto start possible
	Vacuum gradient control	Program operation in up to nine steps Gradient control possible only for pressure Auto start possible
	Expert	Teaching control operation in step 1 Program operation after step 2 Up to nine steps, auto start possible
	Setting range	Temperature: 0 to +200 Pressure: 0 to 1013 × 10 <sup>2</sup> Pa Time: 1 minute to 99 hours 59 minutes
	Setting and indication resolution	Temperature: 1 Pressure: 1 × 10 <sup>2</sup> Pa Time: 1 minute
	Communications function	E-BUS
	Alarm functions	Upper and lower temperature and pressure limit alarm Temperature and pressure sensor disconnection alarm Overheat protector operation alarm Thermal fuse disconnection alarm CPU memory error alarm Motor valve malfunction alarm Vacuum pump thermal relay operation alarm



DANGER

Do not use specimens which are explosive or flammable, or which contain such substances. To do so could be hazardous, as this may lead to fire or explosion.



CAUTION

Read the User's manual thoroughly prior to use to ensure correct operation of the vacuum pump.

## OPTIONS

### Hermetic terminals for voltage application

Used when applying to specimens voltage.

- Specifications: Hermetic terminal (four-core)
- Max. current: 6 A
- Max. voltage: 200V AC, 250V DC
- Mounted location: Oven rear

\* Up to four hermetic connectors can be connected to terminals for voltage application and thermocouples.

### Hermetic terminals for thermocouples

Used for connecting to thermocouples from specimens or interior chamber.

Specifications: Hermetic terminal (eight-core, four pairs)

Mounted location: Oven rear

\* Up to four hermetic connectors can be connected to terminals for thermo-couples and voltage application.



Hermetic terminal for voltage application

Hermetic terminal for thermocouples

### Terminal for recorder

Output interior temperature and pressure via 1 to 5V DC linear output.

Temperature: + 20 to + 220 , 1V to 5V

- Pressure: 0 to 106.7 kPa, 1V to 5V
- Mounted location: Oven rear (above inlet)

### Pirani vacuum gauge

Pressure is displayed digitally, while this gauge is used to measure pressure accurately below 2,700 Pa.

- Measuring range: 0.4 to 2,700 Pa
- Measuring accuracy: within  $\pm 3\%$  of full-scale 100% equivalent on linear scale

\* The temperature and pressure recorder cannot be fitted to the VAC-100PR if the Pirani vacuum gauge is installed.



Pirani vacuum gauge

### Paperless recorder

Records temperature and pressure inside the chamber. Additional inputs may also be recorded.

Temperature range: + 20 to + 220

Pressure range: 0 to 106.8kPa

Number of inputs: Temperature 1

Pressure 1

(4 more but turned OFF\*1)

Data saving cycle: 5 sec

External recording media:

CF memory card (32MB)

\*1 Settings may be modified.

\* The Pirani vacuum gauge cannot be fitted to the VAC-100PR if the paperless recorder is installed.

### Temperature and pressure recorder

Records the interior oven temperature and pressure.

- Temperature range: + 20 to + 220
- Pressure range: 0 to 106.7 kPa
- Inputs: Temperature ( $\times 1$ ), Pressure ( $\times 1$ )
- Recording method: Intermittent recording

\* The Pirani vacuum gauge cannot be fitted to the VAC-100PR if the temperature and pressure recorder is installed.

### Integrating hour meter

Indicates the total integrated operating time.

This is used as a guide for time recording during continuous operation, as well as for maintenance and inspection timing.

- Mounting location: Bottom of operating panel



Integrating hour meter

## OPTIONS

### External alarm terminal

If the safety device of the chamber activates, an error is notified to a distance via the external alarm terminal.

- Power capacity: 250V AC, 3A
- Operation: Connection output when error occurs (closed)
- Mounted location: Oven rear (above inlet)

### Signal tower

Illuminates to indicate errors when the safety device activates.

- Color: Red
- Mounting location: Top panel

### Inlet filter

Filters the air drawn into the depressurized interior.

- Pore size: 0.2  $\mu$ m
- Max. pressure: 411.9 kPa (4.2 kg/cm<sup>2</sup>)
- Connector: NPT 1/8, male screw
- Mounting location: Inlet

### Cold trap

Cools and removes moisture and organic solvents contained in the outlet air before being drawn into the vacuum pump.

(Separate from oven)

- Outside dimensions: W306 × H700 × D355mm

### Vacuum pump outlet port

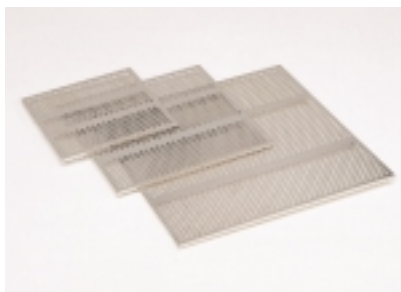
Vents gas from the vacuum pump externally.

- Outside connector: NW25 (ISO standard)
- Connection: Quick coupling Center ring with O-ring (not provided)
- Mounting location: Shelf rear

### Shelves

Stainless steel punched trays

\* Up to five can be fitted inside the oven.



shelves

### Vacuum pump oil (one-liter can)

Used when maintaining the vacuum pump.

### Power cord

Length from oven: 5 and 10m (two extra cords provided)

\* The standard cord provided is 2.5 m from the oven.

**ESPEC CORP.** <http://www.espec.co.jp/english>

**Head Office**

3-5-6, Tenjinbashi, Kita-ku, Osaka 530-8550, Japan

Tel: 81-6-6358-4741 Fax: 81-6-6358-5500

**Europe Office**

Tel: 49-6196-77-99980 Fax: 49-6196-77-99985

**ESPEC NORTH AMERICA, INC.**

Tel: 1-616-896-6100 Fax: 1-616-896-6150

**ESPEC EVALUATION & TEST SYSTEMS, INC.**

Tel: 1-408-433-2295 Fax: 1-408-433-2296

**ESPEC ENVIRONMENTAL EQUIPMENT (SHANGHAI) CO., LTD.**

**Head Office**

Tel: 86-21-58303322 Fax: 86-21-58661781

**BEIJING Rep. Office**

Tel: 86-10-64627025 Fax: 86-10-64627036

**GUANGZHOU Rep. Office**

Tel: 86-20-83317826 Fax: 86-20-83317825

**SHENZHEN Rep. Office**

Tel: 86-755-83674422 Fax: 86-755-83674228

**SUZHOU Rep. Office**

Tel: 86-512-68664007 Fax: 86-512-68601994

**ESPEC TEST TECHNOLOGY (SHANGHAI) CO., LTD.**

Tel: 86-21-68798008 Fax: 86-21-68798088

**ESPEC (MALAYSIA) SDN. BHD.**

Tel: 60-3-89451377 Fax: 60-3-89451287



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R001



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RE 009



**ISO 9001/JIS Q 9001**

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**ISO 14001 (JIS Q 14001)**

**Environmental Management System Assessed and Registered**

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