



ENVIRONMENTAL CHAMBERS FOR BATTERY TESTING



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.



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



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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)

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.

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



AGREE Temperature, Humidity Chamber interfaced with Vibration Shaker Table

Features and Options

Safety Features and Options

We provide 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 - 6) 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



Reference: FreedomCAR: Electrical Energy Storage System Abuse Test Manual for Electric and Hybrid Vehicle Applications SAND 2005-2123



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 $\geq 50\%$ 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

Safety Features and Options

- External Lights - externally mounted lights eliminates potential spark source
- Temperature Limited Sheath Heaters - Standard ni-chrome wire heaters can reach temperatures of $+540^{\circ}\text{C}$ ($+1000^{\circ}\text{F}$). Temperature is set below ignition temp. of gases.
- Protective Enclosure/Structure - External structure that would contain any fire or explosion
- Non Sparking Fan Blades or Blower Wheels - Prevents sparking/explosion
- 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

Fresh Air Exchange System
- Aids in removing all gases from inside the chamber prior to opening the door



Safety Door Interlock - Prevents entry either during tests or after an event



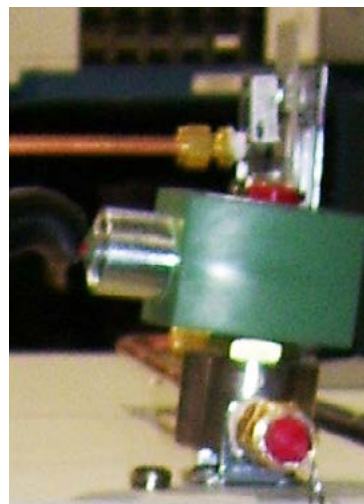
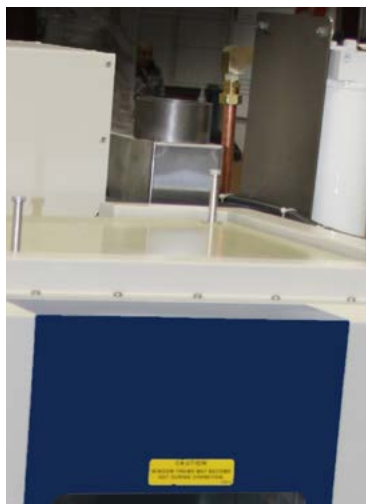
Gas Monitors - O₂, H₂, CO, etc - Can be interlocked to controller to shut down chambers





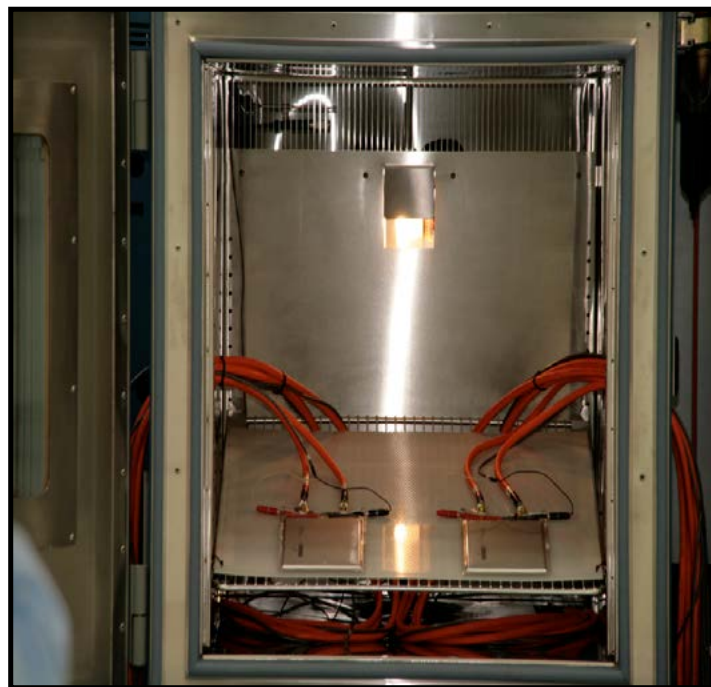
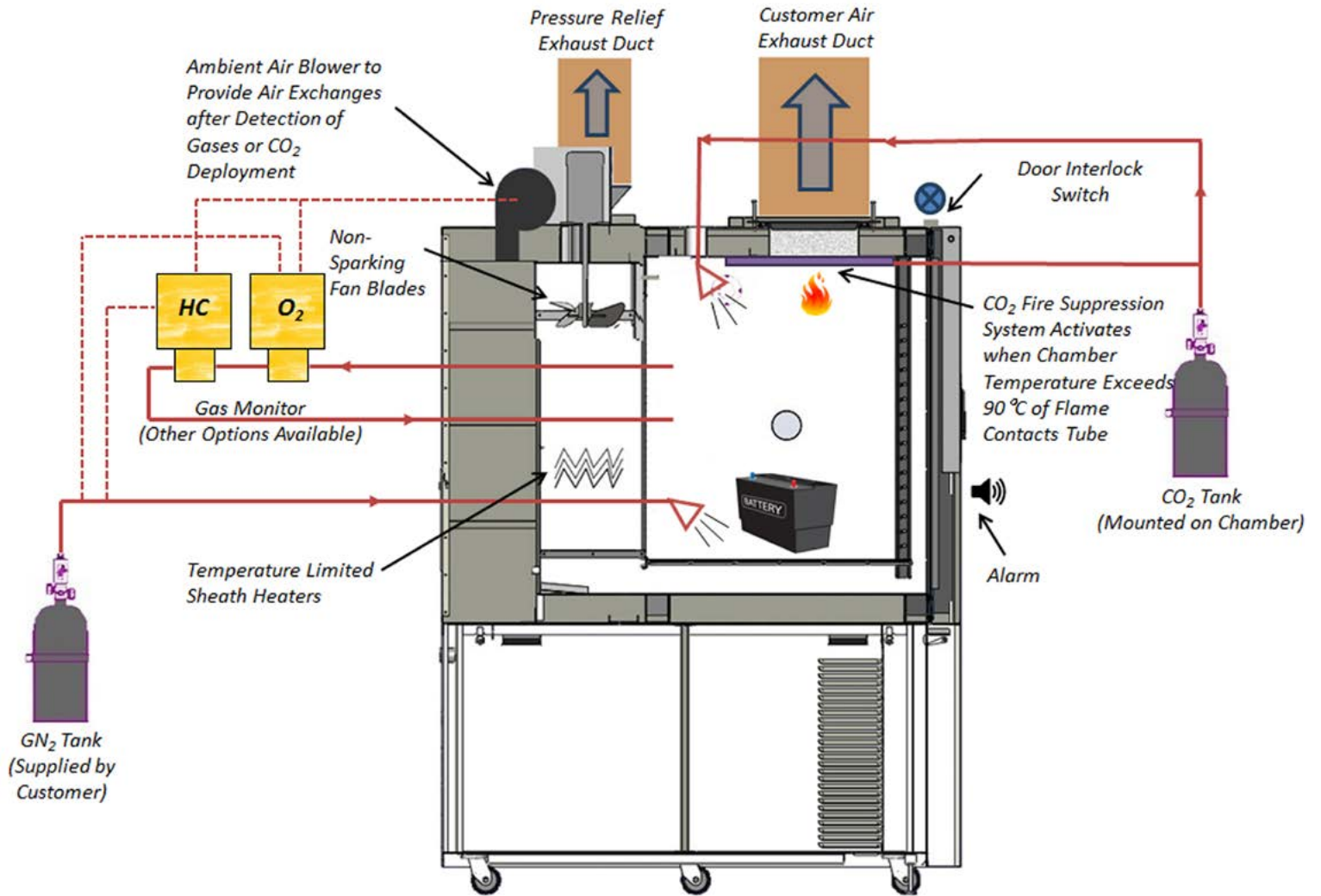
Fire Suppression Systems
Inert Atmosphere Uses N₂ or CO₂ to eliminate Oxygen
- does not prevent thermal runaway but can help contain

Pressure Relief Vent -
Protects chamber from a sudden release of high pressure gas



GN₂ Purge
Helps flush out outgassing from product under test

Features and Options



Battery Cell Testing



Battery Test Specifications for Environmental Testing

Below are common battery testing standards that require the environmental testing such as temperature cycling, humidity, altitude and vibration.

Test Specification	Description
IEC 62660-2	Reliability & Abuse Testing for Lithium Ion Cells in Electric Vehicles
SAE J2464	EV & HEV Rechargeable Energy Storage System Safety & Abuse Testing
SAE J2929	Safety Standard for Electric and Hybrid Vehicle Propulsion Battery Systems Utilizing Lithium-based Rechargeable Cells
IEC 60086-4	Primary Batteries, Part 4: Safety of Lithium Batteries
UL 1642	Standard for Lithium Batteries
UL 2580	Batteries for use in Electric Vehicles
UN/DOT 38.3	UN Lithium Battery Testing Requirements
IEC 61960	Secondary Lithium Cells and Batteries for portable applications
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
IEC 62281	Safety of Primary and Secondary Lithium Cells and Batteries during Transport
RTCA DO-311	Minimum Operational Performance Standards for Rechargeable Lithium Battery Systems
UL 2054	Household and Commercial Batteries



EZT-570S Touchscreen Controller

The Next Generation Controller with Smartphone Technology

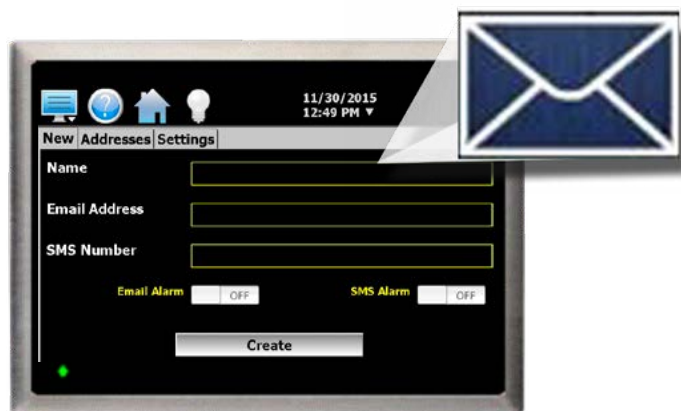
All features are built into the controller interface so no additional software or internet is required for access to all the features the controller has to offer.

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-570S 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 USB or email from controller in a compatible .csv file format for ease of use. Also import profiles to other chambers saving valuable profile entry time.
- Files may also be automatically backed up daily for hassle-free file management using FTP, FTP/FileWeb/DataWeb (LAN/WAN).

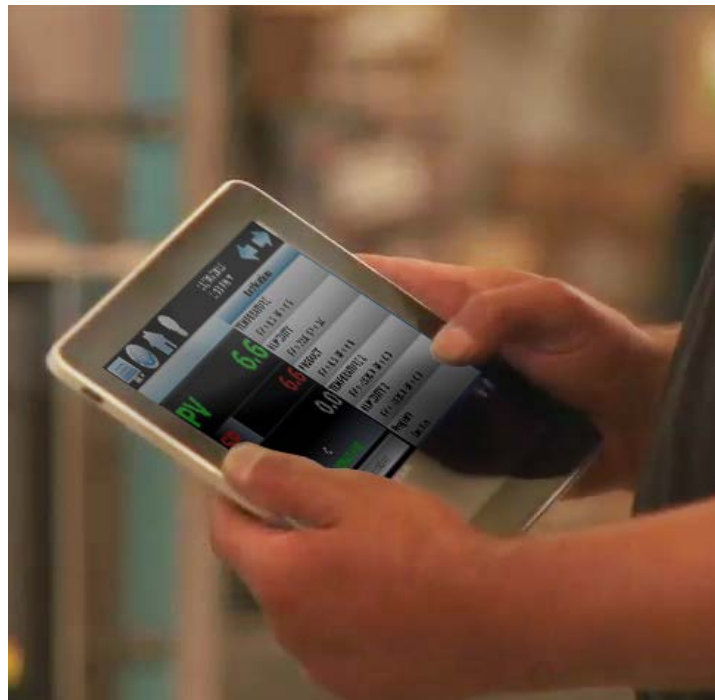
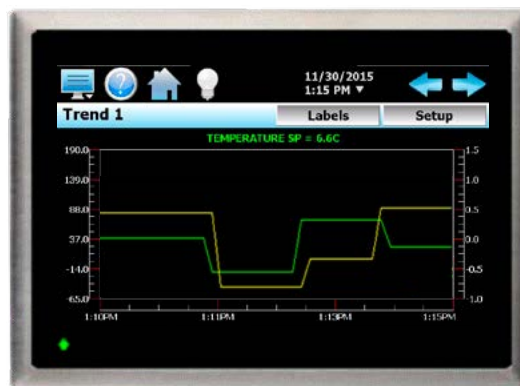


User Convenience & Flexibility

- 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.



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 2,400 people in 22 group companies in 15 countries.



Testing Services

Our A2LA Accredited Test Laboratory provides environmental simulation testing utilizing the latest test technology to meet your testing needs from product qualification testing, overflow testing and /or third party product validation. Capabilities include Temperature, Humidity, and/or Vibration, Thermal Shock, Burn-in, Radiator Testing, Altitude, Vibration, HALT/HASS, Shock, Salt Spray, Cyclic Corrosion test and Drop Testing. Serving you from two locations in **Cincinnati, OH** and **Sterling Heights, MI**.

FOR MORE INFORMATION please call our Testing headquarters at
513-793-7774 or visit **www.wnatesting.com**.



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The Testing Standard.

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