



HERCULES

high performance battery testing



I N P H Y S I C S W E T R U S T

Hercules - advanced testing capabilities

The novel **Hercules TR Chamber** leverages your battery abuse testing to the next stage. Designed to provide precise, reliable, and safe evaluation of battery performance under extreme conditions, it enables comprehensive testing of lithium-ion cells, stacks, and modules, ensuring they meet the highest safety standards. This cutting-edge chamber is essential for analyzing critical scenarios like thermal runaway, helping manufacturers optimize battery safety and performance.

The varying operation modes of the chamber allows you to simulate real-world conditions with unparalleled precision. From continuous fresh air supply to inert environments with controlled oxygen levels, this chamber can replicate the exact conditions under which batteries might fail, providing invaluable insights into potential risks.

Designed for both simplicity and efficiency, the **Hercules TR Chamber** offers easy operation with its intuitive controls. Key features include adjustable overpressure valves, flexible sensor ports and compatibility with a wide range of measurement technology, making it the perfect tool for complex testing setups. With its robust construction, the chamber is built to endure high pressure (up to **10 bar**) and extreme temperatures, providing consistent and reliable results every time.

Experience unparalleled innovation with our chamber, designed to replicate real-world failure scenarios and drive advancements in battery technology. Empower your team to lead with confidence and stay ahead in the dynamic energy storage industry.



closed | defined
O2 content



closed |
compl. inerted

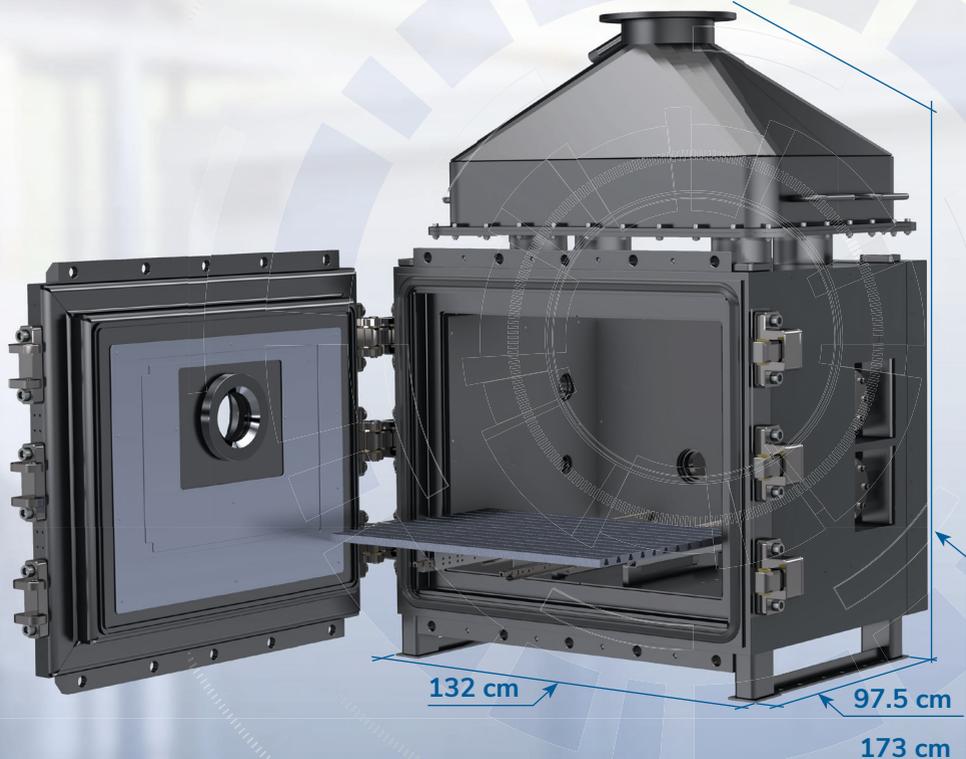


open | cont.
gas extraction

safety features

The **Hercules TR Chamber** is equipped with advanced safety systems to ensure secure operation:

- **pressure monitoring & safety circuit:** monitors up to 10 bar with automatic intervention.
- **overpressure valves:** automatically open at 10 bar and reseal when pressure drops.
- **SPS safety circuits:** prevent operation during setup or loading.
- **inertization inlets:** create oxygen-free environments for safe testing.
- **controlled pressure release:** safety valves discharge pressure in case of emergencies.
- **extraction hood & bypass:** contamination-free gas extraction in regular operation.
- **maintainable spark protection system:** to prevent of oxy-hydrogen explosions.
- **fail-safe pressure venting:** ensures safe access by releasing pressure and venting the chamber in case of a system or power failure.



specifications

max energy	10 kWh
max. cell capacity	500 Ah
high current feedthroughs	250 A
max. temperature signal connections	60
voltage based sensor signal connections	up to 10
connectors (voltage supply or DAQ)	up to 24
chamber heating	3.5 kW
weight incl. exhaust hood	1500 kg
free volume inside reactor	385 dm ³
usable inner dimensions x / y / z	870 / 685 / 530 mm



cell level



stack level



module level

ARC-like test possibility and gas chromatography analysis

Whether testing individual battery cells, multi-cell stacks, or entire battery modules, the TR Chamber is equipped to handle a broad spectrum of testing requirements. It supports ARC-like tests, simulating extreme conditions that are crucial for assessing battery safety. With the capability to heat the entire chamber volume up to 80 °C for these tests, it replicates critical conditions that batteries may face during thermal events.

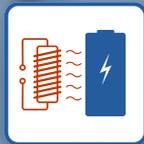
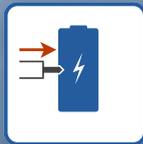
Take safety and innovation to the next level with our advanced chamber. Featuring an optimal interface for gas chromatography (GC) analysis, it delivers precise insights into the chemical composition of vent gases during testing. Equipped with dual tangential centrifugal fans for optimal gas mixing, the chamber ensures accurate detection of hazardous compounds. This cutting-edge technology enhances safety protocols while offering a comprehensive understanding of risks associated with thermal runaway and other failure modes, empowering your team to innovate confidently.

The chamber's capability to support these analytical methods provides an extra layer of security, ensuring that your testing adheres to the highest safety and environmental standards while providing comprehensive evaluation for today's advanced battery technologies.

operation and handling

The **Hercules TR Chamber** is designed for ease of use and optimal functionality, ensuring smooth operation and effortless handling during testing

- **heavy-duty loading systems:** durable drawer for easy loading and unloading.
- **fully opening door:** easy access to the chamber interior and all measurement ports.
- **measurement ports:** temperature-protected & integrated for efficient sensor placement.
- **multiple flanges:** flexible feed-through solutions. Cooling systems, GCA connections ...
- **inspection window:** enables external real-time HD video recording of tests.
- **efficient closure mechanism:** quick and pressure-tight sealing for reliable operation.



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