

Quality is more than a word

ESPEC

Thermal Shock Chamber

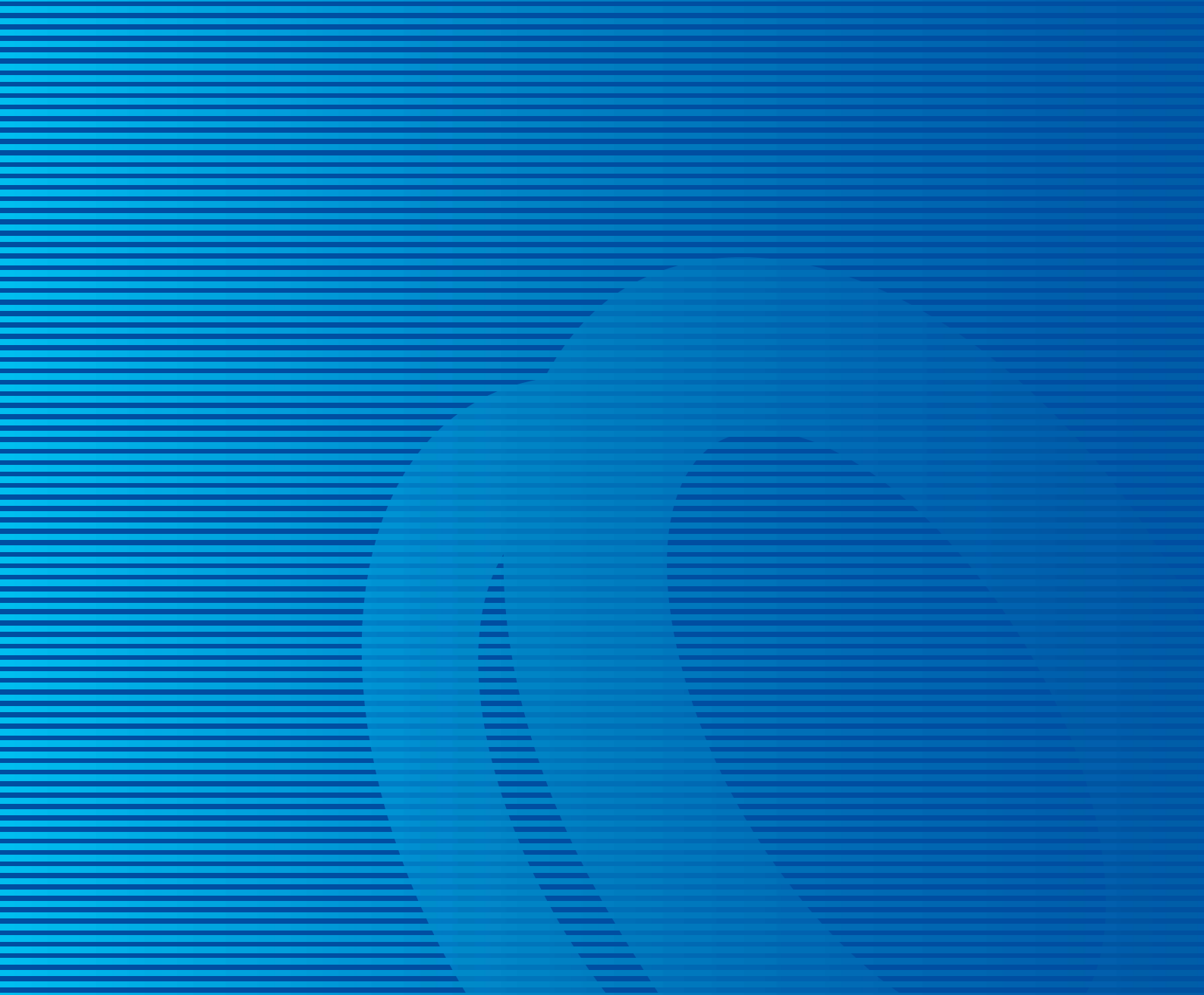
TSD-100



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

Two-zone thermal shock chamber ideally suited for MIL/IEC/JASO Japanese and international test standards. This new Thermal Shock Chamber from ESPEC is capable of subjecting specimens to uniform thermal stress with a 100 L test area and outstanding thermal distribution characteristics, making them ideally suited for use in a wide range of applications from research and development to inspection and production.





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

Performance

Offers the high performance demanded by today's test standards.

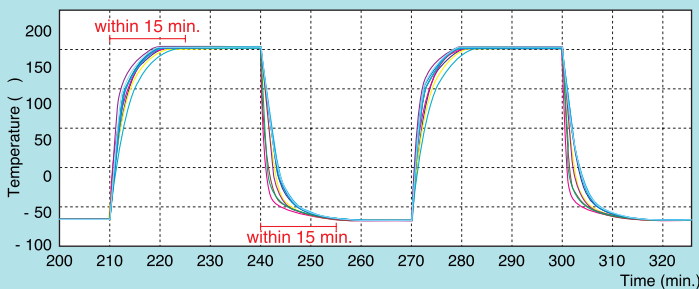
Specimen temperature recovery (example) (based on MIL-883 condition C)

Test conditions

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

Temperature distribution measurement method

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



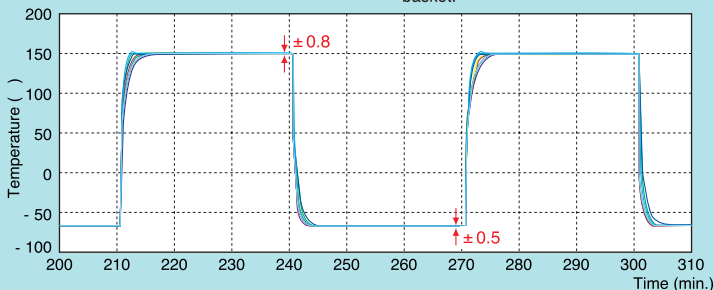
Temperature distribution performance (example)

Test conditions

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

Temperature distribution 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 the specimen basket.



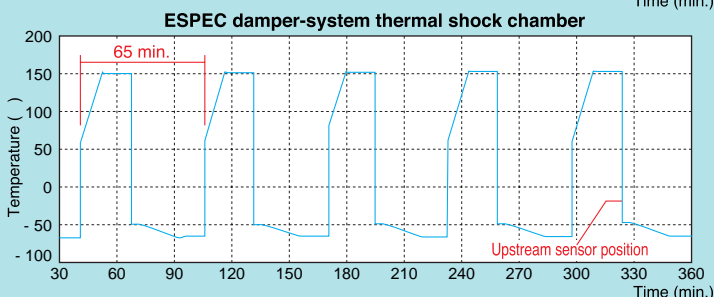
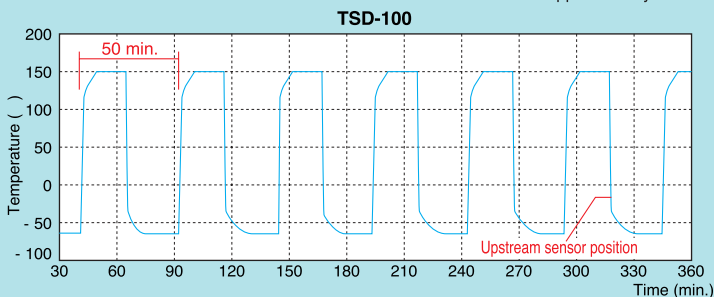
Test time comparison (example)

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 sensor positions

Measurements

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



- **Two-zone system reduces specimen temperature recovery time**

Using 10 kg of plastic molded ICs with temperature settings of + 150 °C and - 65 °C, the specimen temperature recovers within less than 15 minutes.

- **Compatible with MIL-STD-883 and other test standards**

The chamber is compatible with test standards such as MIL-STD-883, JIS C 0025, and JASO-D001. (see p.9, 10)

- **Improved temperature distribution performance**

The chamber feature outstanding temperature distribution characteristics, 30% better than previous ESPEC products during temperature recovery, and include features to ensure uniform air flow to the test area. The specimens are thus subject to a more uniform thermal stress, with variations in test results between specimens minimized.

- **Reduced test time by moving between two test areas**

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

- **Incorporate new Specimen Temperature Trigger (STT) function**

The chamber incorporate an STT function which 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 advance pre-testing, reducing the overall test time and ensuring accurate specimen temperature attainment. The specimen and test area temperatures can be recorded by connecting a temperature recorder.

- **Test area boasting a 100L capacity**

The test area has a capacity of 100L. This dramatically increases the processing capacity and even allows testing of A4-size printed circuit boards laid flat.

- **Reduced vibration impact**

“Soft move mode” is automatically selected when stopping to minimize the vibration impact on specimens when the test area is moved between the high-temperature and low-temperature chambers.

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

A braking system is fitted to the drive mechanism, which engages when the drive is stopped inside the chambers. This prevents specimens from falling inside the test area.

- **Ambient temperature recovery feature allows specimens to be removed safely**

An ambient temperature recovery feature is included to draw in exterior air after testing is completed and return the chamber interior to room temperature, allowing specimens to be removed safely.

- **Easy cable wiring**

A cable port is provided on the right-hand side of the chamber to facilitate wiring for specimen measurements during high-temperature and low-temperature testing. (Optional cable port can also be provided on the left-hand side.)

- **Optional viewing window**

Optional viewing window can be included to check specimens and wiring during testing. The viewing window include interior lighting.

- **Comprehensive safety system**

The chambers feature a dual safety system which automatically stops the test area drive mechanism if the door is left open and automatically locks the door when the test area is being moved.



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 (optional)

Control operation



Instrumentation

Color LCD interactive touch-screen system

The color LCD touch-screen instrumentation simplifies operation and setting, allowing users to touch the screen as indicated by the on-screen instructions. The screen allows 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. This reduces the overall footprint and frees up both sides of the chamber for easy access.

Setting	Interactive input system using a touch-screen
Display	TFT Color LCD
Temperature control function	Test area: exposure temp. High-temp. chamber: pre-heating temp. Low-temp. chamber: pre-cooling temp. Low-temp. chamber: defrosting temp.
Preset temperature range	High-temperature: + 60 to + 205 Low-temperature: - 77 to 0
Setting resolution	1
Input	Thermocouple type T (Copper/Copper-Nickel)
Control system	PID control
Sequence control	Preset time range: 0 minutes to 99 hours 59 minutes Preset cycle range: 1 to 9,999 cycles
Accessory function	Timer preset Test continuity selection Overheat/overcool protection Up-stream/down-stream sensor selection STT Stable time control Exposure time reducing Power failure/recovery operation selecting Automatic defrosting Temperature recovery time setting Program memory Automatic power shut-off Programmed time display Test halt preset Test completion mode selecting Trend graph Alarm history display Sensor calibration RS-485 communications

Control operation

INSTRUMENTATION PANEL

■ Test detail monitor

This screen displays the test details while the test is in progress.



■ Product sensor settings

This screen is used to enable or disable the specimen temperature sensor used for the STT function.



It is also used to enable or disable additional optional specimen temperature sensors.



■ Pattern editing

This screen is used to set the test conditions.



■ Alarm

If a problem occurs, "ALARM" flashes on the screen and a buzzer sounds.



■ Error description

Pressing the alarm name when an alarm occurs displays a detailed description together with information on how to correct problem and reset the alarm.



■ Service guide

When an inspection item is selected, a description of the required maintenance steps is displayed. This is useful before commencing tests or to aid periodic maintenance.



■ Detailed description

This screen displays details of the regular inspection items.



Eco-friendly

A number of environmentally-friendly (energy-saving and ozone layer protection) features



Built-in paperless recorder (optional)
*Right-hand side rear



Portable paperless recorder (optional)

● Reduced power consumption

From the customer's viewpoint, reducing power consumption is a major issue. The TSD-100 incorporates a number of features, including variable refrigeration capacity control using electronic expansion valves, to reduce overall power consumption by approximately 30% (compared with previous ESPEC products).

● Recyclable material labeling

Environmental features include material labeling on plastic molded components to facilitate recycling when the system is disposed of in the future, and a design that enables recyclable components to be removed easily.

● Use of HFCs with zero ozone layer damage coefficient

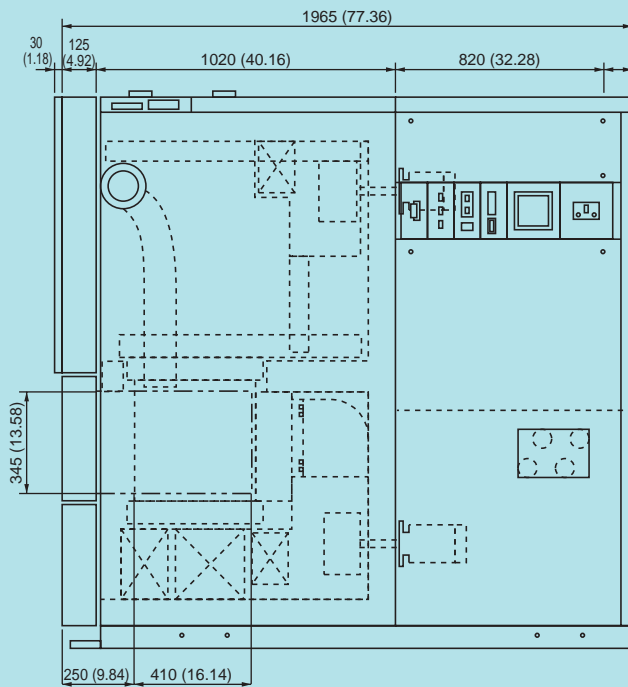
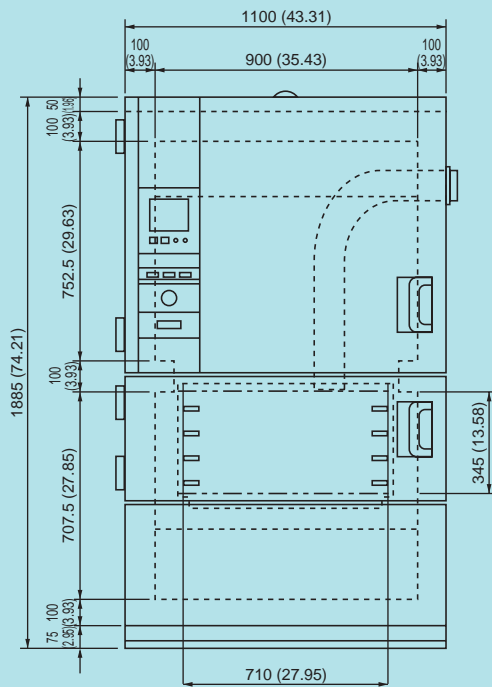
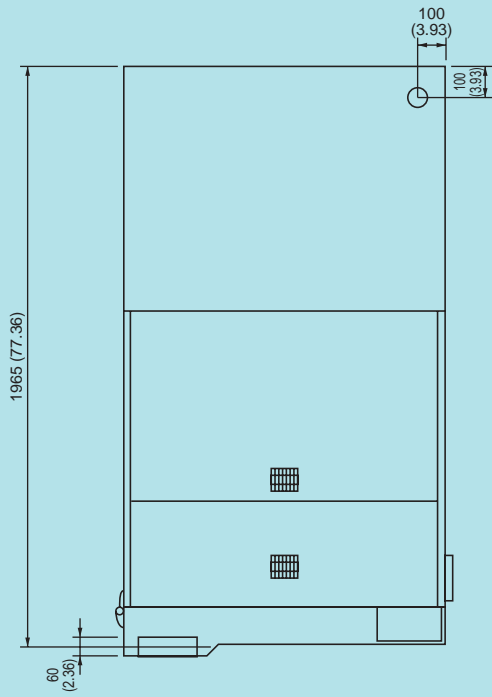
HFCs used for the refrigerant conform to the Montreal Protocol to prevent ozone layer damage.

● Paperless recorders (optional)

Paperless recorders are available to record the internal chamber temperatures easily onto a (Compact Flash) memory card. Paperless recorders are available as built-in and portable types.

DIMENSIONS

Unit: mm (inch)



TEST STANDARD (TSD-100 COMPATIBILITY)

Test standard		Temperature setting		Recovery time	Soak time	Number of cycles
		High temp. ()	Low temp. ()			
IEC 60749-25 (JESD22-A104B)	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 0025 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-961747-5 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-202G 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	5 25 50 100
	B	+ 125 (+ 3, - 0)	- 65 (+ 0, - 5)			
	F	+ 150 (+ 3, - 0)	- 65 (+ 0, - 5)			
MIL-883F 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 (+ 15, - 0)	- 65 (+ 0, - 10)			

TEST STANDARD (TSD-100 COMPATIBILITY)

Test standard		Temperature setting		Recovery time	Soak time	Number of cycles
		High temp. ()	Low temp. ()			
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 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 switching by vertical transfer of specimens				
Operating temperature		+ 5 to + 40 (+ 41 to + 104° F)				
Performance *1	Test area	High temp. exposure range	+ 60 to + 200 (+ 140 to + 392° F)			
		Low temp. exposure range	- 65 to 0 (- 85 to + 32° F)			
		Temperature fluctuation *2	± 0.5 (± 0.9° F)			
	High temp. chamber	Pre-heat upper limit	+ 205 (+ 401° F)			
		Temp. heat-up rate *3	Ambient temp. to + 200 (+ 392° F) within 90 min.			
	Low temp. chamber	Pre-cool lower limit	- 77 (- 106.6° F)			
		Temp. pull-down rate *3	Ambient temp. to - 77 (- 106.6° F) within 90 min.			
	Temp. recovery (Two-zone)	Recovery conditions	2-zone • High-temp. exposure: + 150 *4 30 min. • Low-temp. exposure: - 60 *4 30 min.	• Power supply voltage: Normal voltage • Sensor position: Downstream of specimens • Specimen: Plastic molded ICs, 10kg		
		Temp. recovery time	Specimen IC temp: within 15 min.			
	Ambient recovery	Recovery conditions	• High-temp. exposure: + 150 to max + 55 • Power supply voltage: Normal voltage	• Ambient temp.: + 23 • Specimen: Plastic molded ICs, 10 kg		
Ambient temp. recovery time		Within 90 min.				
Noise *5		Max. 65 dB				
Calorific value of exhaust heat		12,600 kJ/h (3,000kcal/h)				
Exhaust rate		250 m³/h				
Construction	Outer shell		Painted steel			
	Interior		18-8 Cr-Ni stainless steel plate			
	Insulation		Glass wool, expanded polyurethane			
	Test area		Shelf brackets on 2 shelves (up to 4 shelves can be installed)			
	Door		Door handle (right-hand handle, left-hand hinge), door locking mechanism			
	Cable port		100 mm, on right-hand side of chamber			
	Heater		Strip wire heater			
	Refrigerator unit	Refrigeration system	Mechanical cascade refrigeration system (water-cooled condenser)			
		Compressor	Scroll type (3.75kW)			
		Refrigerant	R23, R404A			
		Unit	Cascade condenser, refrigeration capacity controller, cooling water supply unit			
	Cooler		Plate fin cooler, cold accumulator			
Air circulator		Sirocco fan				
Transfer mechanism		For elevating specimen: Power slider				
Auxiliary devices		Specimen temperature input (× 2), time signal, integrating hour timer				
Test area dimensions (W × H × D)		710 × 345 × 410mm (27.95 × 13.58 × 16.14inch)				
Test area capacity		100L				
Test area load capacity *6		30kg				
Outside dimensions (W × H × D) *7		1100 × 1885 × 1965mm (43.31 × 74.21 × 77.36inch)				
Weight		Approx. 1100kg				
Utility requirement	Power supply within ± 10% of the rated voltage	200V AC 3 3W 50/60Hz	208V AC *10 3 3W 60Hz	220V AC 3 3W 60Hz	380V AC 3 4W 50Hz	400/415V AC *11 3 4W 50Hz
	Maximum current (A)	64	62	58	34	32
	Cooling water Supply pressure *8	0.2 to 0.5 MPa (2 to 5 kg/cm²G)				
	Cooling water supply rate *9	2,050L/h (at reference water temp. + 25), 3,400L/h (at reference water temp. + 32)				
	Carbon steel pipe size	32A				
	Operable cooling water temp. range	+ 5 to + 38 (+ 41 to + 100° F)				

*1 At + 23 ambient temperature.

*2 Performance shown above is conformable to IEC 60068-3-5: 2001.

*3 When each chamber is operated independently.

*4 Setting: High-temp exposure + 155 , low-temp exposure - 68

*5 Measurements are to be taken in a location with low reverberation, such as in an anechoic chamber at a height of 1.2 m and 1 m from the system front face.

(A characteristics: Compliant with JIS-Z-8731)

*6 When using the test area floor or specimen shelves for heavy loads (optional)

*7 Excluding protrusions

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

*9 The rate fluctuates when heat exchanger is unclean.

*10 This equipment is in compliance with the requirements of the National Electric Code (NFPA 70) for the United States of America. (NEC spec.)

*11 This equipment is in compliance with the requirements of the European Community Directives. (CE spec.)

SAFETY DEVICES

Leakage breaker (200, 220, 380V AC)
 Circuit breaker (208, 400/415V AC)
 Distribution compartment door switch
 Temperature switch for overheat protection of high temperature chamber
 Temperature switch for overheat protection of low temperature chamber
 Overheat protector for high-temp. chamber (Built-in controller)
 Overheat and overcool protector for low-temp. chamber (Built-in controller)
 Test area overheat and overcool protector (Built-in controller)
 Test area overheat and overcool protector
 Wiring circuit breaker
 Refrigerator high and low pressure switch
 Compressor built-in protector
 Temperature switch for compressor
 Water suspension relay
 Current sensing switch for air circulator
 Thermal relay for air circulator
 Motor protection device
 Motor reverse-prevention relay
 High-temp chamber door switch
 Low-temp chamber door switch
 Door locking mechanism
 Fuse
 Specimen power supply control terminal
 Cooling tower interlock terminal

ACCESSORIES

Specimen basket
 (18-8 Cr-Ni stainless steel: 5 mesh metal basket)
 W700 x H40 x D410 mm/ load capacity 5kg 2
 Shelf bracket 2 sets
 Cartridge fuse (1A, 7A, 10A, 15A) 4
 Cable port rubber plug 2
 Perforated cable port cap 1
 Wirefisher (specimen wiring tool) 1
 Specimen temperature measuring thermocouple, JIS T 2
 3-pole socket (208V AC only) 3
 Nipple R1 1/4 in. (32A) 1
 Strainer R1 1/4 in. (32A) 1
 Strainer element R1 1/4 in. (32A) 1
 User's manual 1



DANGER

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

Do not place corrosive materials in the chamber. If corrosive substances or liquid is used, the life of the unit may be significantly shortened specifically because of the corrosion of stainless steel, resin and silicone materials.

Do not place life forms or substances that exceed allowable heat generation.



CAUTION

Be sure to read the instruction manual before operation.

OPTIONS

Paperless recorder

Records temperature of each section such as the temperature inside the chamber. Choice of 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

Temperature range: - 100 to + 220

External memory media:

CF memory card (32MB)

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

Temperature range: - 100 to + 220

External memory media:

CF memory card (32MB)

Language support: ENG, JPN



Portable type

Temperature recorder (digital)

- 100 to + 220 /100 mm

• RK-61: 1 pen

• RK-63: 3 pens

• RK-64: 6 dots



Temperature recorder for future installation

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

Recorder terminal

Serves to output the temperature within test area, high-temp. chamber, low-temp. chamber.

Specimen temperature measuring thermocouple

Attached to specimens to measure specimen temperature.

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

*Same as accessory items

STT 3-point Expansion

Adds three specimen temperature inputs used for STT function.

(Two-input expansion provided 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, such as to apply a voltage to specimens only during high temperature exposure, or monitor 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

A cable port can be included on the left-hand side in addition to the standard cable port on the right-hand side, if required.

- Location: Left-hand side of main unit (directly opposite standard cable port)
- Internal diameter: 100 mm

Cable port rubber plug

Same as accessory item provided with cable port.

Heavy-duty shelves

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

- Load capacity: 15kg

Specimen basket/ shelf bracket

Equivalent to standard accessory.

- Material: Stainless steel (5 mesh)



Specimen basket

Caster

Installed for mobility.

- 6 casters
- 4 adjuster-feet

Chamber dew tray

Prevents water leaks from the chamber onto the floor.

*The use of casters is recommended to facilitate operation.

Additional overheat protector

This additional overheat protector is used to prevent the temperature in the test area from rising abnormally in addition to the standard overheat protector.

External alarm terminal

If the safety device of the chamber activates, the external alarm terminal will notify a remote alarm.



Emergency stop switch

Stops the chamber immediately.



Fixture for securing body

Used to bolt the chamber to the floor.

Communication functions

Computer interface.

- GPIB
- RS-232C
- E-BUS

* Select one, in place of standard RS-485.

Communication cables

- RS-485 5, 10m
- GPIB 2, 4m
- RS-232C 1.5, 3, 5m
- E-BUS 5, 10m

Power cord

5, 10m

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

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