

Isothermal Battery Testing Calorimeters

Non-abusive, non-destructive testing for enhanced characterization of thermal behavior and electrical performance of batteries.



Boost your battery intelligence with enhanced characterization of thermal behavior and electrical performance

Faster product development, testing, and launch through scientifically robust data

- Reveal battery heat-release profiles for an optimised battery management system
- Understand performance consequences of use, misuse, and cell aging
- Define effects of environment temperature on battery heat generation to ensure product performance and safety

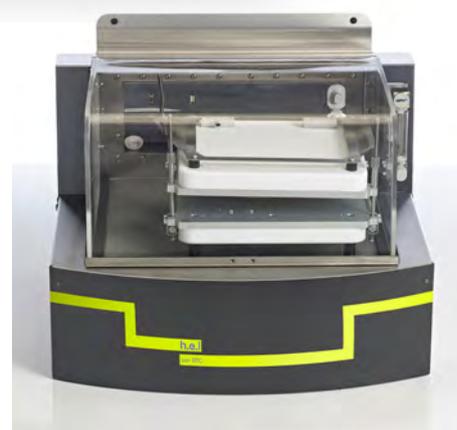


Non-abusive, non-destructive isothermal testing equipment

The **iso-BTC**, and the **new iso-BTC+**, are designed for measuring heat-release profiles during battery charge and discharge testing, giving you enhanced performance and lifespan data. Building on established capabilities, the **new iso-BTC+** allows for testing of even higher power and physically larger batteries.

This performance data will better inform the efficient design of thermal management systems; yielding safer, higher-performing products. A deeper understanding of battery thermal behavior can also enhance thermal propagation modeling/simulations leading to time savings during battery and product testing.

The **iso-BTC** and **new iso-BTC+** work with a range of cyclers and battery formats to precisely quantify the thermal behavior of batteries during real-world use conditions. Electrical and thermal measurements are made simultaneously at defined temperatures, including charge/discharge profiles, all controlled by versatile and easy-to-use software.



iso-BTC



iso-BTC+

What are the consequences of environment temperature on heat released from the battery during use?

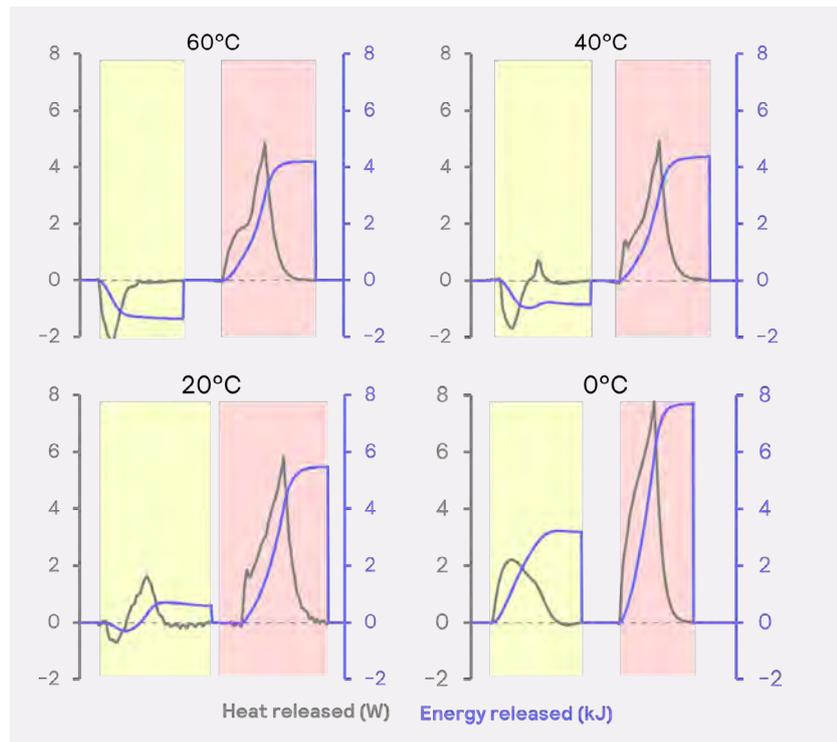
Charge/Discharge cycles of triple gel cell battery at varying temperatures

Charge:

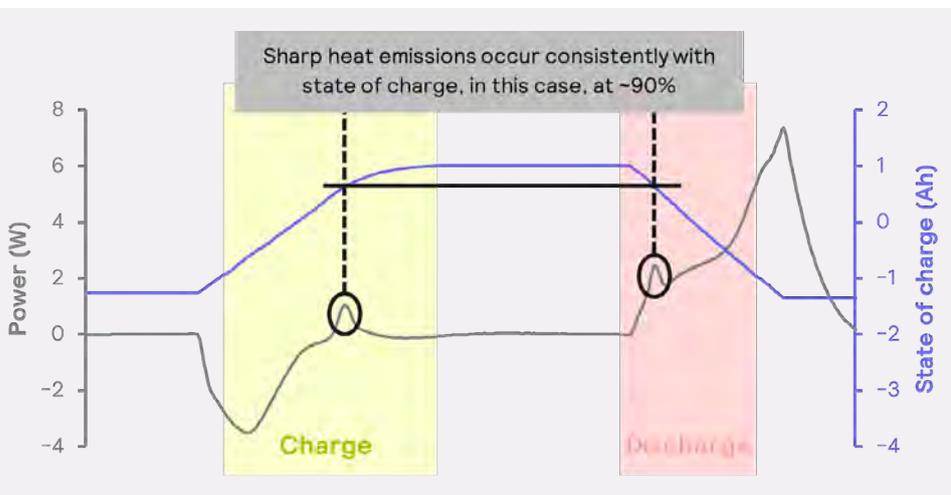
- Energy release profile during charging reveals endothermic and exothermic stages.
- At high temperatures the profile is predominantly endothermic. Charging in hot environments will result in battery cooling.
- At low temperature the profile is predominantly exothermic. Charging in cold environments will result in battery heating.

Discharge:

- Discharging is exothermic, Energy release profile is quantified over a range of temperatures. More energy is released at lower temperatures.



See critical information from fine structure in heat release profiles for increased Performance and Safety



Fine detail in heat release profiles may serve as a means of tracking consistency in battery production processes or represent critical performance and/or safety information.

Customer Insight

“...heat determination under isothermal condition reveals that an efficient and smart battery thermal management system must comprehensively consider the effects of work temperature, state of charge, charge–discharge current rate, and charge–discharge protocol on heat generation. These findings will shed promising lights on thermal runaway prevention as well as development of high energy safe lithium–ion batteries.”

Huang, Lang, Qingdao

Institute of Bioenergy and Bioprocess Technology, Chinese Academy of Sciences

Huang, Lang, et al. “Uncovering LiH Triggered Thermal Runaway Mechanism of a High–Energy $\text{LiNi}_{0.5}\text{Co}_{0.2}\text{Mn}_{0.3}\text{O}_2$ /Graphite Pouch Cell.” *Advanced Science* 8.14 (2021): 2100676.

Performance and Lifespan Testing

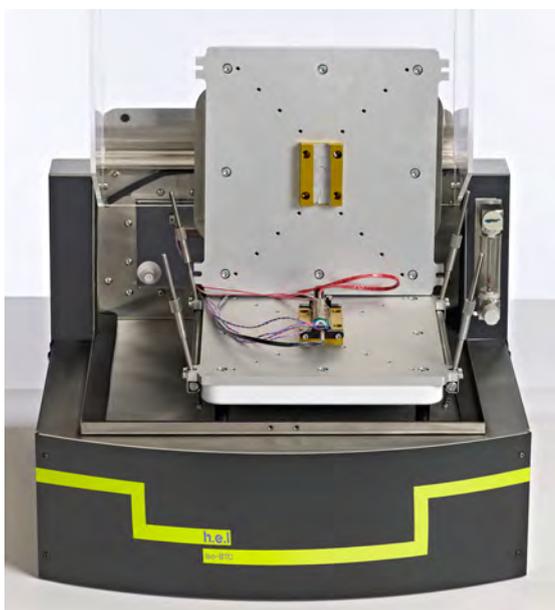
Specification Point	iso-BTC	iso-BTC+
Measurement Type	Isothermal Calorimetry	Isothermal Calorimetry
Type of Test	Performance testing <ul style="list-style-type: none"> • Characterizing performance under normal and abnormal use • Aging and life testing 	Performance testing <ul style="list-style-type: none"> • Characterizing performance under normal and abnormal use • Aging and life testing
Selected Key Data	Battery behavior as a function of (dis) charging rate and temperature <ul style="list-style-type: none"> • Heat release profiles • Battery efficiency profiles • Battery (dis)charging capacity profiles 	Battery behavior as a function of (dis) charging rate and temperature <ul style="list-style-type: none"> • Heat release profiles • Battery efficiency profiles • Battery (dis)charging capacity profiles
Typical Data Use	<ul style="list-style-type: none"> • Thermal management requirements • Cell performance characterization 	<ul style="list-style-type: none"> • Thermal management requirements • Cell performance characterization
Testing Chamber Dimensions	255 x 275 mm (width x depth)	350 x 350 mm (width x depth)
Battery /Sample Size	Coin cells, cylindrical cells, small prismatic cells and small pouch cells	Cylindrical cells, prismatic cells, and pouch cells
Battery Adaptors	Battery adaptor selection for testing on cylindrical cells: <ul style="list-style-type: none"> • 18650 • 26650 • 21700 Optional: Custom adaptors available upon request	Battery adaptor selection for testing on cylindrical cells: <ul style="list-style-type: none"> • 18650 • 26650 • 21700 • 38120 • 40120 • 86116 Optional: Custom adaptors available upon request
Temperature Range	-20 °C to 90 °C as standard* Optional: Temperatures starting from -40 °C	-20 °C to 90 °C as standard*
Maximum Measurable Power	60 W as standard Optional: 100 W	200 W as standard ** (2 x 100 W power zones)
Minimum Heat Detection	5 mW	5 mW
Control & Analysis Software	Common control software (WinISO) and analysis package (iQ)	Common control software (WinISO) and analysis package (iQ)
Data Acquisition Rate	Default sampling rate up to 10 Hz.	Default sampling rate up to 10 Hz.

Specification Point	iso-BTC	iso-BTC+
Operation and Safety Features	<ul style="list-style-type: none"> Automated shutdown procedures if a safety condition is exceeded to ensure user safety N₂ purge for when operating under sub-ambient conditions Multipoint sample temperature measurement 	<ul style="list-style-type: none"> Automated shutdown procedures if a safety condition is exceeded to ensure user safety N₂ purge for when operating under sub-ambient conditions Multipoint sample temperature measurement
Instrument Dimensions (w x d x h)	600 x 550 x 750 mm (with lid open)	1200 x 900 x 1980 mm (with lid open)
Additional Options	<ul style="list-style-type: none"> Heat capacity evaluation Integrated charge cycler Thermal mapping (enhanced resolution from additional multipoint sample temperature measurements) 	<ul style="list-style-type: none"> Heat capacity evaluation Integrated charge cycler Thermal mapping (enhanced resolution from additional multipoint sample temperature measurements)

* dependent on battery power output

** dependent on battery form factor

Please contact our specialist team if the functionality you require is not listed in our standard configuration



iso-BTC



iso-BTC+

Built around the next generation of the proven WinISO software engine and introduces new features that enable scientists to improve laboratory efficiency and boost productivity.

Designed around the user experience, labCONSOL[®] combines:

- **advanced real-time data display**
- **automated monitoring of experiment completion and failure states**
- **rapid data capture modes**

across single or multiple parallel reaction systems.

Enabling researchers to quickly and accurately track how an experiment is proceeding, focusing on the most critical aspects, avoiding unnecessary repeated lab work, which can be both costly and time-consuming.



Better user experience – increased productivity

- New intuitive design means less training time required
- Creating new plans/recipes is now simplified. labCONSOL[®] will also provide hints and tips along the way to prevent errors.
- New plans can be created while an existing experiment is running

Fully configurable workspace – improved efficiency by displaying the info you need

- No swapping between windows required; configure the workspace to suit you.

Improved data-logging and graphing functionality

- New SQL database for file management – no risk of data loss from any experiment
- Improved graphing performance – view entire experiment on a single graph

Invest for the future – benefit from additional features and functionality

- Free software upgrades during the warranty period of your equipment
- Can be extended with a Premium Agreement or Extended Warranty

Powerful software

- One piece of software to support the full range of H.E.L equipment
- Powerful and flexible code base combined with intuitive and user-friendly design

**For more information, and how to request an upgrade,
visit <https://helgroup.com/products/labconsol/>
or speak to your local H.E.L representative**

Upgrades, Support and Training

We understand that your needs can change over time and you may require:

- A system upgrade
- Training for new team members
- Support on your processes
- To book some time with our service team

Our dedicated service team and highly knowledgeable technical staff will work with you to find the right solution.



Customer Service Enquiries & Technical Support Requests

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About H.E.L Group

H.E.L Group's mission is to work together with chemistry, safety and biotechnology experts to engineer and unleash the full potential of the scientific community. To this end, H.E.L develops and manufactures innovative scientific instruments and software designed to optimize the efficiency, safety and productivity of key processes in chemistry and biology applications.

The H.E.L team includes highly skilled process and software engineers, based at their extensive research and manufacturing facilities in the UK, as well as sales and support offices around the world.

H.E.L has a long history of solving complex challenges for customers. For more than 30 years the company has worked with businesses and laboratories globally, providing proprietary automated solutions for the pharma, biotechnology, chemical, battery and petrochemical sectors. H.E.L is accredited with ISO 9001 : 2015 and ISO 14001 : 2015.

- With a strong focus on the customer, our **service and support** enables our customers to keep working efficiently
- Our **wide range of customizable products** put the customer at the heart of what we do, with solutions designed around their needs



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