

Quality is more than a word

ESPEC



Selecting a "temperature chamber" for Secondary battery safety testing

Secondary batteries are quickly becoming key devices for achieving carbon neutrality across the globe in many different applications. As the drive towards improving battery performance with higher output and improved energy density continues, the requirements to provide a safe test environment increase. Rigorous testing of secondary batteries can involve risk-the Espec BTC Chamber enables repeatable and reliable testing whilst delivering the highest levels of operator safety.

Temperature Chamber for Charge-Discharge
Testing for Secondary batteries

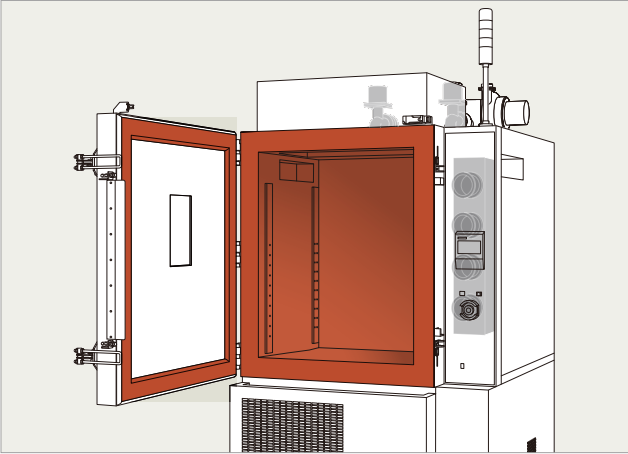
BTC
Series

SAFETY DEVICES

Protects operators and laboratories from rechargeable battery explosions.

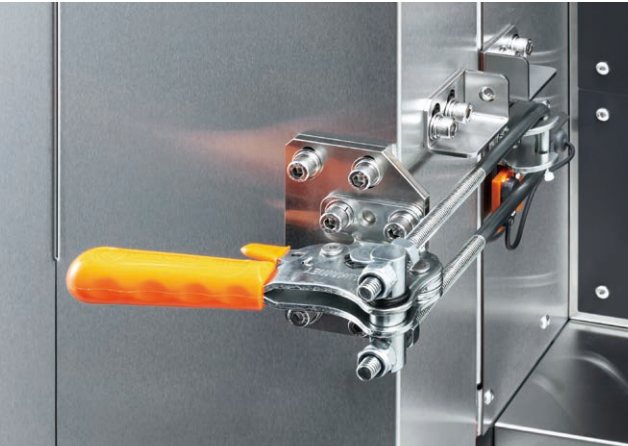
DESIGN

User-friendly and designed to accommodate safety features whilst minimizing sharp edges and obstructions.



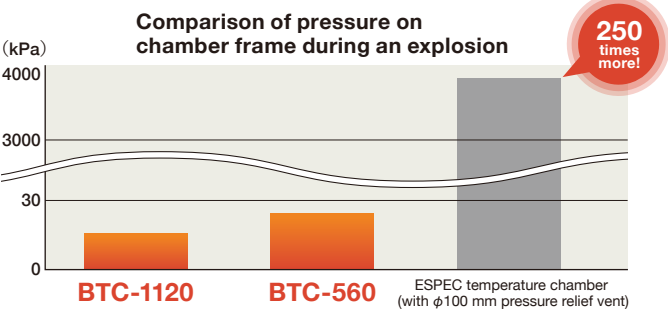
SAFETY DOOR LOCK

The door lock withstands the explosive pressure of secondary batteries and can be locked with a single action.

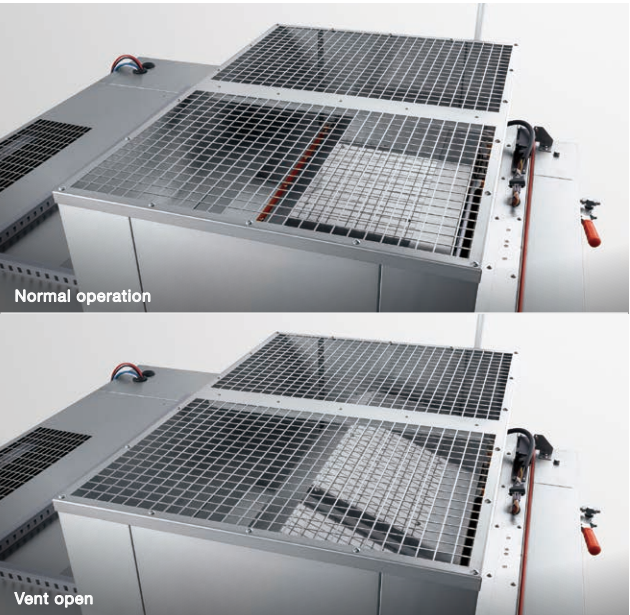


Large pressure relief vent with high-pressure release capability

The large pressure relief vent enables pressure to be safely released through the top of the chamber in the event of an explosion, further increasing the safety of the chamber. (Static operating pressure: 470 Pa)



* Calculated values for expected pressure on chamber frame in the event of a methane gas explosion



EUCAR Hazard levels

EUCAR Hazard Levels are used to gauge the level of danger associated with handling batteries and the outcome of tests performed on the cells. Specifying the chamber to your required EUCAR level has been made easy.

Level	Event of battery	Required functions
1	Activation of protective functions	Charge/discharge system linking (External input/output terminal)
2	Defect, damage	
3	Fluid leakage (Electrolyte weight loss: Less than 50%)	Gas/smoke detection, test area ventilation device
4	Significant fluid leakage (Electrolyte weight loss: 50% or more)	
5	Ignition, combustion	Heat detection, fire extinguisher operation, door lock, pressure relief, spatter prevention measures
6	Rupture, scattering of components	
7	Explosion	

Reference: EUCAR (European Council for Automotive R&D) Hazard Levels

OPTIONS

Easily select the chamber's recommended safety devices according to hazard level.

Recommended Options for Hazard Levels 3 and 4

① Intake/exhaust damper

The damper acts as a test area ventilation function in addition to manual ventilation using a manual switch. Automatic ventilation is also possible by synchronizing operation with the gas detector (optional).

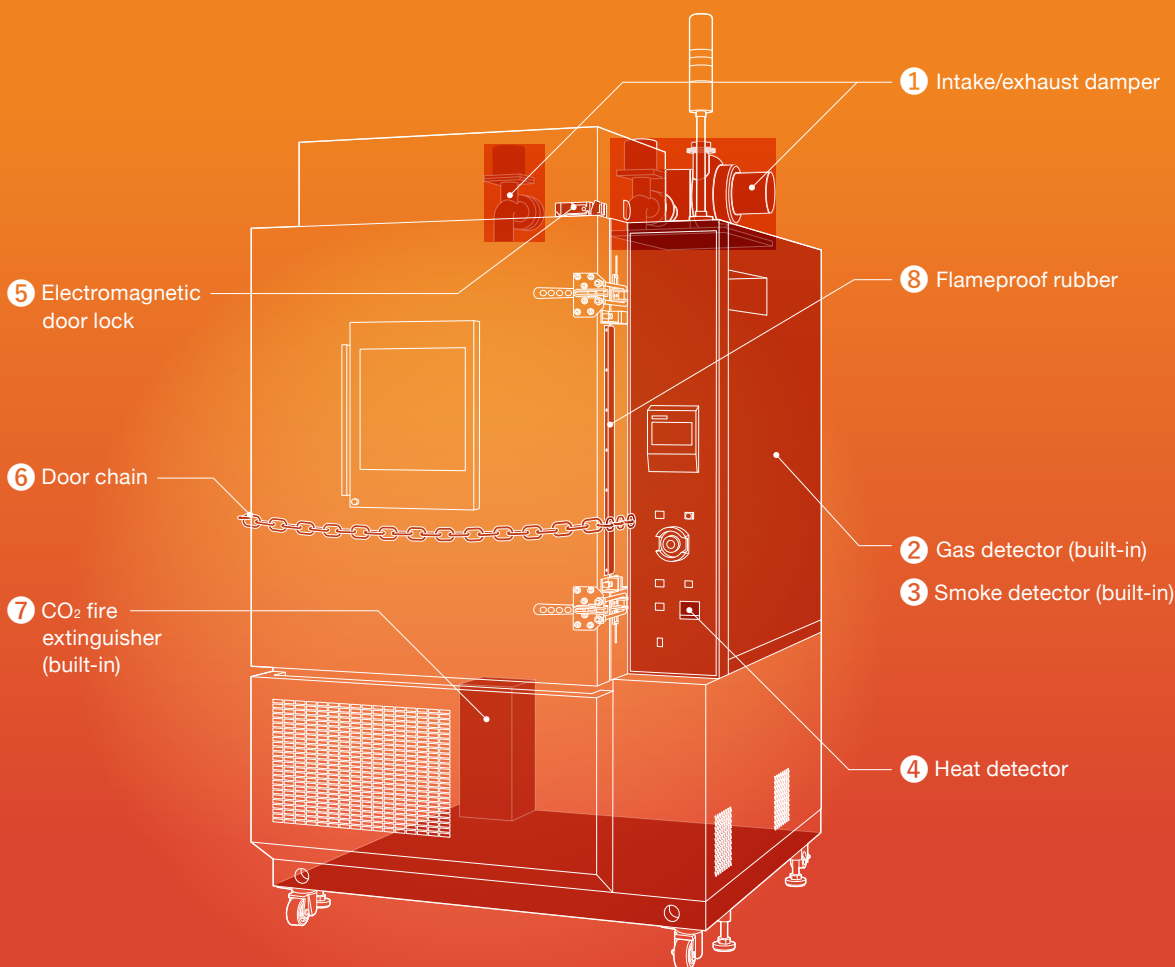
A forced exhaust fan is also available if required.

② Gas detector (H₂, CO, H₂S)

The gas detector is used to detect harmful gases generated by batteries. Detection is based on two alarm setpoint levels, with different effects on the chamber operation for each level. At the first level, normal operation continues but harmful gas concentration is registered. At the second level, an emergency stop occurs.

③ Smoke detector

If smoke is detected in the chamber whilst a battery is under test an alarm will be sounded. When the chamber is fitted with a heat detector and CO₂ fire extinguisher (optional) the extinguishing agent will be deployed when the smoke detector is activated.



Recommended Options for Hazard Levels 5 and 6

④ Heat detector

The heat detector is used to detect increases in test area temperature due to heat generated by batteries. If the chamber includes a CO₂ fire extinguisher (optional), the extinguishing agent will be deployed when the heat detector is activated.

⑦ CO₂ fire extinguisher

CO₂ is deployed in the test area if the heat detector or both of the heat detector and smoke detector are activated. The agent can also be dispersed by the manual switch.

⑤ Electromagnetic door lock

The door is locked electrically during testing, and when the temperature in the test area reaches a high danger level (adjustable setting). The door is opened if the temperature is between -10 and +60°C (default setting).

⑥ Door chain

The door chain reduces the risk of the door flying forward if dislodged by a battery explosion.

⑧ Flameproof rubber

Flameproof rubber helps to prevent flames from being released from the gaps around the door in the event of a battery explosion. The rubber is made of flame-retardant chloroprene.

Remarks: The options are what we recommend for each description of hazard level. However, as the maximum level of any hazard may be beyond our expectations, it is the user's responsibility to assess and take any additional measures to minimize the dangers.

EASE OF USE

Safe and easy-to-use chambers support your battery testing.

Continuous operation for long hours

Frosting prevention in the refrigeration circuit makes continuous operation possible.

The test area can be set to temperatures $\geq 10^{\circ}\text{C}$

Chamber status checking

A status indicator light shows the chamber status at a glance.

Color	Status	Operation
Red	Error stop	Light up
Yellow	Power on	Light up
Green	Operating	Light up

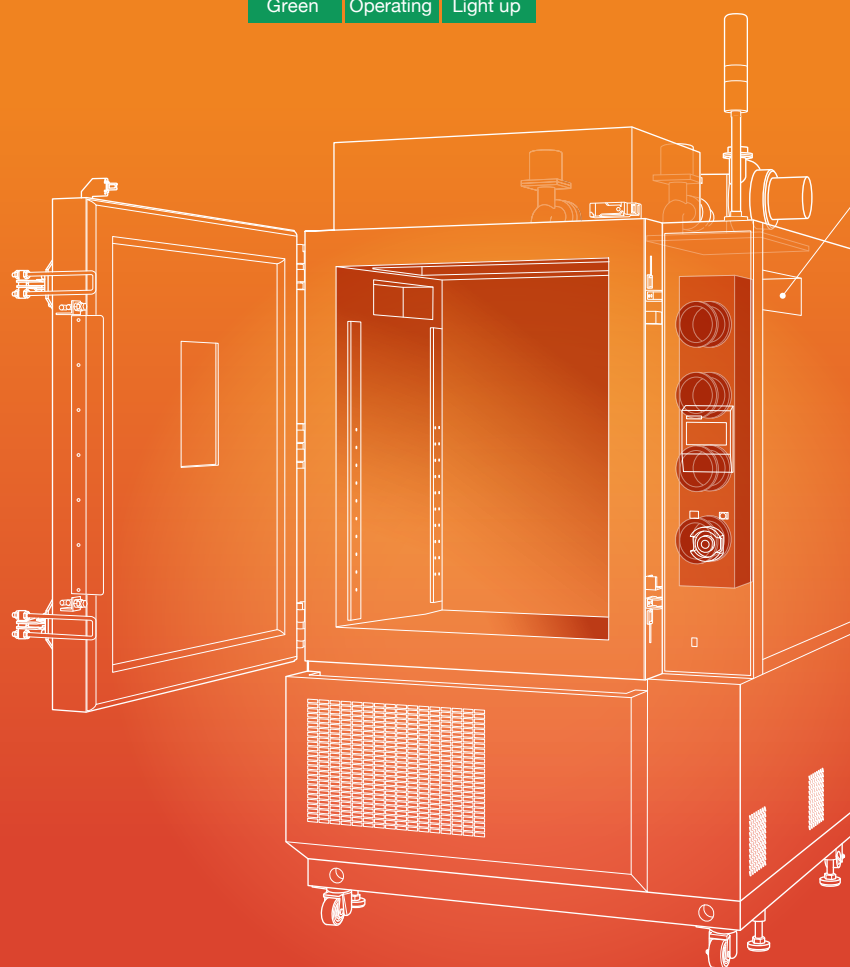
Simple design

Easy-to-use design with no protrusions when equipped with safety devices.

Allows for a variety of layouts

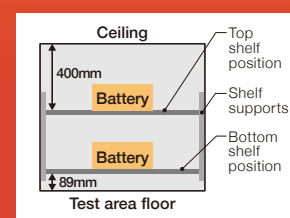
Cable ports on both sides and rear of the chamber allow for versatile layout with battery charging and discharging systems.

Back: $\phi 100\text{ mm}$ ports $\times 4$
Left/right: $W400 \times H100\text{ mm}$ square on each side



Heavy load shelves

Load capacity of shelf supports: 100 kg
Shelf bracket pitch: 50 mm
Shelf load capacity: 50 kg or 100 kg
(The shelf and shelf bracket are optional.)
* Shelves are insulated with resin coating.

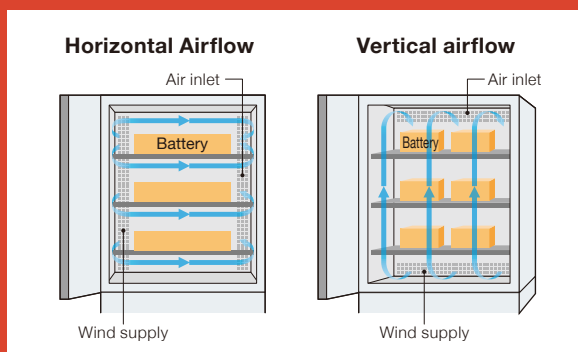


Available for heavy load installations

Heavy module batteries and battery racks can be installed in the chamber. The floor load capacity of the test area is 300 kg.

Selectable test area airflow direction

Either horizontal or vertical airflow can be selected. This allows for optimal airflow for the specific shape and setting method of the batteries being tested.



Test area status checking

A viewing window with shatter proof glass and stainless steel cover is available as an option. Built-in LED lights also provide a wider field of view.



SYSTEM START-UP

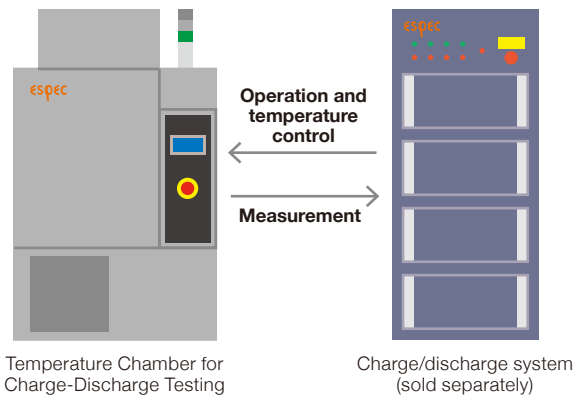
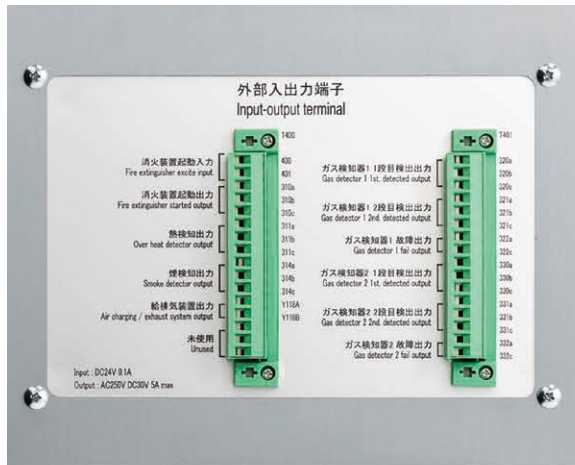
The standard interface allows easy integration with battery charging and discharging systems.

Chamber operation and temperature settings can be made from the charging/discharging system.

Ethernet port for chamber control is included. RS-485 and RS-232C are available as options.

Chamber error status can be output to the charging/discharging system.

Sends a signal to the charging/discharging system in the event of a chamber error. Receives a signal in the event of a charging/discharge system error, and the chamber is stopped by that signal. These signals are not communication connections, but signal lines connected to the interface terminals.

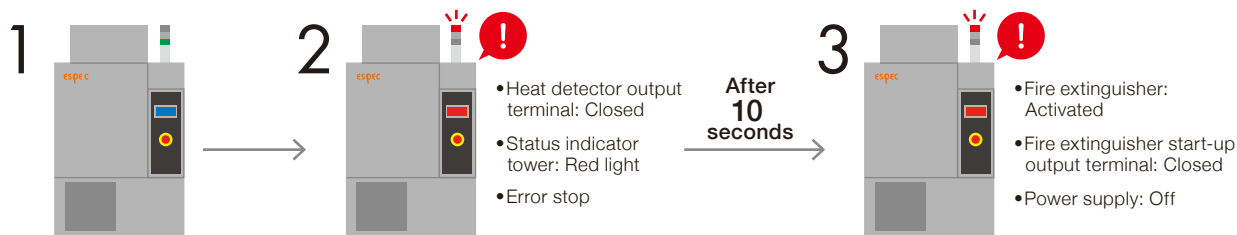


Input signal	External equipment error input
	Temperature chamber forced stop input
	Fire extinguisher deployment input (optional)
Output signal	Door open output
	External alarm output (Temperature chamber error)
	Pressure relief vent open output
	Specimen power supply control terminal
	Internal chamber temperature output terminal
	Fire extinguisher start output (optional)
	Heat detection output (optional)
	Smoke detection output (optional)
	Gas detection 1 output (Level 1/Level 2/Failure) (optional)
	Gas detection 2 output (Level 1/Level 2/Failure) (optional)
	Air supply/exhaust system output (optional)

Optimal safety equipment settings

Standard procedures are pre-programmed for all specified safety equipment, eliminating the need for manual set-up. An operations matrix table allows users to quickly and easily specify how and in what order the safety functions run in the event of a failure or error during a battery test. This applies to both onboard features and external input/output terminals including the status indicator tower lighting.

Example: Optional configuration heat detector and CO₂ extinguisher



Example operation matrix

	Operation	Chamber status	Power supply	Status indicator tower	External equipment alarm output terminal	Heat detection output terminal	Fire extinguisher start-up output terminal	Recovery method
1	In operation	Operating	On	Green light	Closed	Open	Open	—
2	Heat detection	Error stop	On	Red light	Open	Closed	No change	Turn on the controller main power switch
3	Fire extinguisher activated	Error stop	Off	Red light	Open	No change	Closed	Turning on the main power switch

SPECIFICATIONS

Model	BTC-560Hb1	BTC-560 Vb1	BTC-1120Hb1	BTC-1120Vb1
Airflow direction	horizontal	vertical	horizontal	vertical
Temperature range	-40°C to +100°C			
Temperature change rate	Temperature range*1	-26°C ⇔ +86°C		
	Heat-up rate	2.1K/min		
	Cool-down rate	2.2K/min		
Temperature variation in space	1.5°C		2.5°C	
Allowable heat load	1750 W (+20°C when stabilized)*3		3000 W (+20°C when stabilized)	
Interior volume	560 L		1120 L	
Floor load capacity	300 kg distributed load			
Inside dimensions*2	W800 × H1000 × D700 mm		W1600 × H1000 × D700 mm	
Outside dimensions*2	W1250 × H2195 × D1406 mm		W2050 × H2195 × D1406 mm	
Refrigerant	R-449A			
Cooler	Plate fin cooler			
Heater	Sheathed heater			
Breaker capacity	200V AC, 3ϕ, 30A		200V AC, 3ϕ, 50A	
	220V AC, 3ϕ, 30A		220V AC, 3ϕ, 50A	
	380V AC, 3ϕ, 30A		380V AC, 3ϕ, 50A	
	400V AC, 3ϕ, 30A		400V AC, 3ϕ, 50A	
Weight	650kg		1200kg	
Equipment	Cable port (Right: Square, W400 × H100 mm; Left: Square, W400 × H100 mm; Back: ϕ100 mm × 4), Door lock, Large pressure relief vent, Emergency stop switch (with guard), Status indicator light External input/output terminal, Ethernet port (LAN), Internal chamber temperature monitoring terminal board			
Accessories	Operation manual (booklet), Electric circuit diagram, Shipping inspection data (temperature increase/decrease), Round plug for cable port (3×50×1000 mm; 4 sets of 3), Sealing sheet for square cable port, Eyebolt			

* 1 The test area temperature range is based on IEC 60068-3-5 with an ambient temperature of +23°C at the rated voltage with no specimen inside. * 2 Excludes protrusions.

* 3 In case of 400V AC 50Hz, allowable heat load is 2000W.

OPTIONS

- ☐ Electromagnetic door lock
☐ H₂ gas detector
☐ CO gas detector
☐ H₂S gas detector
☐ Smoke detector
☐ Heat detector (for fire extinguisher operation)
☐ Specimen temperature detector (for fire extinguisher operation)
☐ CO₂ fire extinguisher port
☐ Intake/exhaust damper (with/without forced exhaust fan)
- ☐ Flameproof rubber
☐ Door chain
☐ Viewing window (with cover)
☐ Power supply voltage variation (220V AC, 380V AC and 400V AC)
☐ Water-cooled refrigeration circuit
☐ Heavy duty shelf/shelf brackets (Load capacity: 50 kg/100 kg)
☐ Communication interface (RS-485/RS-232C)
☐ Chamber anchoring fixtures

UTILITIES

200V power supply system with drainage

Adoption of environmentally friendly low-GWP refrigerant

ESPEC programs to combat global warming

ESPEC provides products that use a low-GWP refrigerant.
 (These products use R-449A with a Global Warming Potential that is 64% lower than the conventional refrigerant (R-404A).)

[Source] R-404A GWP: Act for Rationalized Use and Proper Management of Fluorocarbons portal site,
 FY 2018 report R-449A GWP: IPCC 4th Evaluation Report (AR4)



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Specifications, external appearance, and other descriptions are subject to change without notice due to product improvements.

LEAF No.20220702 A7B04L00 (As of July 2022)