

BATTERY ENCLOSURE THERMAL RUNAWAY TESTER (BETR)



Battery Enclosure Thermal Runaway Tester (BETR) — ToronFT™ BETR

ToronFT™ BETR Battery Enclosure Thermal Runaway Tester (BETR) is a specialized fire safety testing instrument designed to evaluate the thermal performance of battery enclosure materials during thermal runaway events in lithium battery fuel packs. By inducing controlled thermal runaway within a lithium battery pack positioned inside the test chamber — while the enclosure material specimen is sealed across the open side — the ToronFT™ BETR accurately tests the thermal performance, fire resistance, and structural integrity of battery enclosure materials under the realistic and demanding conditions of a real thermal runaway event.

The battery enclosure thermal runaway tester is designed to bridge the gap between standard material fire tests and the real-world thermal hazards generated by lithium battery thermal runaway — providing EV manufacturers, battery enclosure material developers, and safety certification laboratories with the most application-specific thermal performance data available for enclosure material qualification.

APPLICATIONS

Battery Enclosure Thermal Runaway Tester (BETR) — ToronFT™ BETR Applications

- Battery enclosure material manufacturers: thermal performance and fire resistance qualification under real lithium battery thermal runaway conditions
- Electric vehicle and energy storage system manufacturers: enclosure material selection and design validation for battery pack fire containment
- Third-party safety testing laboratories: battery enclosure material thermal performance testing per UL 9540A and related thermal runaway propagation standards

- R&D departments: evaluation of new composite materials, intumescent systems, and fire-resistant coatings for EV battery enclosure applications
- Regulatory compliance programs: enclosure material qualification for EV battery pack safety certification and homologation



Standards

The ToronFT™ BETR supports battery enclosure material thermal performance testing in compliance with internationally recognized battery safety and fire protection standards, including:

- UL 9540A: Standard test method for evaluating thermal runaway fire propagation in battery energy storage systems (thermal and mechanical performance of battery enclosure materials section)
- IEC 62619: Secondary cells and batteries — Safety requirements for secondary lithium cells and batteries for industrial applications
- SAE J2929: Safety standard for electric and hybrid vehicle propulsion battery systems utilizing lithium-based rechargeable cells
- ISO 26262: Road vehicles — Functional safety (battery system fire containment reference)
- UN/ECE R100: Uniform provisions concerning the approval of vehicles with regard to specific requirements for the electric power train

FEATURES

Battery Enclosure Thermal Runaway Tester (BETR) — ToronFT™ BETR Key Features

- Tests battery enclosure materials under real lithium battery thermal runaway conditions — the most application-relevant fire test for EV battery enclosures
- Test principle: specimen sealed on open side of chamber; lithium battery fuel pack inside chamber induces thermal runaway; thermal performance of enclosure material accurately measured
- Fuel pack configuration: batteries in defined array; individual battery diameter, height, and capacity specified per test requirements

- Control section: computer control system using high-precision bit data acquisition card; accuracy grade up to 1/100; stable performance; good repeatability
- Computer control interface: developed using professional Labview software; strict interface design; high automation; all complex procedures and calculations integrated into the computer; fast response and user-friendly operation
- Provides quantitative thermal performance data — temperature, heat flux, burn-through behavior — under real thermal runaway fire attack
- Compliant with UL 9540A thermal and mechanical performance of battery enclosure materials requirements

THEORY & METHOD

Theory and Method

The ToronFT™ BETR test procedure fixes the battery enclosure material specimen on the open side of the test chamber, sealing it in place. A fuel pack — consisting of type batteries arranged in a defined array inside the chamber — is used to induce thermal runaway. When thermal runaway propagates through the fuel pack, the resulting heat, flame, hot gas, and molten ejecta impinge on the inner surface of the enclosure material specimen from inside the chamber.

The instrument accurately measures and records the thermal performance of the enclosure material throughout the thermal runaway event, including surface temperature, heat flux transmitted through the specimen, and any structural failure or burn-through. The test directly replicates the actual thermal attack that a battery enclosure material must withstand in a real EV battery pack thermal runaway scenario — providing far more relevant data than any indirect furnace or radiant panel fire test.

TECHNICAL SPECIFICATIONS

Battery Enclosure Thermal Runaway Tester (BETR) — ToronFT™ BETR

Technical Specifications

Parameter	Specification
Test Principle	Specimen sealed on open side of test chamber; lithium battery fuel pack induces thermal runaway from inside
Fuel Pack Configuration	Type batteries in array; individual diameter, height, capacity per test spec
Control System	Computer control; high-precision bit data acquisition card; accuracy grade 1/100
Control Interface	Labview software; high automation; integrated calculation; fast response
Measured Parameters	Surface temperature, heat flux, structural integrity of enclosure material
Standard Compliance	UL 9540A (thermal and mechanical performance of battery enclosure materials)



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