

Environmental Chambers for Battery Testing



Battery Testing Solutions

Cincinnati Sub-Zero (CSZ) is a leading provider of environmental test chambers with over 70 years of industry experience in designing and manufacturing temperature-humidity controlled products. CSZ supplies a variety of test chambers for testing batteries of any size. We offer 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.



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



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Battery Testing Solutions

Environmental chambers are available from small benchtop chambers for testing small battery cells to large walk-in chambers for testing large battery packs. Temperatures range from -73°C to $+190^{\circ}\text{C}$ with an optional humidity range as low as 10% to 95%. Sizes are available from small benchtop units to large walk-in rooms.

Products

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

Temperature Ranges

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: -54°C to 190°C (-65°F to 375°F)

Cascade: -73°C to 190°C (-100°F to 375°F)

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. CSZ offers the patented Tundra system, which utilizes a single compressor to get to -45°C , and the Tundra II system which also uses a single compressor and provides the ability to test as low as -54°C .

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



Temperature Cycling Chamber

Features and Options

Available Safety Features

CSZ provides safety features for reliability and abuse testing of batteries. Each environmental chamber is designed with safety in mind. Our Engineering team will review your test requirements and incorporate applicable test chamber safety features for the specific battery test application. Below is a list of safety features that may be incorporated into CSZ test chambers and tailored to the various hazard levels (0 - 7) to help mitigate potential risks.

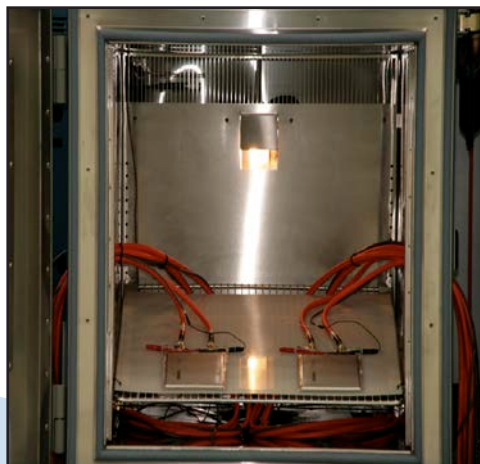
- Safety Door Interlocks
- Venting System
- Rapid Air Expansion Compensation
- Product Temperature Monitoring
- Temperature Limited Sheathed Heaters
- Intrinsically Safe Barriers
- Cooling for Test Article (CO₂ & Immersion)
- GN₂ Purge
- Fire Detection and Suppression
- Gas Monitors (O₂, CO, HC)
- Control Signal for Separate External Systems

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



Battery Cell Testing



Gas Monitor System

Features and Options

Time-Saving Features to Test Faster

EZ→Programming EZ→Datalogging

EZ→To be Connected to Your Test World

CSZ's EZT-570i controller offers a 7" or 10" touch screen and the latest in test chamber programming. **Flexible configurations along with a full range of user-friendly features combine to simplify programming and save valuable time for greater return on your investment.** Intuitive controller includes built-in data security & safeties to protect your chamber and product under test.



Communications & Connectivity

- Ethernet capability to remotely monitor and control multiple test chambers. Wired, wireless, local area network or World Wide Web Ethernet connectivity provides anytime, anywhere access using a PC or PDA device.
- Alarm notification system sends email and/or text phone messages in the event of a test chamber alarm, saving valuable tests while reducing downtime.
- Integrated email sends data files directly from the controller with a touch of a button.



Data Logging

- Data logging with custom file names, batch & lot numbers, operator events & digital signatures.
- Automated "Ethernet" back-up of data files provides "hassle free" file management.
- Easily download profiles, alarm files, audit trail files and data files to USB memory stick in a compatible .CSV file format. Also import profiles to other chambers saving valuable profile entry time.
- Access data files directly from controller or PC.



User Convenience & Flexibility

- Real time & historical trend graphs. Print graphs directly to a printer.
- Profile status view provides details on the profile with stop date and time.
- Profile autostart allows profiles to begin at a date, day and time.
- Help menu provides text and voice assistance in multiple languages (English, Spanish, French or Chinese).

The screenshot shows the 'RUNNING PROFILE: RH TEST' status window. It contains a table with the following data:

Description	Value
PROFILE STATUS:	SOAKING
START DATE:	09/08/10-14:03
ESTIMATE STOP DATE:	09/10/10-08:04
CURRENT STEP:	2
STEP TIME LEFT:	00:30:27
WAIT FOR INPUT:	NOT WAITING
WAIT SETPOINT:	NOT WAITING
TEMPERATURE SP:	42.3
HUMIDITY SP:	12.0
PRODUCT SP:	0.0

At the bottom, it says 'EDITING PROFILE: RH TEST.txt'.

Enhanced Functionality

- Adapt-a-tune technology provides the ultimate in chamber performance and control stability.
- Product control feature accelerates temperature cycling of the device under test.
- Product high/low limit protects product.
- Selectable power failure/recovery options.
- Fully configurable alarm settings.
- Full system security allows up to 30 different users with three different levels of security.

Battery Test Specifications for Environmental Testing

Test Specification	Description
IEC 62660-2	<p>Reliability & Abuse Testing for Lithium Ion Cells in Electric Vehicles</p> <ul style="list-style-type: none"> • 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. <ul style="list-style-type: none"> • 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	<p>EV & HEV Rechargeable Energy Storage System Safety & Abuse Testing</p> <ul style="list-style-type: none"> • 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	<p>Primary Batteries, Part 4: Safety of Lithium Batteries</p> <ul style="list-style-type: none"> • Altitude Simulation Test Store at pressure of 11.6 kPa or less for a minimum of 6 hrs at ambient. • Thermal Cycling Store for a minimum of 6 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 Short Circuit Product temperature to stabilize at 55 °C. • Thermal Abuse Raise temperature 5 °C/min. to 130 °C and soak for 10 minutes.
UL 1642	<p>Standard for Lithium Batteries</p> <ul style="list-style-type: none"> • 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 <ul style="list-style-type: none"> • 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 <ul style="list-style-type: none"> • Store for 6 hours at 11.6kpa (50,000) and a temperature of 20 °C
UN Lithium Battery Testing	<p>UN Lithium Battery Testing Requirements</p> <ul style="list-style-type: none"> • Altitude Simulation Test Store at 11.6kpa (50,000) 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.
IEC 61960	<p>Secondary lithium cells and batteries for portable applications</p> <p>Discharge performance test at 20 °C and -20 °C</p>

Battery Test Specifications for Environmental Testing

Test Specification	Description
IEC 62133	<p>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</p> <ul style="list-style-type: none"> • Altitude Simulation Test Store at 11.6kpa (50,000) 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	<p>Household and Commercial Batteries</p> <ul style="list-style-type: none"> • 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 <ul style="list-style-type: none"> • 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	<p>Laptop Rechargeable Batteries</p> <ul style="list-style-type: none"> • Altitude Simulation Test Store at 11.6kpa (50,000) 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	<p>Phone Rechargeable Batteries</p> <ul style="list-style-type: none"> • Heating Test 130°C for 60 minutes • Temperature Stability 150°C for 10 minutes

The Experience you Rely on...

Cincinnati Sub-Zero (CSZ) Products, Inc. is an ISO-9001 certified company with over 70 years of industry experience designing and manufacturing temperature-controlled products of the highest quality, with a commitment to total customer satisfaction.

At CSZ, we offer a complete line of both standard and custom-designed environmental simulation chambers including:

- Temperature Cycling
- Humidity
- Stability Cabinets & Rooms
- Thermal Shock
- Stress-Screening
- Altitude
- AGREE Vibration
- Freezers
- Liquid Chillers
- Liquid Chillers
- Wind & Rain
- Sand & Dust
- Other Temperature Management Solutions

Sizes range from benchtop to full walk-in/drive-in chambers.

TESTING SERVICES

CSZ Testing Services is an A2LA Accredited Test Laboratory utilizing the latest test technology. CSZ is your one stop source for all of your environmental simulation testing needs. Our testing laboratory is here to help with your product qualification testing, overflow testing and /or third party product validation. Testing capabilities include Temperature, Humidity, and/or Vibration, Thermal Shock, Burn-in, Altitude, Vibration, Shock, Salt Spray, and Cyclic Corrosion test. Serving you from two locations in Cincinnati, OH and Sterling Heights, MI. For more information please call CSZ Testing headquarters at 513-793-7774 or visit www.csztesting.com.



CSZ is your one stop solution for ...

- Environmental Chambers
- Freezers
- System Upgrades
- Preventative Maintenance
- Calibration Services
- Contract Testing Services

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