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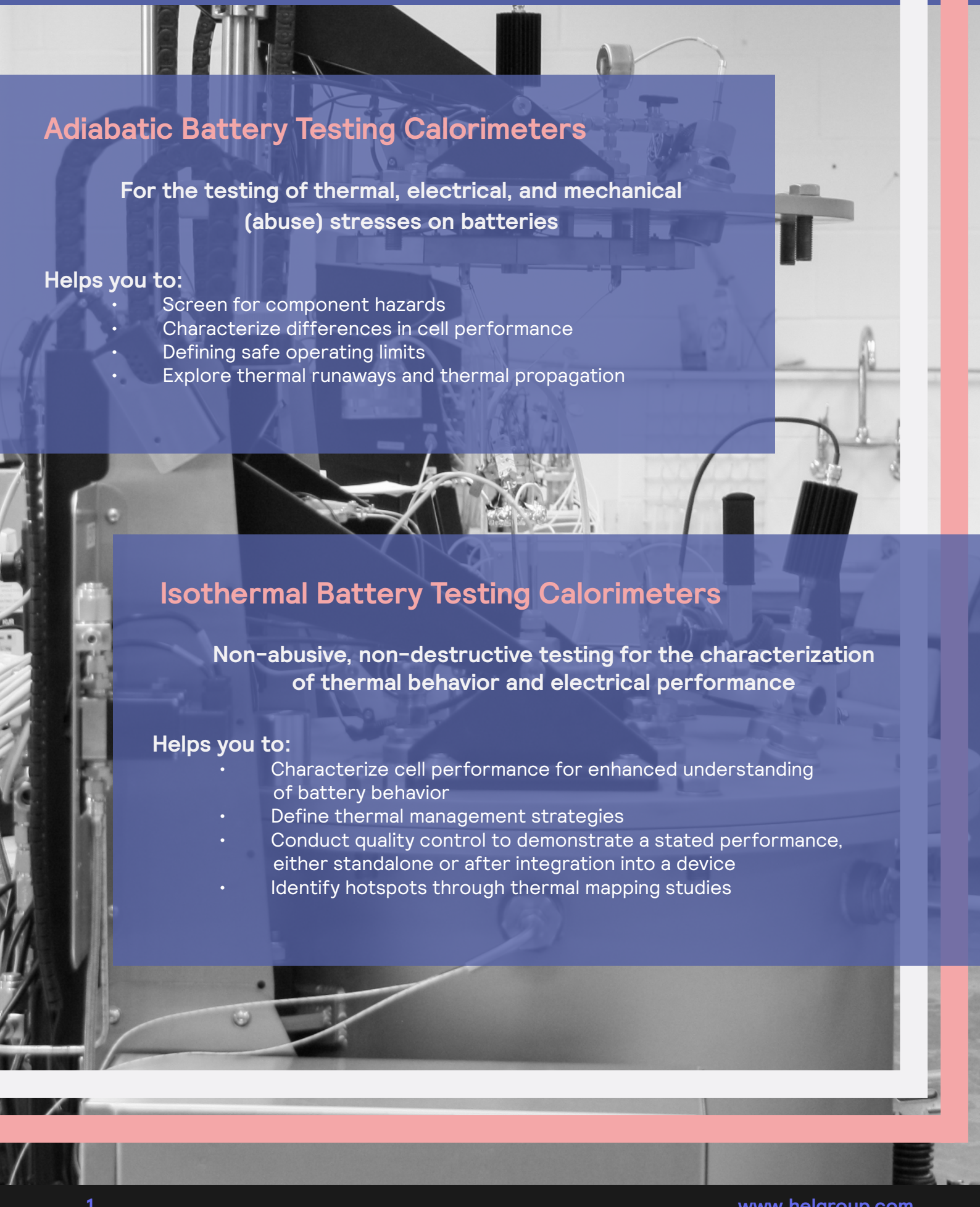
Specification Book

Battery Performance and Safety Testing

Hazard screening, safety testing and performance characterization solutions





Adiabatic Battery Testing Calorimeters

For the testing of thermal, electrical, and mechanical (abuse) stresses on batteries

Helps you to:

- Screen for component hazards
- Characterize differences in cell performance
- Defining safe operating limits
- Explore thermal runaways and thermal propagation

Isothermal Battery Testing Calorimeters

Non-abusive, non-destructive testing for the characterization of thermal behavior and electrical performance

Helps you to:

- Characterize cell performance for enhanced understanding of battery behavior
- Define thermal management strategies
- Conduct quality control to demonstrate a stated performance, either standalone or after integration into a device
- Identify hotspots through thermal mapping studies

Product Range Overview

Specification Point	BTC-130	BTC-500	iso-BTC	iso-BTC+
Measurement Type	Adiabatic Calorimetry	Adiabatic Calorimetry	Isothermal Calorimetry	Isothermal Calorimetry
Type of Test	Safety Testing	Safety Testing	Performance Testing	Performance Testing
Selected Key Data	• Onset Temperature • Battery Thermal and Electrical Behavior Under Stress Conditions	• Onset Temperature • Battery Thermal and Electrical Behavior Under Stress Conditions	Battery behavior as a function of (Dis)Charging rate and Temperature • Heat Release Profiles • Battery Efficiency Profiles • Battery (Dis)Charging Capacity Profiles	Battery behavior as a function of (Dis)Charging rate and Temperature • Heat Release Profiles • Battery Efficiency Profiles • Battery (Dis)Charging Capacity Profiles
Internal Testing Chamber Dimensions	Cylindrical Diameter 130 mm x Height 200 mm	Cylindrical Diameter 500 mm x Height 500 mm	255 x 275 (width x depth)	350 x 350 mm (width x depth)
Battery/ Sample Size	Cell Components, Coin Cells, Small Pouch Cells and Cylindrical Cells	Cylindrical Cells, Prismatic Cells, Pouch Cells and Small Modules	Coin cells, cylindrical cells, small prismatic cells and small pouch cells	Cylindrical cells, prismatic cells, and pouch cells
Temperature Range	Ambient to 500 °C	-40 °C to 500 °C*	-20 °C to 90 °C*	-20 °C to 90 °C
Control & Analysis Software	Y	Y Including Video Monitoring	Y	Y
Data Acquisition Rate	Up to 10 000 Hz*	Up to 10 000 Hz*	Up to 10 Hz	Up to 10 Hz
Operation and Safety Features	Automatic Shutdown	• Automatic Shutdown • Containment Vessel • N_2 Purge	• Automatic Shutdown • N_2 Purge	• Automatic Shutdown • N_2 Purge
Instrument Dimensions (w x d x h)	700 x 600 x 800 mm	1200 x 900 x 1980 mm	600 x 550 x 750 mm	1200 x 900 x 1980 mm
Additional Options	• Integrated Charge Cycler • Nail Penetration Test • Heat Capacity Evaluation • Compatible with Spherical Test Cells for Cell Component Testing	• Integrated Charge Cycler • Nail Penetration Test • Heat Capacity Evaluation • Thermal mapping* • External Shorting Test • Automated Gas Analysis	• Integrated Charge Cycler • Heat Capacity Evaluation • Thermal mapping* • Custom Battery Adaptors	• Integrated Charge Cycler • Heat Capacity Evaluation • Thermal mapping* • Custom Battery Adaptors

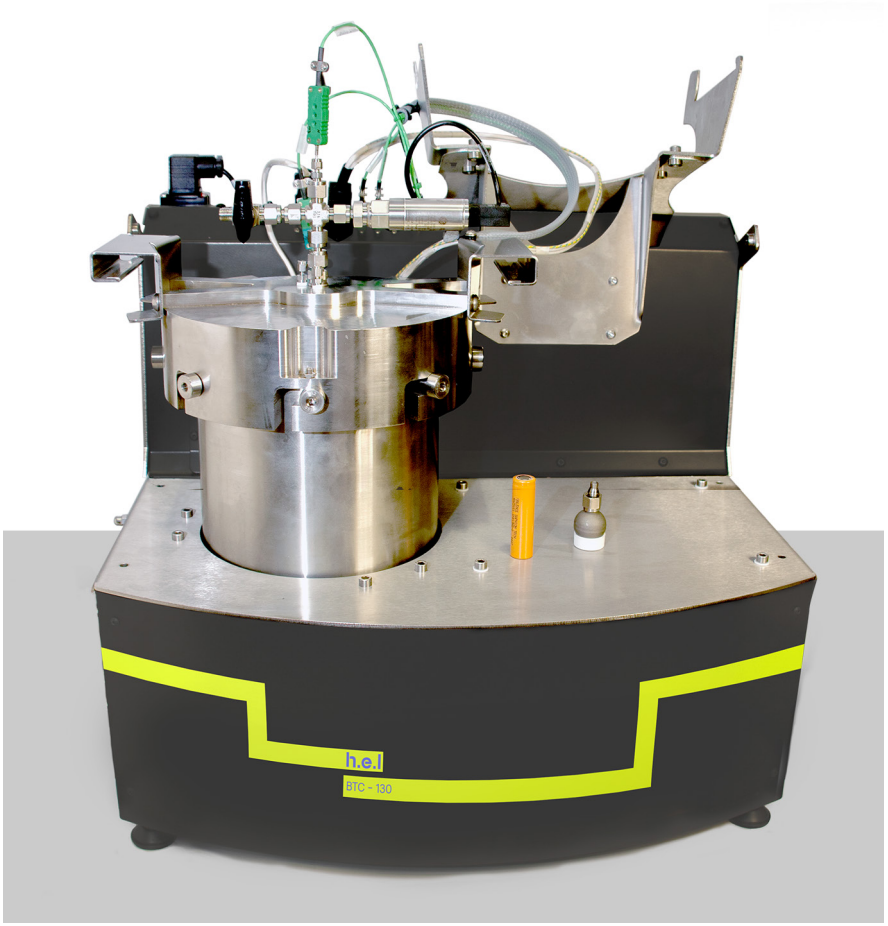
* Further details can be found on the instrument specific page

BTC-130

Specification Point	BTC-130
Measurement Type	Adiabatic Calorimetry
Type of Test	Safety testing - Thermal stress tests - Electrical stress tests - Mechanical stress tests
Electrical Stress Test Options	- Integrated charge cycler
Mechanical Stress Test Options	- Nail penetration test
Selected Key Data	- Onset temperature of exotherm - Battery thermal and electrical behavior under stress conditions
Typical Data Use	Hazard screening Defining safe operating limits - Safe working temperature - Maximum safe voltage - Maximum safe current Understanding thermal runaways and thermal propagation
Testing Chamber Dimensions	Internal cylindrical diameter: 130 mm Maximum internal height: 200 mm
Battery/ Sample Size	Cell components, coin cells, small pouch cells and cylindrical cells
Operating Temperature Range	Ambient to 500 °C
Max Temperature Measurement	500 °C
Detection Threshold to Exothermic Activity	0.02 °C /min
Control & Analysis Software	Common control software (WinISO) and analysis package (iQ)
Operating Modes of the Software	- Ramped screening - Heat-Wait-Search tests - Heat soak operation - Adiabatic tracking - Isothermal aging tests
Data Acquisition Rate	- Sampling rate automatically adjusts to allow greater resolution when tracking exothermic events. - Default sampling rate up to 10 Hz. - **Optional:** High data rate acquisition available for characterizing extremely fast reactions (up to 10 000 Hz) and for compliance with GB/T 36276-2018

Specification Point	BTC-130
Operation and Safety Features	Automated shutdown procedures if a safety condition is exceeded to ensure user safety
Instrument Dimensions (w x d x h)	700 x 600 x 800 mm (with lid open)
Additional Options	- Heat capacity evaluation - Spherical test cells (pressure range 1-150 bara) for cell component testing - N-Type Thermocouples

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



BTC-500

Specification Point	BTC-500
Measurement Type	Adiabatic Calorimetry
Type of Test	Safety testing - Thermal stress tests - Electrical stress tests - Mechanical stress tests
Electrical Stress Test Options	- External shorting test - Integrated charge cycler
Mechanical Stress Test Options	- Nail penetration test
Selected Key Data	- Onset temperature of exotherm - Battery thermal and electrical behavior under stress conditions
Typical Data Use	Defining safe operating limits - Safe working temperature - Maximum safe voltage - Maximum safe current Understanding thermal runaways and thermal propagation
Testing Chamber Dimensions	Internal cylindrical diameter: 500 mm Maximum internal height: 500 mm
Battery/ Sample Size	Cylindrical cells (upwards from 18650), prismatic cells, pouch cells and small modules
Operating Temperature Range	- Ambient to 500 °C as standard - **Optional:** Sub-ambient temperatures starting from -40 °C
Max Temperature Measurement	1200 °C
Detection Threshold to Exothermic Activity	0.02 °C/min
Control & Analysis Software	Common control software (WinISO) and analysis package (iQ)
Video Monitoring	High resolution camera offering 30 frames per second for still and video capture
Operating Modes of the Software	- Ramped screening - Heat-Wait-Search tests - Heat soak operation - Adiabatic tracking - Isothermal aging tests

Specification Point	BTC-500
Data Acquisition Rate	- Sampling rate automatically adjusts to allow greater resolution when tracking exothermic events. - Default sampling rate up to 10 Hz. - **Optional:** High data rate acquisition available for characterizing extremely fast reactions (up to 10 000 Hz) and for compliance with GB/T 36276-2018
Operation and Safety Features	- Automated shutdown procedures if a safety condition is exceeded to ensure user safety - Containment vessel designed to retain fragments and fumes should a sample decompose - N_2 purge for when operating under sub-ambient conditions
Instrument Dimensions (w x d x h)	1200 x 900 x 1980 mm (with lid open)
Additional Options	- Heat capacity evaluation - Automated gas analysis - Thermal mapping (multipoint temperature measurement) - External shorting test - Current, voltage and resistance measurements

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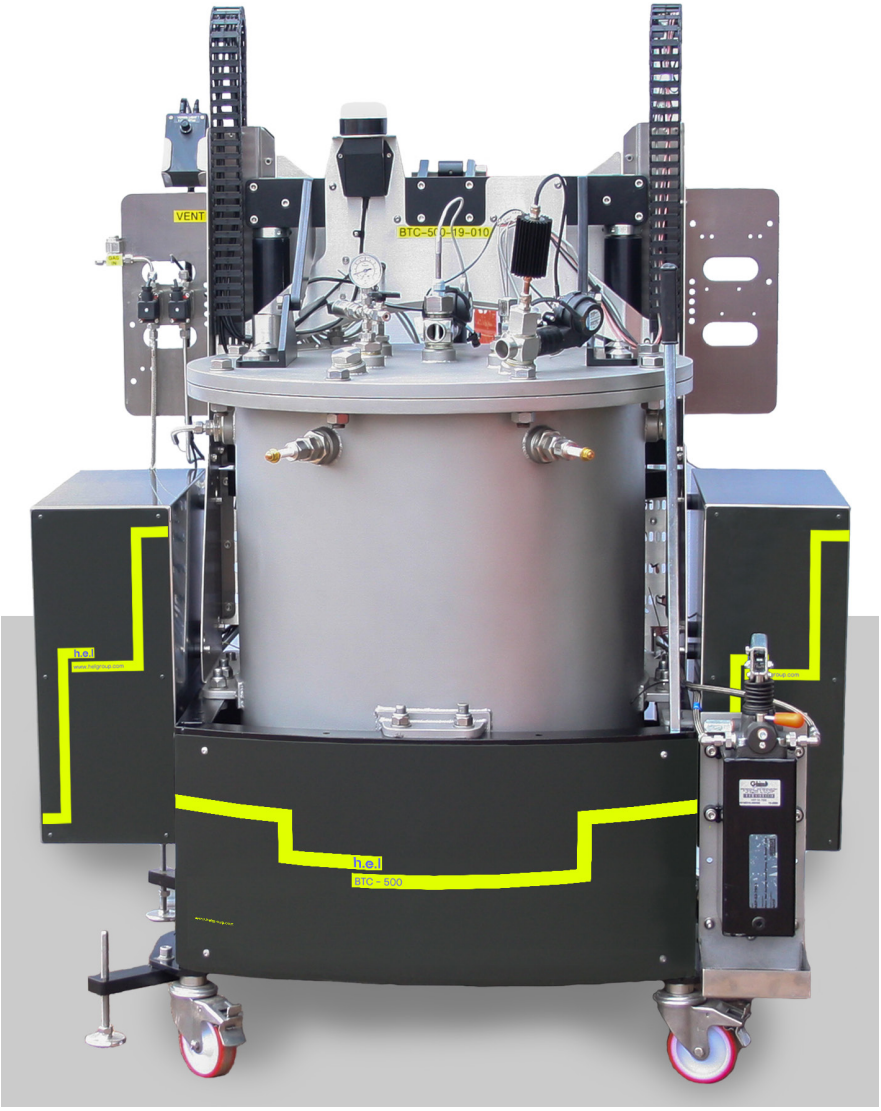

iso-BTC

Specification Point	iso-BTC
Measurement Type	Isothermal Calorimetry
Type of Test	Performance testing • 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 • Heat release profiles • Battery efficiency profiles • Battery (dis)charging capacity profiles
Typical Data Use	• Thermal management requirements • Cell performance characterization
Testing Chamber Dimensions	255 x 275 mm (width x depth)
Battery /Sample Size	Coin cells, cylindrical cells, small prismatic cells and small pouch cells
Battery Adaptors	Battery adaptor selection for testing on cylindrical cells: • 18650 • 26650 • 21700 **Optional:** Custom adaptors available upon request
Temperature Range	-20 °C to 90 °C as standard* **Optional:** Temperatures starting from -40 °C
Maximum Measurable Power	100 W as standard
Minimum Heat Detection	5 mW
Control & Analysis Software	Common control software (WinISO) and analysis package (iQ)
Data Acquisition Rate	Default sampling rate up to 10 Hz.

Specification Point	iso-BTC
Operation and Safety Features	• Automated shutdown procedures if a safety condition is exceeded to ensure user safety • N_2 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)
Additional Options	• Heat capacity evaluation • Integrated charge cycler • Thermal mapping (enhanced resolution from additional multipoint sample temperature measurements)

* dependent on battery power output

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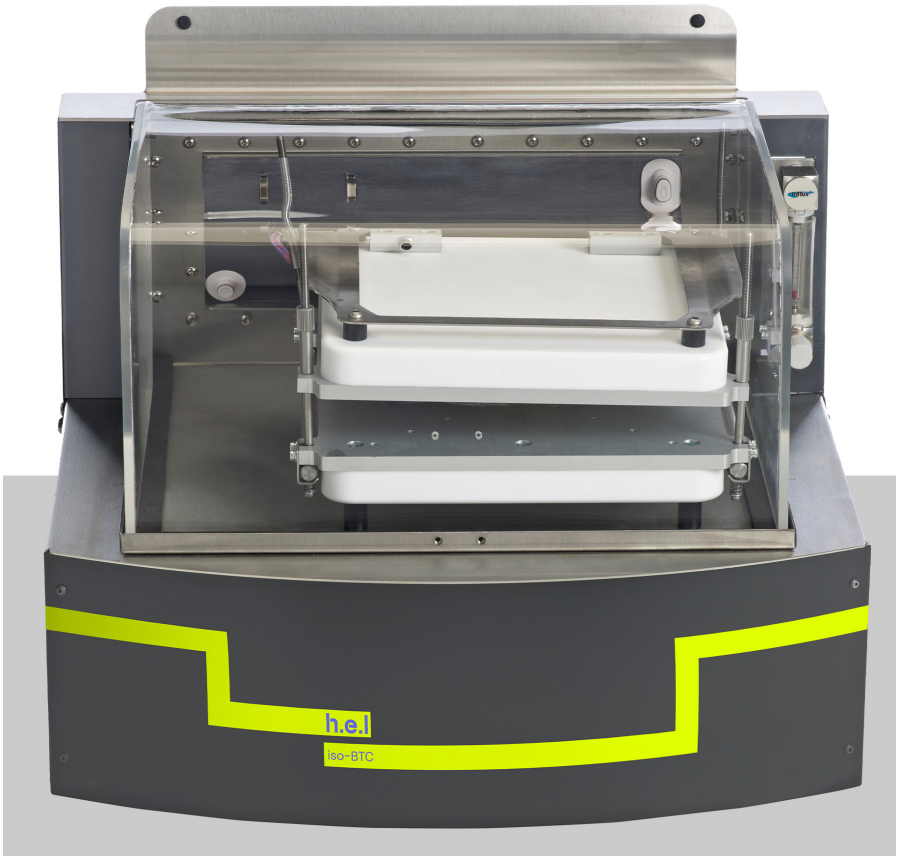

iso-BTC+

Specification Point	iso-BTC+
Measurement Type	Isothermal Calorimetry
Type of Test	Performance testing • 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 • Heat release profiles • Battery efficiency profiles • Battery (dis)charging capacity profiles
Typical Data Use	• Thermal management requirements • Cell performance characterization
Testing Chamber Dimensions	350 x 350 mm (width x depth)
Battery /Sample Size	Cylindrical cells, prismatic cells, and pouch cells
Battery Adaptors	Battery adaptor selection for testing on cylindrical cells: • 18650 • 38120 • 26650 • 40120 • 21700 • 86116 **Optional:** Custom adaptors available upon request
Temperature Range	-20 °C to 90 °C as standard*
Maximum Measurable Power	200 W as standard ** (2 x 100 W power zones)
Minimum Heat Detection	5 mW
Control & Analysis Software	Common control software (WinISO) and analysis package (iQ)
Data Acquisition Rate	Default sampling rate up to 10 Hz.

Specification Point	iso-BTC+
Operation and Safety Features	• Automated shutdown procedures if a safety condition is exceeded to ensure user safety • N_2 purge for when operating under sub-ambient conditions • Multipoint sample temperature measurement
Instrument Dimensions (w x d x h)	1200 x 900 x 1980 mm (with lid open)
Additional Options	• 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

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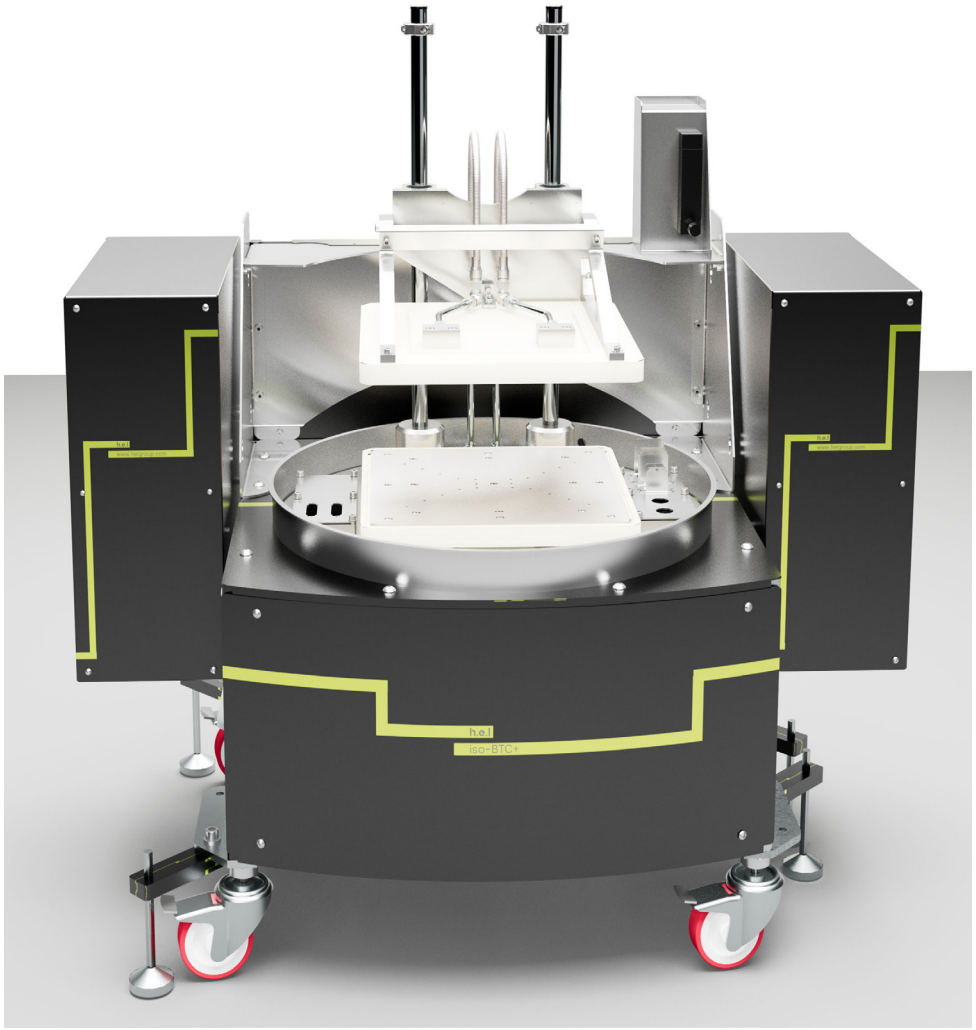



About H.E.L Group

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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H.E.L Group

UK - London	e: sales@helgroup.com	t: +44 208 7360 640
US - New Jersey	e: sales@helgroup.com	t: +1 609 912 1551
China - Beijing	e: info@helchina.com	t: +86 10 8210 1033
India - Mumbai	e: info@helindia.com	t: +44 208 7360 640

For a complete listing of all global contacts, visit www.helgroup.com/contact/

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