

Quality is more than a word



# Environmental Chambers

## For Secondary Lithium Ion Batteries



ESPEC NORTH AMERICA, INC.

# Battery Testing

Rechargeable lithium batteries have been the choice for portable electronic devices. As they now become important for electric vehicles, reliability and safety become paramount. The batteries must perform well in hot and cold conditions, while not posing a hazard due to leaking or exploding.

Through temperature testing with ESPEC chambers, the batteries' ability to withstand environmental extremes and stress can be identified safely.

Published standards by UL, IEC, SAE, and UN specify environmental tests like: short circuit while hot, heat resistance, temperature cycling, and thermal abuse. Because failure of these tests can produce hazardous results, the test chambers will require proper safety features and considerations.

## Common test standards for secondary lithium ion battery cells or modules:

- UL 1642 - Standard for Lithium Batteries
- UL 2054 - Household and Commercial Batteries
- IEC 62133 - Safety requirements for portable sealed secondary cells
- IEC 62660-2 - Secondary lithium-ion cells for the propulsion of electric road vehicles - Part 2: Reliability and abuse testing
- SAE J2464 - Electric and Hybrid Electric Vehicle Rechargeable Energy Storage System (RESS)
- UN/DOT 38.3 - Lithium batteries during shipping



Monitoring temperature of the battery under test is important. Our product monitor option alarms if batteries exceed 75°C, as suggested by IEC test methods.

Hazard Level	Battery State	Danger
0	Operational	None
1 - 2	Non-operational	Runaway
3	Leakage	Acid
4	Venting	Caustic Gas
5	Fire or Flame	Fire
6	Rupture	Caustic Gas, Acid
7	Explosion	Pressure, Shrapnel

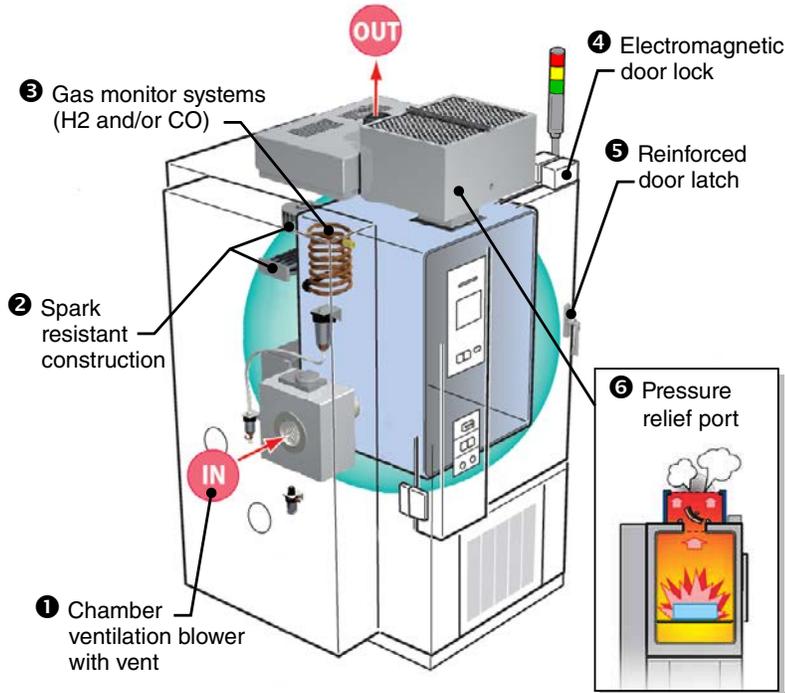
Possible battery failure modes and their related hazard level, as defined by EUCAR.

## Test Chamber Selection

Heat	Hot/Cold		Fast Cycling / Shock	
				
Ovens	Benchtop	Platinous	Global-N	Thermal Shock
IEC 62133 - Short circuit test at 55°C; mold stress relief test at 70°C; thermal abuse: ramp at 5°C/m to 130°C	IEC 62133 - Temp cycling: 75 to 20 to -20°C (30 min. transitions)		UN/DOT 38.3 - Temp cycling: 75 to -40°C (30 min. transitions)	
UL 2054 - Mold stress relief test at 70°C	IEC 61960 - Discharge performance test at 20°C and -20°C		SAE J2464 - Thermal shock test: 70 to -40°C (15 min. transitions)	
UL 1642 & 2054 - Short circuit test at 60°C; heating test: 5°C/m to 150°C	UL 1642 & 2054 - Temp cycling: 70 to 20 to -40°C (30 min. transitions)			
IEC 62660-2 - Thermal test: ramp at 5°C/m to 130°C	IEC 62660-2 - Cycling: 85 to -40°C at ~1°C/m (or 65 to -20°C with electrical operation)			
SAE J2464 - Thermal stability: Increasing temperature in 5°C increments	IEC 62660-2 - Capacity discharge test at -20, 0, 25, and 45°C			

Chambers for hot/cold also suitable for heat-only tests. Hot/cold cycling tests may require fast cycling chambers depending on mass of batteries. See our website for links to these products: [www.espec.com/battery](http://www.espec.com/battery)

# Safety & Protection



## Safety features per your needs

Because battery failure is a real risk (and sometimes a desired outcome), environmental chambers need safety systems to protect from harmful explosions and ensure operator safety.

Of greatest risk is the release of gases from a battery, which may ignite on their own, or by the test chamber's heaters. Special low-temperature heaters are recommended, but additional precautions may be necessary. By monitoring the battery for thermal runaway, the chamber may be shut off and an alarm made prior to an explosion.

Based on your testing needs and safety requirements, ESPEC can help with the following options to create a complete testing system.

Protection Options		
1	Chamber ventilation blower with vent port	Ventilation purges chamber with ambient air, activated by a gas monitoring system
2	Spark resistant construction	Fan blades, motor port, and sheathed heaters are all spark resistant
3	Gas monitor systems (H2 and/or CO)	Monitors the chamber workspace for hazardous gas, includes an alarm and light
4	Electromagnetic door lock	Prevent operator access during operation (500 lbs. of holding force)
	Fire detection system with vent port	Detects fire and shuts down the chamber, includes an alarm and light
	Product overheat with product sensor	Protects test load from temperatures that are higher than desired
	Chamber door switch	Inhibits chamber operation if chamber door is open
	Product drip tray	Removable/replaceable tray to contain any corrosive leaks

Safety Options		
5	Reinforced door latch	Designed to withstand pressure increase due to explosion
6	Pressure relief blow-out port	Quickly relieves pressure inside of chamber
	Fire suppression system	Suppresses fire by flooding workspace with CO2, use with fire detection system
	Port plug restraint	Cover that restrains port plugs from flying out due to over pressurization

Exact configuration of these options may vary by model and customer request.

See Quick Look Youtube videos on these options for [Benchtop](#) and [Platinous](#) chambers.

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