TORONTECH

BATTERY ALTITUDE SIMULATION CHAMBER

High Altitude Insulation and Charge and Discharge Test Chamber for Battery Modules and Clusters

ToronFT™ ATC Battery Altitude Simulation Chamber is a specialized environmental simulation instrument designed for comprehensive electrical performance testing of battery modules and battery clusters under high-altitude conditions. As lithium batteries are increasingly deployed in high-altitude energy storage systems, electric vehicles for mountainous regions, grid-scale storage at high-elevation sites, and aviation applications, verifying their electrical performance — including insulation integrity, withstand voltage capability, and charge/discharge performance — at high-altitude, low-pressure conditions is essential for product safety and performance certification.

The ToronFT™ ATC provides a controlled low-pressure environment that accurately simulates high-altitude conditions, enabling electrical insulation performance testing, high-altitude electrical withstand voltage testing, and initial charge/discharge performance testing of battery modules and clusters. It is designed to comply with international standards for lithium-ion battery electrical energy storage system high-altitude performance testing.

APPLICATIONS

Battery Altitude Simulation Chamber – ToronFT™ ATC Applications

The ToronFT™ ATC is applicable for electrical performance testing at high altitude for the following battery and energy storage product categories:

- Battery modules and battery clusters for electrical energy storage systems requiring high-altitude electrical insulation performance testing
- Battery modules and battery clusters requiring high-altitude electrical withstand voltage testing for safety certification

- Battery modules and clusters requiring initial charge/discharge performance testing at high-altitude, low-pressure conditions
- Lithium-ion battery systems for grid-scale energy storage deployed at high-elevation sites requiring altitude electrical performance qualification
- Electric vehicle battery packs for high-altitude and mountainous region operation requiring altitude electrical performance verification
- Aviation and UAV battery systems requiring high-altitude electrical insulation and charge/discharge performance characterization

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ToronFT™ ATC
Power
Stop
Start
Controller

Standards

The ToronFT™ ATC is designed to comply with the following international standards for lithium battery high-altitude electrical performance testing:

- IEC 62619: Safety requirements for secondary lithium cells and batteries for use in industrial applications
- IEC 62933-5-2: Electrical energy storage systems: Safety requirements for grid-integrated electrical energy storage systems
- IEC 60068-2-13: Environmental testing: Test M: Low air pressure
- IEC 60664-1: Insulation coordination for equipment within low-voltage supply systems (insulation performance standards)
- UN 38.3: United Nations Manual of Tests and Criteria: Test T.1 — Altitude simulation
- IEC 62660-2: Secondary lithium-ion cells for the propulsion of electric road vehicles: Reliability and abuse testing

FEATURES

Battery Altitude Simulation Chamber – ToronFT™ ATC Key Features

- Comprehensive three-in-one high-altitude electrical performance test capability: insulation performance testing, electrical withstand voltage testing, and initial charge/discharge performance testing — all conducted within the same low-pressure altitude simulation chamber
- High-altitude insulation performance test: DC test voltage ±(kV) configurable; test resistance measurement range ±(GΩ) — verifying dielectric insulation integrity of battery modules under reduced-pressure altitude conditions
- High-altitude electrical withstand voltage test: AC and DC test voltage kV configurable — confirming that battery module insulation withstands the specified dielectric stress at altitude pressure conditions
- High-altitude initial charge/discharge performance test: configurable charge/discharge voltage ±V and current A — characterizing the electrochemical performance of battery modules and clusters at high-altitude, low-pressure

operating conditions
- Configurable low-pressure chamber internal dimensions (W × D × H mm) with custom size options — accommodating a wide range of battery module and cluster sizes for high-altitude electrical performance testing
- Precise pressure regulation system maintains the specified altitude-equivalent low pressure throughout all three electrical performance test sequences for reproducible, standards-compliant results
- Complies with IEC 62619, IEC 62933-5-2, and IEC 60068-2-13, providing internationally recognized high-altitude electrical performance test data for lithium battery energy storage system certification in global

THEORY & METHOD

Theory and Method

High-altitude electrical performance testing evaluates how the electrical properties of lithium battery modules and clusters change under reduced atmospheric pressure conditions. At high altitude, the reduced air pressure lowers the dielectric breakdown voltage of air gaps and insulation surfaces — meaning that the same insulation design that passes electrical withstand testing at sea level may fail at high altitude due to the reduced insulating effectiveness of the lower-density air. High-altitude electrical testing is therefore essential to verify that battery module insulation systems maintain adequate safety margins under the reduced-pressure conditions of high-altitude service environments.

In the ToronFT™ ATC, the battery module or cluster specimen is placed inside the low-pressure chamber, and the chamber pressure is reduced to the specified altitude-equivalent pressure. Three key electrical performance tests are then conducted within the low-pressure chamber environment: (1) High-altitude insulation performance test — DC test voltage ±(kV) applied, insulation resistance measured (GΩ range); (2) High-altitude electrical withstand voltage test — AC/DC test voltage kV applied to verify dielectric integrity under altitude conditions; (3) High-altitude initial charge/discharge performance test — charge/discharge cycling at specified voltage (±V) and current (A) to assess electrochemical performance under altitude low-pressure conditions. All test parameters are configurable to the specific requirements of the applicable standard and product specification.

Battery Altitude Simulation Chamber – ToronFT™ ATC Technical Specifications

Parameter	Specification
Product Name	Battery Altitude Simulation Chamber — ToronFT™ ATC
Chamber Internal Dimensions (W×D×H)	Customizable mm (standard and custom sizes; prices vary)
Low Air Pressure Range	kPa to kPa (configurable per altitude test requirement)
High-Altitude Insulation Test Voltage	DC ±(kV) (configurable)
High-Altitude Insulation Resistance Range	±(GΩ) (configurable)
High-Altitude Withstand Voltage	kV (AC/DC) (configurable)
Charge/Discharge Voltage Range	±V (configurable)
Charge/Discharge Current	A (configurable)
Test Scope 1	Electrical insulation performance and withstand voltage — battery modules and clusters at altitude
Test Scope 2	Initial charge/discharge performance — battery modules and clusters at altitude
Compliance Standards	IEC 62619; IEC 62933-5-2; IEC 60068-2-13; UN 38.3

For more information, pricing, or to request a quotation, please contact ToronFT. Specifications are subject to change without prior notice.

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