Cincinnati Sub-Zero

ENVIRONMENTAL CHAMBERS FOR BATTERY TESTING

www.cszproducts.com

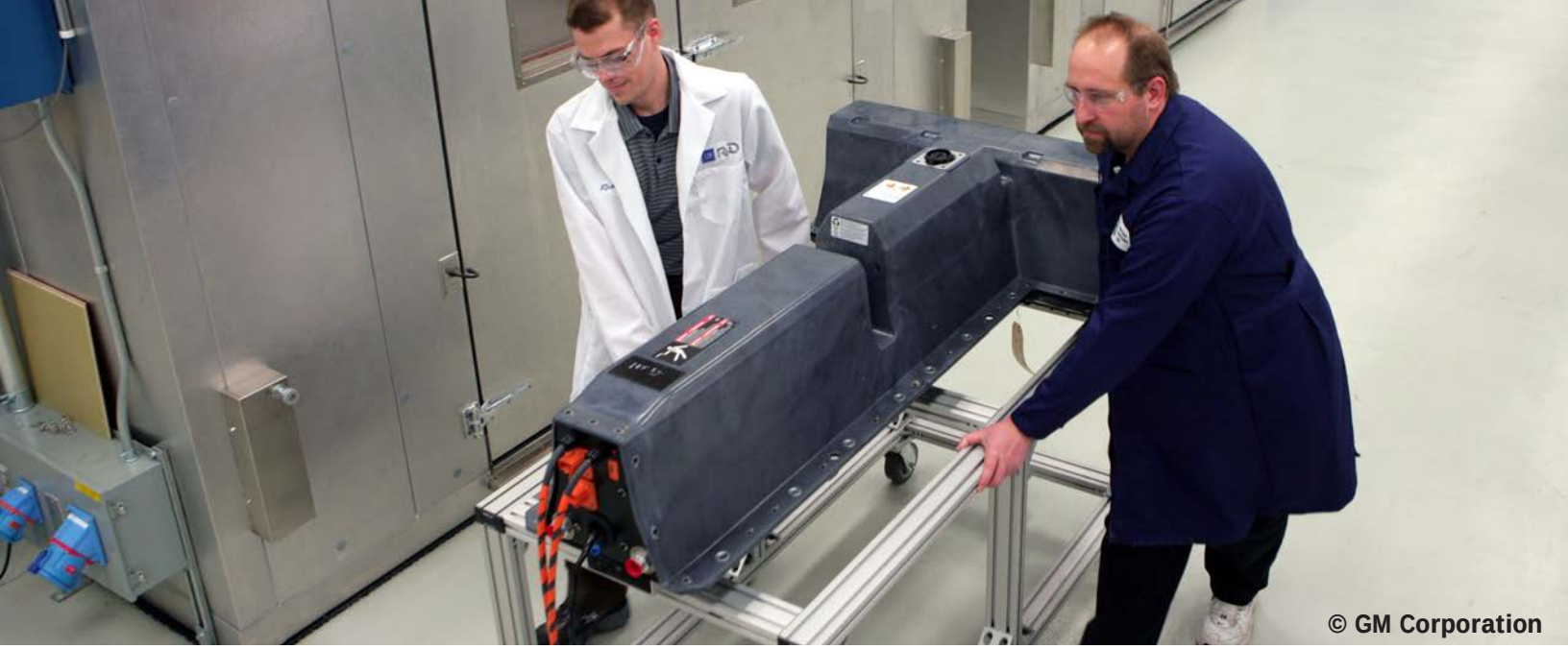
BATTERY TESTING SOLUTIONS

We are a leading provider of environmental test chambers with over 80 years of industry experience in designing and manufacturing temperature-humidity controlled products. We supply a variety of test chambers for testing batteries of any size with extensive experience in chambers designed for testing NIMH, lead acid and lithium ion batteries from small battery cells to large battery packs.

Battery testing chambers are supplied to a variety of industries including, automotive, computer, telecommunications, defense, and alternative energy markets. With the goal of reducing automobile emissions and the push toward electric hybrid vehicles, the need for lithium ion battery testing is even more critical. Our proven experience provides the most cost-effective solutions.

Each test chamber is built according to specific test requirements and may be interfaced with battery cyclers, control & monitoring data acquisitions systems and other test equipment for a complete integrated test solution.

CSZ reach-in and walk-in chambers featured at GM Battery Test Laboratory.



Products

- High/Low Temperature Cycling Chambers
- Humidity Chambers
- Thermal Shock Chambers
- AGREE Temperature/Vibration Chambers
- Altitude Chambers
- Explosion Proof Chambers

Temperature Ranges

Temperatures range from -70°C to +190°C (-94°F to + 375°F) with an optional humidity range as low as 10% to 95%. Sizes are available from small benchtop units to large walk-in rooms.

Single Stage: -34°C to +190°C (-30°F to +375°F)
Tundra®: -45°C to +190°C (-49°F to +375°F)
Tundra® II: -50°C to +190°C (-58°F to +375°F)
Cascade: -70°C to +190°C (-94°F to +375°F)

We offer extensive experience in chambers designed for battery testing from small battery cells to large battery packs.

Exclusive Tundra® Refrigeration System

The utilities involved with battery testing facilities and electric consumption add to the operating cost of each piece of equipment, a consideration to the bottom line and an important aspect in selecting test equipment. The compressors on an environmental chamber are often a large portion of the electrical load. Our patented Tundra system utilizes a single compressor to get to -45°C (-49°F), and the Tundra II system which also uses a single compressor and provides the ability to test as low as -50°C (-58°F).

By using only one compressor for cold temperature testing at these low temperatures, significant savings can be realized in both operating and maintenance costs.

AGREE Temperature, Humidity Chamber interfaced with Vibration Shaker Table

Features and Options

Safety Features and Options

CSZ provides safety features for reliability and abuse testing of batteries. Each environmental chamber is designed with safety in mind. Safety features may be incorporated into CSZ test chambers and tailored to the various hazard levels (0 - 5) to help mitigate potential risks.

Battery Testing Risks

- Chemical reactions
- Thermal charges & thermal runaways
- Reactions to overcharge
- Reactions to fast charge
- Reactions to damage
- Rupture
- Fire & flame from ignition of flammable gas/liquid
- Explosion

Failure Modes

- Cracks in membrane separating anode and cathode
- Overheating
- Over charging
- Under charging

Hazard Severity Level	Description	Classification Criteria and Effect
0	No Effect	No effect. No loss of functionality
1	Passive Protection Activated	No defect; no leakage; no venting, fire, or flame; no rupture; no explosion; no exothermic reaction or thermal runaway. Cell reversibly damaged. Repair of protection device needed.
2	Defect/Damage	No leakage; no venting, fire, or flame; no rupture; no explosion; no exothermic reaction or thermal runaway. Cell irreversibly damaged. Repair needed.
3	Minor Leakage	No venting, fire, or flame*; no rupture; no explosion. Weight loss <50% of electrolyte weight (electrolyte = solvent + salt).
4	Major Leakage/ Venting	No fire or flame; no rupture; no explosion. Weight loss ≥50% of electrolyte weight (electrolyte = solvent + salt).
5	Fire or Flame	No rupture; no explosion (i.e., no flying parts).
6	Rupture	No explosion, but flying parts of the active mass.
7	Explosion	Explosion (i.e., disintegration of the cell).

* The presence of flame requires the presence of an ignition source in combination with fuel and oxidizer in concentrations that will support combustion. A fire or flame will not be observed if any of these elements are absent. For this reason, we recommend that a spark source be used during tests that are likely to result in venting of cell(s). We believe that "credible abuse environments" would likely include a spark source. Thus, if a spark source were added to the test configuration and the gas or liquid expelled from the cell was flammable, the test article would likely progress from level 3 or level 4 to level 5.

Features and Options

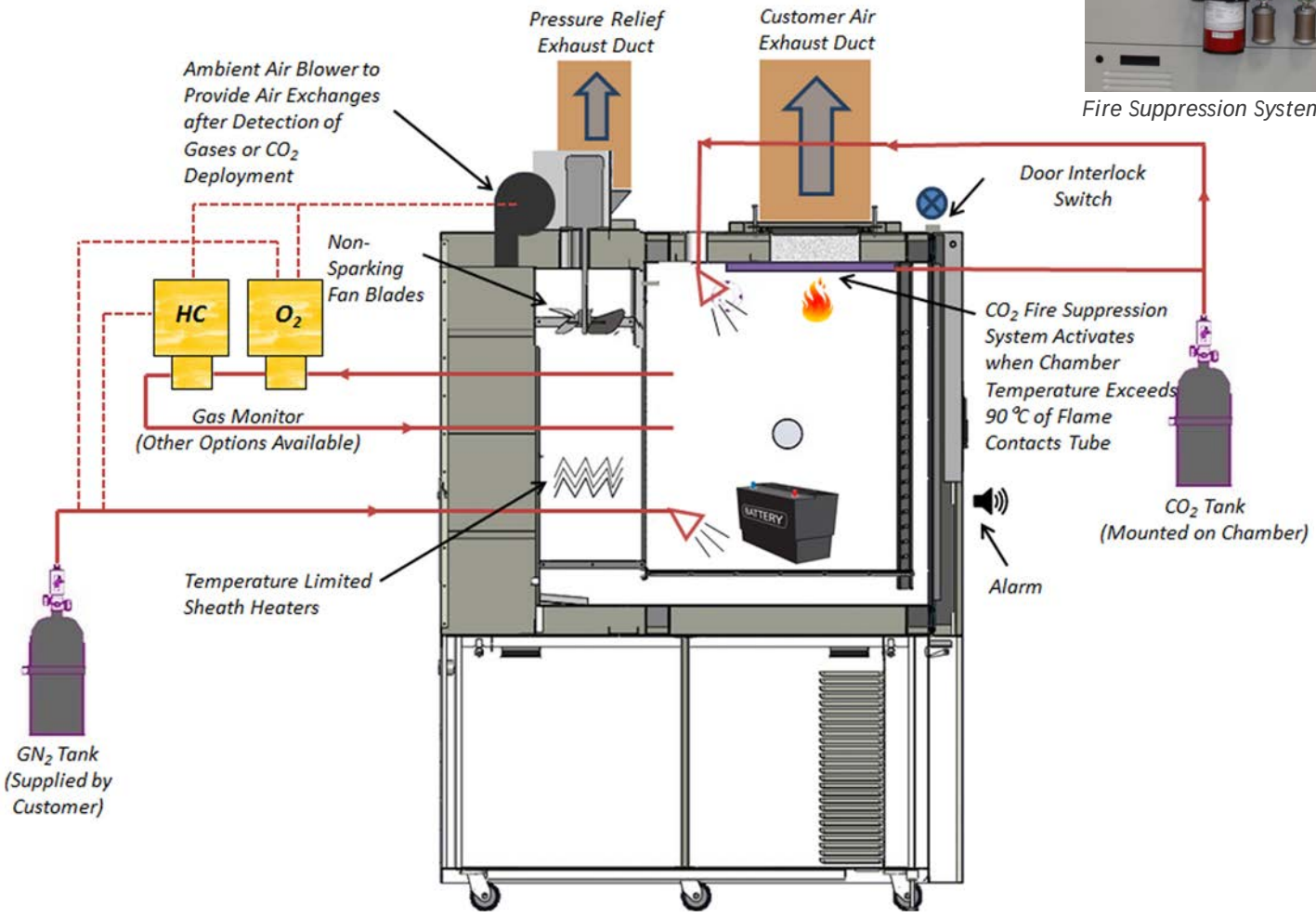
Fresh Air System

Gas Monitor System

Fire Suppression System

Safety Features and Options

- Safety Door Interlock - Prevents entry either during tests or after an event
- Custom Pressure Relief Vent - Protects chamber from a sudden release of high pressure gas
- Fresh Air Exchange System - Aids in removing all gases from inside the chamber prior to opening the door
- Temperature Limited Sheath Heaters - Standard ni-chrome wire heaters can reach temperatures of +540°C (+1000°F). Temperature is set below ignition temp. of gases
- Intrinsically Safe Barriers - Prevents the potential of high voltage pulses
- Gas Monitors - O2, H2, CO, etc - Can be interlocked to controller to shut down chambers
- Protective Enclosure/Structure - External structure that would contain any fire or explosion
- Non Sparking Fan Blades or Blower Wheels - Prevents sparking/explosion
- Fire Suppression-Inert Atmosphere Uses N2 or CO2 to eliminate Oxygen - does not prevent thermal runaway but can help contain
- Reinforced Chamber Floor - To support weight of heavy product and extreme temperature
- LN2 Test Article Surface Cooling - Used to cool cells or packs if they overheat - may help prevent thermal runaway
- GN2 Purge - Helps flush out outgassing from product under test



EZT-570 Touchscreen Controller

Find out more

The Next Generation Controller with Smartphone Technology

All features are built into the controller interface so no additional software or internet is required for access to all the features the controller has to offer.

Communications & Connectivity

- Monitor and/or Control the chamber remotely for anytime, anywhere access from any device using LAN VNC.
- Alarm notification sends email and/or text messages.
- Email built-in to send data, alarm, audit trail files directly from controller.
- Ethernet TCP/IP, EIA-232, EIA-485 communications.

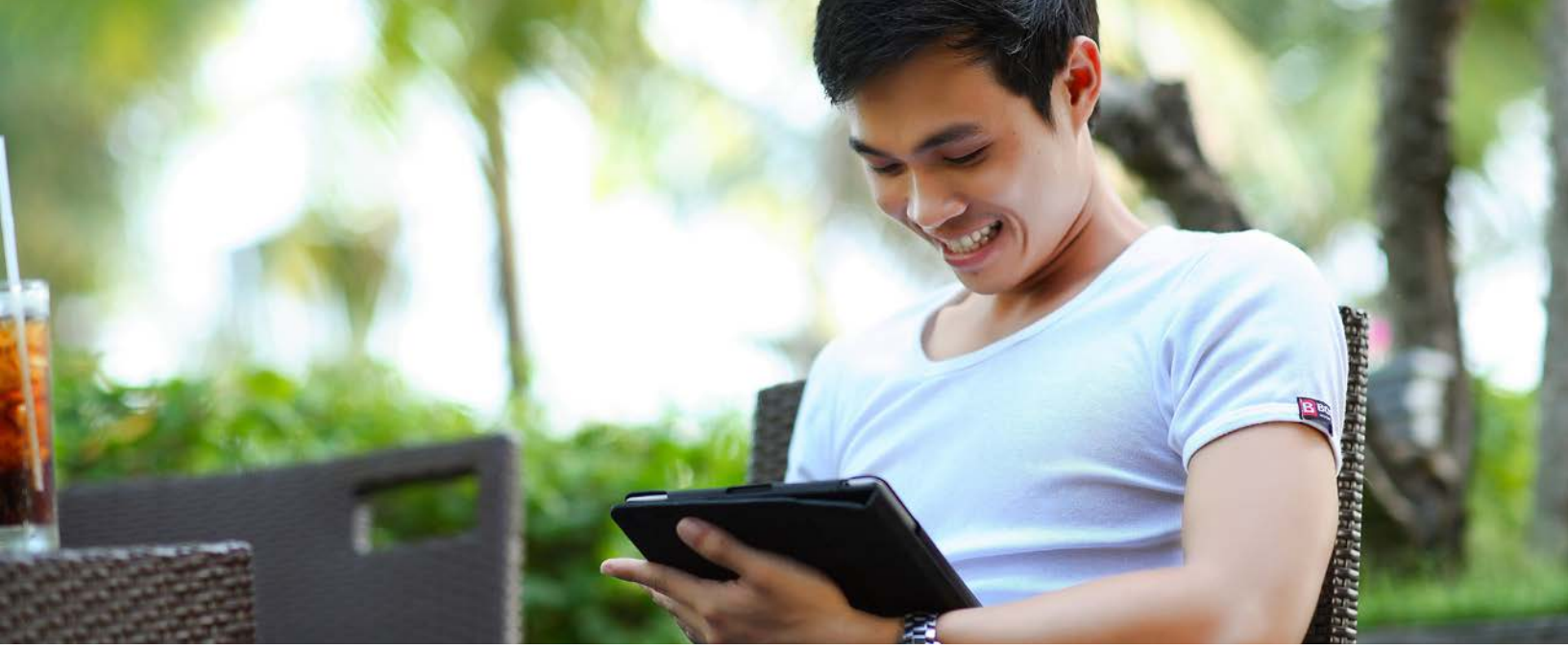
Save valuable time with the ease of use of the EZT-570 featuring fewer steps to accomplish your daily testing needs while incorporating simplified operation and programming to test faster.

Profiling

- Profiling includes up to 99 steps and 1000 cycles.
- Program ramp steps entering time or °C/min.
- Programs may be written using product control function.
- Easily review profile using trend chart or review list of steps before running profile.
- Profile status view displays current step, estimated start/stop date and time and more.
- Profiles may be transferred to different chambers via USB or optional EZ-View software.
- Automated delay profile start.

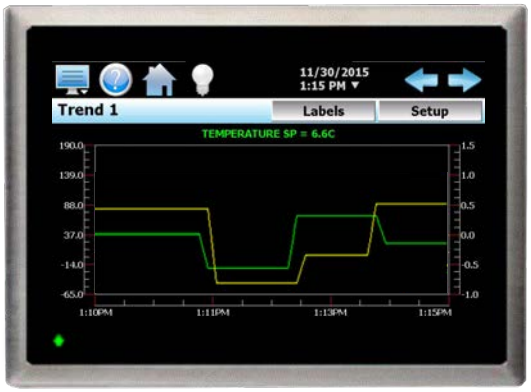
Data Logging

- Configurable log interval, data file length, filename, operator entered batch & lot information as well as an unlimited number of operator notes saved to the data file.
- Access data files directly from controller or PC.
- Easily download profiles, alarm files, audit trail files and data files using LAN (FTP, email) and/or USB in a compatible .csv file format for ease of use. Files may also be automatically backed up daily for hassle-free file management.
- Files may also be automatically backed up daily for hassle-free file management using FTP. FTP/FileWeb/DataWeb (LAN/WAN).



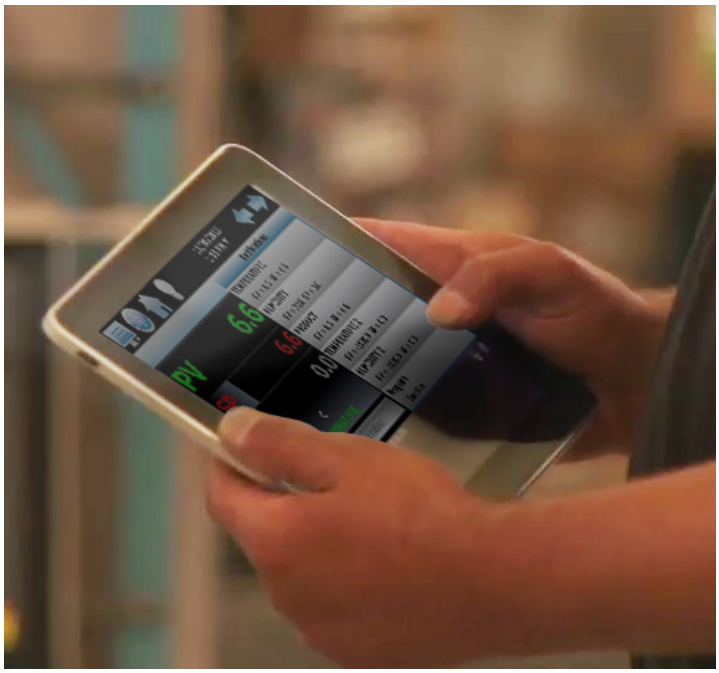
User Convenience & Flexibility

- Controller may be configured in 28 languages
- Selectable power failure/recovery options.
- Full system security allows up to 30 different users with four different levels of security.
- Audit trail files track changes in settings by each user.
- Configure alarm setting and maintenance alerts.



Graphing Technology

- Real-time trend display graph with adjustable time and min/max values.
- Up to eight configurable trend graphs with left & right axis
- Graph historical data files .
- Zoom in/out of graphs for a closer look.



Enhanced Communications & Control Options

- Digital input option provides 8 inputs that can be configured for various control functions including starting, stopping and pausing a profile. "Wait for" function allows the user to pause a profile during a particular step of the profile until a specific digital input is turned on or off.
- Digital output "customer event" feature provides 15 programmable outputs. Each output can be configured to perform other operations including alarm or profile status indicators for more control over your testing.
- Optional refrigeration monitor package displays and data logs temperatures and refrigeration system compressor suction/discharge pressures.
- Condensation control option helps prevent condensation from collecting on the part by automatically managing the air dewpoint.
- Bar code option allows user to scan barcode to start profile and to add notes to current data file when datalogging.

Battery Test Specifications for Environmental Testing

Test Specification	Description

IEC 62660-2	**Reliability & Abuse Testing for Lithium Ion Cells in Electric Vehicles**
	
	• **Capacity discharge test at -20°C, 0°C, +25°C and +45°C**
	• **High temperature endurance**
	This test is performed to characterize cell responses to high-temperature environment. Raise temp at rate of 5°C/min to 130°C +/-2°C. Soak for 30 min
	• **Temperature cycling**
	This test is performed to characterize thermal durability of cell by exposing at low and high temperature environment alternately to cause expansion and contraction of cell components. Start and end below test at +25°C.
	  • Test without electrical operation. Cycles between minimum temperature of -40°C (or specified by mfg) and max of +85°C (or specified by mfg). Repeat for 30 cycles. Refer to spec for timed ramps.
	  • Test with electrical operation. Cycles between minimum temperature of -20°C and max of +65°C. Repeat for 30 cycles. Refer to spec for timed ramps.

SAE J2464	**EV & HEV Rechargeable Energy Storage System Safety & Abuse Testing** •**Thermal Stability.** Increasing temperature in 5°C increments. •**Temperature Cycling.** Cycle between 70°C to -40°C. (soak cells for 1 hr and modules & packs for 6 hours). Repeat for a total of 5 cycles
IEC 60086-4	**Primary Batteries, Part 4: Safety of Lithium Batteries** • **Altitude Simulation Test** Store at pressure of 11.6 kPA or less for a minimum of 6 hrs at ambient. • **Thermal Cycling** For small cells store a minimum of 6 hours. For large cells and batteries store for a minimum of 12 hours at 75°C and -40°C with transition time of ≤30 minutes in between for 10 cycles. Store a minimum of 24 hours at ambient. • **External Case** Product external case temperature to stabilize at 55°C. • **Thermal Abuse** Raise temperature 5°C/min. to 130°C and soak for 10 minutes.

UL 1642	**Standard for Lithium Batteries**
	
	• **Short circuit test at 20°C & 55°C**
	• **Heating test from 20°C to 130°C at 5°C/min and soak for 10 minutes. Return to 20°C.**
	• **Temperature Cycling test with a max of 30 minute transitions**
	  • 70°C and soak for 4 hours
	  • 20°C and soak for 2 hours
	  • -40°C and soak for 4 hours. Return to 20°C. Repeat for total of 10 cycles. Store for a minimum of 24 hours at 20°C
	• **Altitude Simulation Test**
	  • Store for 6 hours at 11.6kpa (50,000 ft.) and a temperature of 20°C

UN Lithium Battery Testing	**UN Lithium Battery Testing Requirements** • **Altitude Simulation Test** Store at 11.6kpa (50,000 ft.) or less and a temperature of 20°C for a minimum of 6 hours. • **Temperature Cycling Test** Store at 75°C and -40°C for a minimum of 6 hours for small cells & batteries or a minimum of 12 hours for large cells & batteries with 30 minutes transitions. Repeat for a total of 10 cycles. Store for 24 hours at 20°C. • **External Case** Product external case temperature to stabilize at 55°C.
IEC 61960	**Secondary lithium cells and batteries for portable applications** Discharge performance test at 20°C and -20°C

Test Specification	Description
IEC 62133	**Secondary cells and batteries containing alkaline or other non-acid electrolytes - Safety requirements for portable sealed secondary cells, and for batteries made from them, for use in portable applications** • **Altitude Simulation Test** Store at 11.6kpa (50,000 ft.) and a temperature of 20°C for 6 hours. • **Temperature cycling** Test at 75°C and soak for 4 hours, 20°C at for a minimum of 2 hours, -20°C at 4 hours, then return to 20°C and soak for a minimum of 2 hours (≤30 minute transitions). Repeat for total of 5 cycles. • **Thermal Abuse** Heat from 20°C to 130°C at a rate of 5°C/min and soak for 10 minutes.

UL 2054	**Household and Commercial Batteries**
	
	• **Heating test from 20°C to 130°C at 5°C/min and soak for 10 minutes. Return to 20°C.**
	
	• **Temp Cycling test with a max of 30 minute transitions**
	  • 70°C and soak for 4 hours
	  • 20°C and soak for 2 hours
	  • -40°C and soak for 4 hours. Return to 20°C. Repeat for total of 10 cycles. Store for a minimum of 24 hours at 20°C

IEEE 1625	**Laptop Rechargeable Batteries** • **Altitude Simulation Test** Store at 11.6kpa (50,000 ft.) and a temperature of 20°C • **Heating Test** 130°C for 10 minutes • **Temperature Cycling Test** Store at 75°C and -40°C for a minimum of 4 hours. Repeat for a total of 5 cycles.
IEEE 1725	**Phone Rechargeable Batteries** • **Heating Test** 130°C for 60 minutes • **Temperature Stability** 150°C for 10 minutes

Cincinnati Sub-Zero is a product brand of Weiss Technik North America, Inc. Weiss Technik North America is a member of the Weiss Technik group of companies, a division of the Schunk Group with its headquarters in Heuchelheim, Germany. Weiss Technik is the world's largest manufacturer of environmental simulation systems and employs more than 2,900 people in 18 group companies in 15 countries.

Request Information

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The Testing Standard.

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