

Quality is more than a word

ESPEC

Thermal Shock Chamber

TSD-100



Large-capacity two-zone chamber capable of exposing specimens to a uniform thermal stress.

Two-zone thermal shock chamber ideally suited for Japanese and international test standards such as MIL, IEC or JASO .

With its 100L test area, and its outstanding thermal uniformity characteristics, the TSD Thermal Shock Chamber from ESPEC can test specimens under a uniform thermal stress, and is ideally suitable for a wide range of applications, from research and development to inspection or production.





*The viewing window, paperless recorder and additional overheat protector are optional.

Performance

Meeting the high performance required by today's test standards

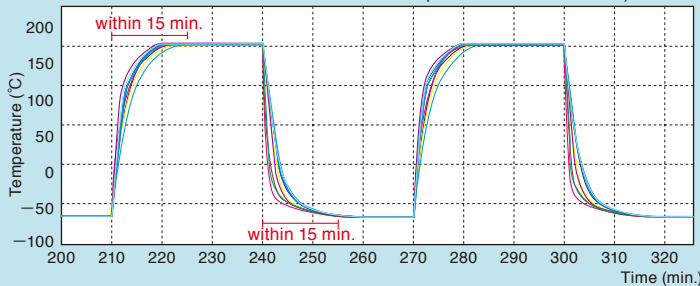
● Specimen temperature recovery (example) (based on MIL-STD-883 condition C)

Test conditions

High temp. exposure: +155°C for 30 min.
Low temp. exposure: -68°C for 30 min.
Specimens: ICs, 10 kg

Temperature uniformity measurement method

Thermocouples were embedded in 10 ICs placed on two levels in each of the corners and in the center of a specimen basket. (Specimens with embedded thermocouples were placed beneath other ICs.)



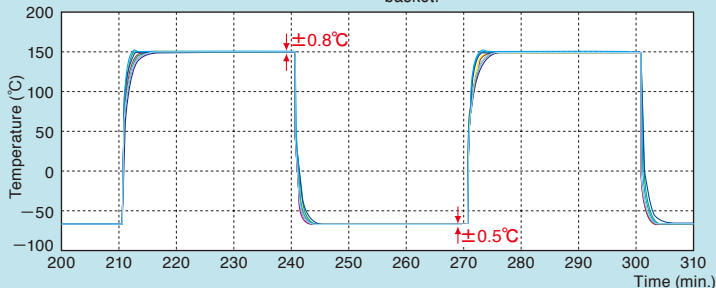
● Temperature uniformity performance (example)

Test conditions

High temp. exposure: +150°C for 30 min.
Low temp. exposure: -65°C for 30 min.
Specimens: ICs (×10)

Temperature uniformity measurement method

Thermocouples were attached to the surface of 10 ICs placed on two levels in each of the corners and in the center of a specimen basket.



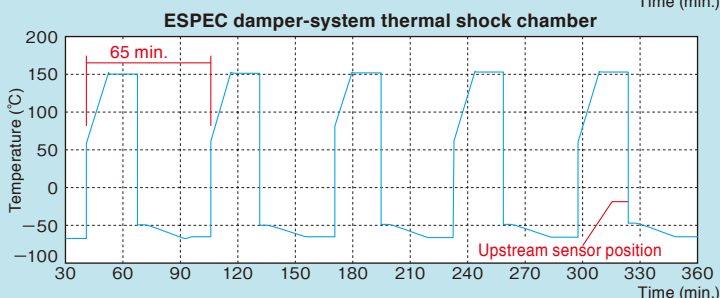
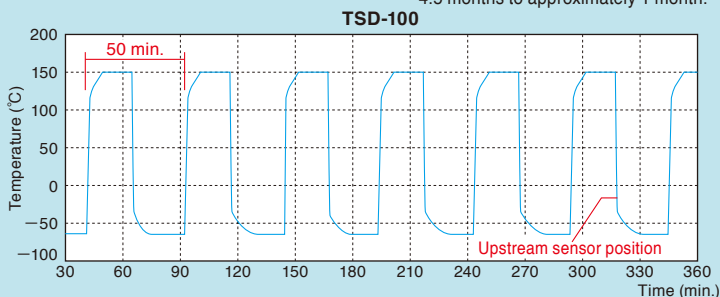
● Test time comparison (example)

Test conditions

High temp. exposure: +150°C, 15 min. after recovery
Low temp. exposure: -65°C, 15 min. after recovery
Specimens: ICs, 10kg
Control points: Upstream of sensor positions

Measurements

Test time reductions of approximately 15 minutes per cycle compared to other ESPEC models. For 3,000 cycles testing this cuts previous test times from 4.5 months to approximately 1 month.



● Temperature recovery time shortened with the two-zone system

During testing of 10 kg of plastic molded ICs, at temperature settings of +150°C and -65°C, the specimen temperature recovers in less than 15 minutes.

● Meets International standards

Designed to comply with major environmental test standards like MIL, IEC, JASO, JEITA. (p.9, 10)

● Improved temperature uniformity performance

The chamber features outstanding temperature uniformity characteristics, 30% better than previous ESPEC models during temperature recovery; it also includes features to ensure uniform air flow into the test area. Specimens are thus subject to a more uniform thermal stress, with reduced variations in test results between specimens.

● Reduced test time by means of test area transfer

Temperature exposure is quickly changed by moving the test area up and down between the high temperature and low temperature chambers, thus reducing the time taken to reach the preset temperature as well as total test duration.

● Specimen Temperature Trigger (STT) function

The TSD-100 chamber now includes a STT function. It monitors the specimen temperature using two sensors attached to the specimen and starts to count the exposure time, or proceeds to the next step once the specimen temperature reaches the preset temperature. This eliminates the need for pretesting, reducing the overall test time and ensures an accurate specimen temperature attainment. The specimen and test area temperatures can be recorded by connecting a temperature recorder.

- **Boast of a 100L capacity**

Featuring a 100L test area capacity, the chamber dramatically increases the processing capabilities and even allows to test A4-size printed circuit boards laid flat at once.

- **Smooth specimen transfer**

The “Soft-move mode” is used to reduce vibration shocks when specimens are moving between the high and low temperature chambers.

- **Test area anti-drop mechanism to protect specimens**

A braking system fitted to the drive mechanism prevents specimens from falling into the test area when the chamber stops operation.

- **Safe specimen handling thanks to ambient temperature recovery**

An ambient temperature recovery feature is included to draw in exterior air after testing is complete and return to ambient temperature, allowing specimens to be removed safely.

- **Easy wiring access**

A cable port is provided on the right side to allow easy wiring of specimen for measurement during high and low temperature cycle tests. (Optional cable port can also be provided on the left side.)

- **Viewing window (option)**

An optional viewing window can be added to check specimens and wiring during testing. The viewing window includes an interior lighting.

- **Comprehensive safety system**

A dual safety system automatically stops the test area drive mechanism if the door is left open, and automatically locks the door when the test area is in motion.



Test areas (top: high temperature chamber
bottom: low temperature chamber)

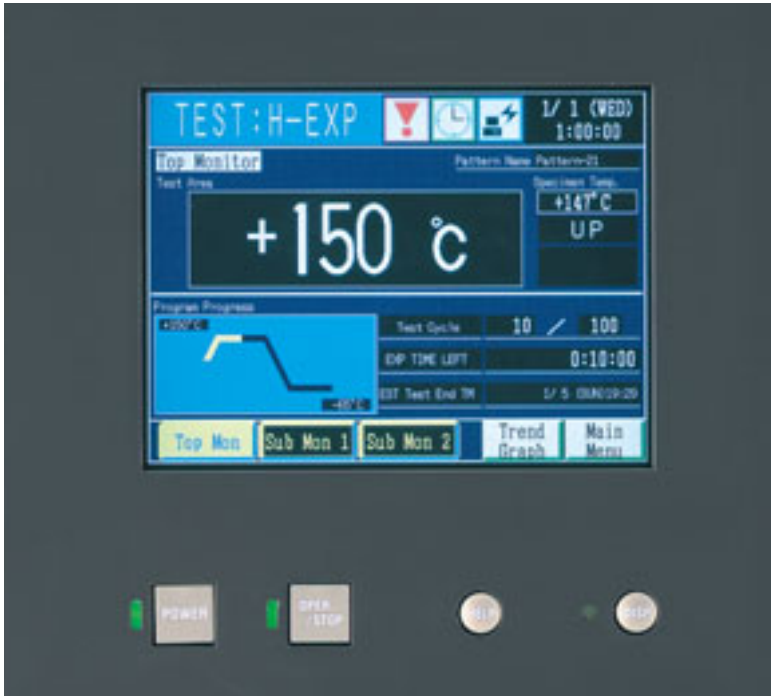


Specimen temperature measurement (specimen temperature input standard equipment: 2 locations
optional: 3 locations)



Viewing window (option)

Control operation



Instrumentation

● Color LCD interactive touch-screen system

Operation and settings simplified by the use of a touch-screen LCD display (instructions displayed on-screen). At-a-glance confirmation of test patterns, test area temperatures, temperature cycles, upstream/ downstream control, and trend graph displays.

● Door-mounted instrumentation

Instrumentation including the touch-screen controller is incorporated into the door. It reduces the overall footprint and frees up both sides of the chamber for easy access.

Setting	Interactive key input by touch panel
Display	TFT color LCD (6.5 inches)
Temperature control function	Test area: exposure temp. Hot chamber: pre-heating temp. Cold chamber: pre-cooling temp. Cold chamber: defrosting temp. PID control
Preset temperature range	High temperature: +60 to +205°C Low temperature: -77 to 0°C
Setting resolution	1°C
Input	Thermocouple type T (Copper/Copper-Nickel)
Setting and indication ranges	Preset time: 0 min. to 99 hours and 59 min. Preset cycle: 1 to 9,999 cycles
Test patterns	RAM mode: 40 patterns (registration possible) ROM mode: 20 standard test patterns (registered)
Accessory function	Timer preset Test continuity selection Overheat/ overcool protection Upstream/ downstream sensor selection STT Temperature attainment control Quick exposure control Power failure/ recovery selection Automatic defrost Temperature recovery time setting Program memory Automatic power shut-off Programmed time display Test suspension Test completion mode selection Trend graph Alarm history display Sensor calibration RS-485 communication

Control operation

INSTRUMENTATION PANEL

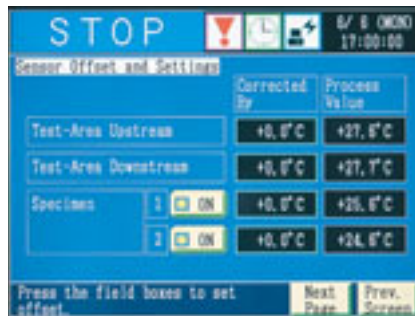
● Test detail monitor

Test details are displayed while the test is in progress.



● Product sensor settings

Possibility to enable or disable the specimen temperature sensor used for the STT function.



Same procedure for additional optional specimen temperature sensors.



● Test setting

Displays the conditions to define for the test.



● Alarm

Displayed when a problem occurs, along with a buzzer.



● Error description

Details on the failure occurred, troubleshooting and alarm reset procedure.



● Service guide

If an inspection item is selected, a description of the required maintenance steps appears. This is useful before proceeding with tests or to assist during periodic maintenance.



● Detailed description

Details the regular inspection items.



A whole range of environmentally-friendly features



Built-in paperless recorder (option)
*Rear side, on the right



Portable paperless recorder (option)

● **Reduced power consumption**

Reducing power consumption is an important issue for our customers. The TSD-100 employs number of measures, such as the use of electronic expansion valves to regulate the refrigeration capacity control, and thus reduce overall power consumption by 30% (compared to previous ESPEC models).

● **Material labeling for easy recycling**

Plastic molded components are labeled and easily detachable to make recycling easier during future disposal of the equipment.

● **Paperless recorder (option)**

2 types of paperless recorders are available (built-in or portable) to record temperatures from various sources, such as test area temperatures.

Recording is possible on Compact Flash Card or via USB port.

TEST STANDARD (TSD-100 COMPATIBILITY)

Test standard	Temperature setting		Recovery time	Soak time	Number of cycles
	High temp. (°C)	Low temp. (°C)			
IEC 60749-25 (JESD22-A104-D)	A	+85 (+10, -0)	-55 (+0, -10)	Specimen 5 to 14 min.	1/ 5/ 10/ 15 min. Not specified
	B	+125 (+15, -0)	-55 (+0, -10)	Specimen 5 to 14 min.	
	C	+150 (+15, -0)	-65 (+0, -10)	Specimen 5 to 29 min.	
	H	+150 (+15, -0)	-55 (+0, -10)	Specimen 5 to 14 min.	
	M	+150 (+15, -0)	-40 (+0, -10)	Specimen 5 to 15 min.	
IEC 60068-2-14 Na (JIS C 60068-2-14 Na DIN EN 60068-2-14 Na BS EN 60068-2-14 Na)	+200±2 +175±2 +155±2 +125±2 +100±2 +85±2 +70±2	-65±3 -55±3 -40±3 -25±3 -5±3	10% of soak time	3 hours 2 hours 1 hour 30 min. 10 min. 3 hours if not specified in product specifications	5
IEC-61747-5 Na (EIAJ ED-2531A Na)	+100±2 +95±2 +90±2 +85±2 +80±2 +75±2 +70±2 +65±2 +60±2	-50±3 -45±3 -40±3 -35±3 -30±3 -25±3 -20±3 -15±3 -10±3 -5±3 -0±3	10% of soak time	3 hours 2 hours 1 hour 30 min. 10 min. 3 hours if not specified in product specifications	5-10
MIL-STD-202 Method 107G	A	+85 (+3, -0)	-55 (+0, -3)	Upstream of specimen within 5 min.	28g and below: 15 min. 28 to 136g: 30 min. 136g to 1.36kg: 1 hour 1.36 to 13.6kg: 2 hours 13.6 to 136kg: 4 hours More than 136kg: 8 hours
	B	+125 (+3, -0)	-65 (+0, -3)		
	F	+150 (+3, -0)	-65 (+0, -5)		
MIL-STD-883 Method 1010.8	A	+85 (+10, -0)	-55 (+0, -10)	Specimen less than 15 min.	10 min. or longer after transition start At least 10
	B	+125 (+15, -0)	-55 (+0, -10)		
	C	+150 (+15, -0)	-65 (+0, -10)		
	D	+200 (+15, -0)	-65 (+0, -10)		
	F	+175 (+10, -0)	-65 (+0, -10)		

TEST STANDARD (TSD-100 COMPATIBILITY)

Test standard		Temperature setting		Recovery time	Soak time	Number of cycles
		High temp. (°C)	Low temp. (°C)			
IPC-TM-650 2.6.6	A	+125 (+3, -0)	-65 (+0, -5)	—	30 min.	5
	B	+85 (+3, -0)	-55 (+0, -5)			
SAE J1879		+150	-55	Specimen less than 15 min.	10 min. or longer after transition start	1000
JASO-D001	Type 1	+85	-40	Air 5 min.	0.2kg and below: 1 hour (+15 min.) 0.2 to 0.8kg: 2 hours (+15 min.) 0.8 to 1.5kg: 3 hours (+15 min.) More than 1.5kg: 4 hours (+15 min.)	6
	Type 2	+75				
	Type 3	+120				
	Type 4	Depends on parties involved				
JASO-D902	Type 1	+85	-40	Air 5 min.	Within 5 min. after solder joint temp. reaches ±2°C of preset temp. Or, 0.2kg and below: 0.5 hours 0.2 to 0.8kg: 1 hour 0.8 to 1.5kg: 1.5 hours More than 1.5kg: 2 hours preset temp	200
	Type 2	Depends on parties involved				
EIAJ ED-4701		Max. storage temp.	Min. storage temp.	Air 5 min. or 10% of soak time, whichever is longer	15g and below: at least 10 min. 15 to 150g: at least 30 min. 150 to 1,500g: at least 60 min. More than 1,500g: individually specified	10
EIAJ ED-4702	A	+125 (±3)	-65 (±3)	Air 5 min. or 10% of soak time, whichever is longer	30 min.	5 cycles unless otherwise specified
	B	+100 (±3)	-65 (±3)			
	C	+100 (±3)	-55 (±3)			
	D	Mounted printed circuit board max. operating temp.	Mounted printed circuit board min. operating temp.			
EIAJ ED-7407	A	+125 ± 5	-25 ± 5	—	7 min. after specimen temperature attainment	—
	B	+125 ± 5	-40 ± 5			
	C	+80 ± 5	-30 ± 5			
	D	Max. operating temp.	Min. operating temp.			

SPECIFICATIONS

Model		TSD-100		
System		2-zone transition by vertical transfer of specimens		
Performance ^{*1}	Test area	High temp. exposure range	+60 to +200°C (+140 to +392°F)	
		Low temp. exposure range	−65 to 0°C (−85 to +32°F)	
		Temp. fluctuation	±1.0°C	
	Hot chamber	Pre-heat upper limit	+205°C	
		Temp. heat up time ^{*2}	Ambient temp. to +200°C within 90 min.	
	Cold chamber	Pre-cool lower limit	−77°C	
		Temp. pull down time ^{*2}	Ambient temp. to −77°C within 90 min.	
	Temp. recovery (2-zone)	Recovery conditions	2-zone • High temp. exposure: +150°C ^{*3} 30 min. • Low temp. exposure: −65°C ^{*3} 30 min. • Power supply voltage: rated voltage • Sensor position: downstream • Specimen: Plastic molded ICs, 10kg	
		Temp. recovery time	Specimen IC temp. within 15 min.	
	Ambient recovery	Recovery conditions	• High temp. exposure: +150°C to max. +55°C • Ambient temp.: +23°C • Power supply voltage: rated voltage • Specimen: Plastic molded ICs, 10 kg	
Ambient temp. recovery time		Within 90 min.		
Construction	Exterior material		Cold-rolled rust-proofed steel plate	
	Test area material		18-8 Cr-Ni Stainless steel plate	
	Heater		Nichrome strip wire heater	
	Refrigeration unit	System	Mechanical cascade refrigeration system (water-cooled condenser)	
		Refrigerator	Scroll-type compressor	
		Expansion mechanism	Electronic expansion valve	
		Refrigerant	R404A, R23	
	Cooler		Plate fin cooler and cold accumulator	
Air circulator		Sirocco fan		
Elevating unit		Power slider (250W)		
Fittings		Cable port ID φ 100mm (×1) on right side (left side available as option), specimen power supply control terminal, time signal (×2), integrating hour meter, specimen temperature input terminal (×2)		
Inside dimensions		W710×H345×D410 mm (W27.95×H13.58×D16.14 inch)		
Test area capacity		100 L		
Test area load resistance ^{*4}		30 kg		
Outside dimensions ^{*5}		W1100×H1885×D1965 mm (W43.31×H74.21×D77.36 inch)		
Weight		Approx. 1100 kg		
Utility requirements	Allowable ambient conditions		+5 to +35°C (+41 to +95°F)	
	Power supply	200V AC 3 φ 50/60Hz	64 A	
		208V AC 3 φ 60Hz ^{*6}	62 A	
		220V AC 3 φ 60Hz	58 A	
		380V AC 3 φ 50Hz	34 A	
		400/415V AC 3 φ 50Hz ^{*7}	32 A	
	Cooling water supply pressure ^{*8}		0.2 to 0.5 Mpa (2 to 5 kg/cm ² G)	
Cooling water supply rate ^{*9}		2050L/h (at reference water temp. +25°C), 3400L/h (at reference water temp. +32°C)		
Piping connection size		Carbon steel pipe, ID 32 mm		
Operating cooling water temp. range		+5 to +38°C (+41 to +100°F)		
Noise level ^{*10}		Max. 65 dB		
Exhaust heat quantity		12600 kJ/h (3000 kcal/h)		
Exhaust rate		250 m ³ /h		

^{*1} The performance values are based on IEC 60068-3-5:2001, JTM K07:2007, under the conditions of a +23°C ambient temperature, cooling water temperature +25°C, rated voltage, and no specimen inside the test area.

^{*2} When each chamber is operated independently

^{*3} Setting: High temp. exposure +155°C, low temp. exposure −68°C

^{*4} When using the test area floor or heavy-duty shelves (option)

^{*5} Excluding protrusions

^{*6} This model complies with the requirements of the National Electric Code (NFPA 70) for the United States of America (NEC spec.)

^{*7} This model complies with the requirements of the European Community Directives (CE spec.)

^{*8} A pressure regulator valve is required if the pressure exceeds 0.5MPa (5kg/cm²G)

^{*9} Rate depends on the cleanliness of the heat exchanger

^{*10} Measurements are to be taken in an anechoic room at a height of 1.2m from the floor, and a distance of 1m from the front panel (ISO 1996-1: 2003.A-weighted sound pressure level)

SAFETY DEVICES

- Leakage breaker (200, 220, 380V AC)
- Circuit breaker (208, 400/415V AC)
- Electrical compartment door switch
- Hot chamber overheat protection switch
- Cold chamber overheat protection switch
- Hot chamber overheat protectors
(Built into temperature controller)
- Cold chamber overheat/ overcool protectors
(Built into temperature controller)
- Test area overheat/ overcool protectors
(Built into temperature controller)
- Test area overheat/ overcool protectors
- Circuit breaker
- Refrigerator high/ low pressure switch
- Compressor built-in protector
- Temperature switch for compressor
- Water suspension relay
- Temperature switch for air circulator
- Air circulator thermal relay
- Motor inverter
- Motor reserve prevention relay
- Hot chamber door switch
- Cold chamber door switch
- Door lock mechanisms
- Cartridge fuse
- Specimen power supply control terminal
- Cooling tower interlock terminal

ACCESSORIES

- Specimen basket
(18-8 Cr-Ni stainless steel: 5 mesh metal basket)
W700×H40×D410 mm/ load capacity 5kg..... 2
- Shelf brackets 2 sets
- Cartridge fuse (1A, 7A, 10A, 15A) 4
- Cable port rubber plug 2
- Perforated cable port cap 1
- Wire fisher (specimen wiring tool) 1
- Specimen temperature measuring thermocouple, JIS T 2
- Specimen temperature input connector 2
- 3-pole socket (208V AC spec. only) 3
- Nipple R1 1/4 in. (32 mm) 1
- Strainer R1 1/4 in. (32 mm) 1
- Strainer element R1 1/4 in. (32 mm) 1
- Operation manual 1



Safety precautions

- Do not use explosive substances, flammable substances, or substances that contain those substances as a specimen under any circumstances.
Danger: Risk of explosion and fire
- Do not put corrosive substances inside the test area. If corrosive substances are generated from the specimen, the life of the product's corrosion resistance will decrease dramatically due, in particular, to corrosion of stainless steel, resin, and silicone.
- Do not use living organisms or items that exceed the allowable heat load as a specimen.
- Always read the operation manual before using the Product.

OPTIONS

Paperless recorder

Records temperature of each section such as the temperature inside the chamber. Select either built-in or portable type.
<Built-in type>

Number of inputs (Initial setting):

PL1S: 1 (5 more channels can be turned ON)

Data saving cycle: 1 sec

PL3S: 3 (3 more channels can be turned ON)

Data saving cycle: 1 sec

PL3L: 3 (3 more channels can be turned ON)

Data saving cycle: 5 sec

PL5S: 5 (1 more channels can be turned ON)

Data saving cycle: 1 sec

PL5L: 5 (1 more channels can be turned ON)

Data saving cycle: 5 sec

PL6S: 6 Data saving cycle: 1 sec

PL6L: 6 Data saving cycle: 5 sec

Temperature range: -100 to +220°C

External memory media:

CF memory card (256MB)

USB port

Language support: ENG, JPN



Built-in type

<Portable type>

Number of inputs (Initial setting):

PPL1S: 1 (5 more channels can be turned ON)

Data saving cycle: 1 sec

PPL3S: 3 (3 more channels can be turned ON)

Data saving cycle: 1 sec

PPL3L: 3 (3 more channels can be turned ON)

Data saving cycle: 5 sec

PPL5S: 5 (1 more channels can be turned ON)

Data saving cycle: 1 sec

PPL5L: 5 (1 more channels can be turned ON)

Data saving cycle: 5 sec

PPL6S: 6 Data saving cycle: 1 sec

PPL6L: 6 Data saving cycle: 5 sec

Temperature range: -100 to +220°C

External memory media:

CF memory card (256MB)

USB port

Language support: ENG, JPN



Portable type

Temperature recorder (digital)

-100 to +220°C /100 mm

- RK-61: 1 pen
- RK-63: 3 pens
- RK-64: 6 dots



Recorder wiring

Preparation of a power cable, temperature sensor, and a grounding wire for additional installation in the future.

Recorder terminal

Used to output the temperature within test area, hot chamber, cold chamber.

Thermocouple

Attached to specimens to measure specimen temperature.

- Thermocouple type T without ball (Copper/ Copper-Nickel)

*Same as accessory items

STT 3-point expansion

3 thermocouples provided to measure the specimens' temperature via the STT function (2 inputs are equipped as standard.)

Exposure signal output

A signal is output via a contact switch when test area temperature is within the user-selected range. This signal can be used to control peripheral instruments, like applying a voltage to specimens only during high temperature exposure, or monitoring test operation from a remote point.

Total cycle counter

Indicates cycle counts.

Display range: 1-99999999
(with resetting function)



Auxiliary cooling injector (LCO₂)

Used to reduce the temperature recovery time of low temperature exposure by injecting liquefied carbon dioxide at beginning of exposure.

Auxiliary cooling injector (LN₂)

Used to reduce the temperature recovery time of low temperature exposure by injecting liquefied nitrogen at beginning of exposure.

Viewing window

Used for observation of the specimens inside the chamber.

Dimensions: W190×H340 mm

Chamber lamp: Halogen lamp (×1)



OPTIONS

Additional cable port

Provided in addition to the standard cable port. (right side)
Location: Left side of the main unit
Internal diameter: 100 mm

Cable port rubber plug

Prevents air leakage from the cable port.

Heavy-duty shelf

Used to hold heavy specimen exceeding the load capacity of the standard specimen basket.

Load capacity: 15 kg

* Equally distributed load, not included shelf brackets and specimen baskets.

Specimen basket/ shelf bracket

Equivalent to standard accessory.
Material: Stainless steel (5 mesh)



Casters

Installed for mobility.

6 casters: 6

levelling-feet: 4

Chamber dew tray

Prevents water leaks from the chamber onto the floor.

* The use of casters is recommended to facilitate operation.

Additional overhear protector

Additional preventive measures can be taken for excessive temperature rise in the chamber, in addition to the standard equipped double overhear protector.

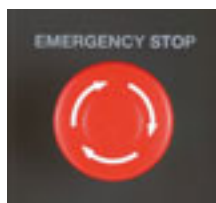
External alarm terminal

If the safety device of the chamber is activated, the external alarm terminal will notify it to a remote point.



Emergency stop pushbutton

Stops the chamber immediately.



Anchoring fixtures

Used to bolt the chamber to the floor.

Interface

• RS-232C

• GPIB

* Select one, instead of standard RS-485.

Communication cables

• RS-485 5m/ 10m/ 30m

• RS-232C 1.5m/ 3m/ 6m

• GPIB 2m/ 4m

Power cable

• 5 m

• 10 m

* Not applicable for optional 208, 380 and 400/415V AC power supply specification.

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ISO 9001/JIS Q 9001

Quality Management System Assessed and Registered

ESPEC CORP. has been assessed by and registered in the Quality Management System based on the International Standard ISO 9001:2008 (JIS Q 9001:2008) through the Japanese Standards Association (JSA).

* Registration : ESPEC CORP.
(Overseas subsidiaries not included)

ISO 14001 (JIS Q 14001)

Environmental Management System Assessed and Registered

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