



BATTERY TESTING

ALL TYPES OF TEST BEDS: CELL, MODULE & PACK



Software and Testing Solutions

[www.fev-sts.com](http://www.fev-sts.com)





FEV has been building battery benches for the past 15 years, with the first major turn-key project being the FEV France e-mobility center in Saint-Quentin commissioned in 2010. Thanks to our unique positioning as test service providers and partners for major OEM developing batteries for EVs we had the opportunity to have an early deep dive in the requirements of the future of battery vehicles and develop fitting testing solutions that will maximize the operation efficiency by integrating all the FEV developed internal knowhow.



### Battery Cell Benches

These benches have voltages up to 10V with currents reaching recently for some OEMs >1000A. They include climatic chambers fitting multiple UUTs and often Electro impedance spectroscopy measurements. Special care is taken in this type of bench for optimizing the test field layout to minimize the total footprint of the set-ups as well as the length of the expensive copper cables.

### Battery Module Benches

With voltages up to 100V and currents up to 300A, a module is usually a combination of multiple cells. These modules have sometimes there dedicated BMS and are becoming more and more liquid cooled.

### Battery pack benches

With voltages and currents up to 1200, also know as the battery system that is combining multiple modules and sometimes multiple packs also known as string packs. Battery packs need big walk-in chambers to be easily installed, these chambers can sometimes take -up to 8 packs at the same time depending on the configuration. The category is certainly the most complex as it could have multiple BMSs as well as multiple cooling circuits. Special care is taken in this type of bench in regards of the safety concept and the safety rating of the hardware used.

#### Cells

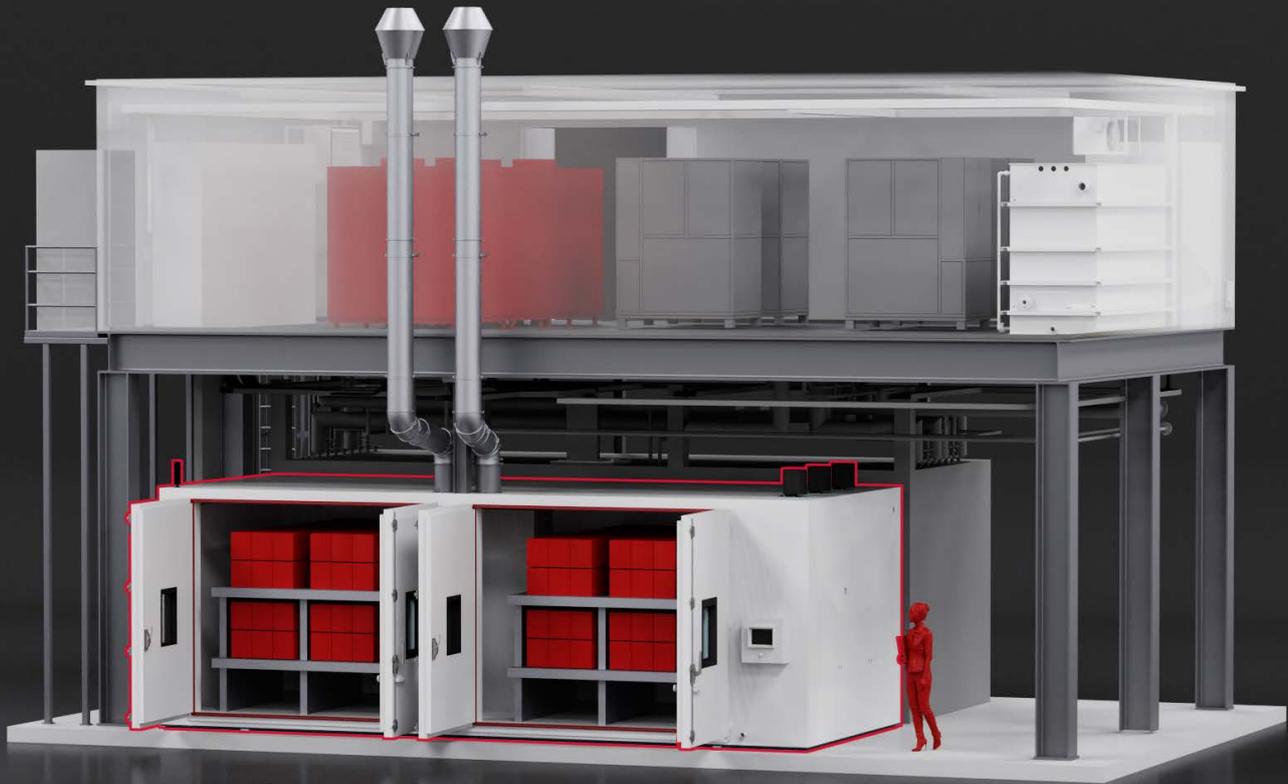
- > A 36 channels power unit
- > 0 - 6 V / 300 A for each channel
- > Climatic chambers -40°C to +80 °C, 0 °C to + 80 °C
- > Current nominal peak: 300 A
- > Current nominal continuous: 200 A
- > Current parallelization: up to 6 channels (1800 A peak)
- > 1 MORPHEE® Asy for the power unit, 3 for controlling 12 channels

#### Modules

- > A 16 channels power unit
- > Voltage: 0 to 120 V
- > A climatic chamber: -40°C to + 80°C, or 0 °C to + 80 °C
- > Fire protection: Fire + smoke detection + CO<sub>2</sub> extinguishing system + smoke exhaust
- > Current nominal peak: 200 A
- > Current nominal continuous: 150 A
- > Current parallelization up to 2 channels (400 A peak)
- > 1 MORPHEE® Asy for 4 channels

#### Packs

- > Charge/discharge cabinet, up to 1200 kW, output voltage: 20-1200V, output current: +/- 2400 A
- > Fully integrated solution with all safety components
- > Climatic chambers: Available in different sizes, including Walk-in Chamber
- > Safety solution includes a sensor system, an extinguishing system, fire flap
- > Cooling system: eCoolCon from FEV
- > MORPHEE® Asy: control of up to 8 packs



## MULTI-INSTANCE FUNCTIONALITY THANKS TO MORPHEE® AUTOMATION SYSTEM

### HEAVY DUTY PACK TESTING

### UP TO 8 HV BATTERY EQUIPPED WITH 1,2 MW ENERGY SYSTEM

- > High power energy systems: Dynamic high power energy system up to 1,2 MW, flexible power profiles for up to 8 test specimens with a mass of 8T in continuous operation.
- > Mobile free field system: Mobile, modular test field. Designed for relocation on demand.
- > Fully automated with MORPHEE
  - In the same test bench , the 4 specimens tested independently thanks to the multi-instance functionality
  - Expert test possible with access to the BMS and simulation mode
- > Dynamic temperature and climate control
  - High-end temperature or climate chamber 1 for simulated environmental conditions from -40 °C to +80 °C, with a temperature change from  $\pm 0,3$  K up to  $\pm 1$  K (per minute)

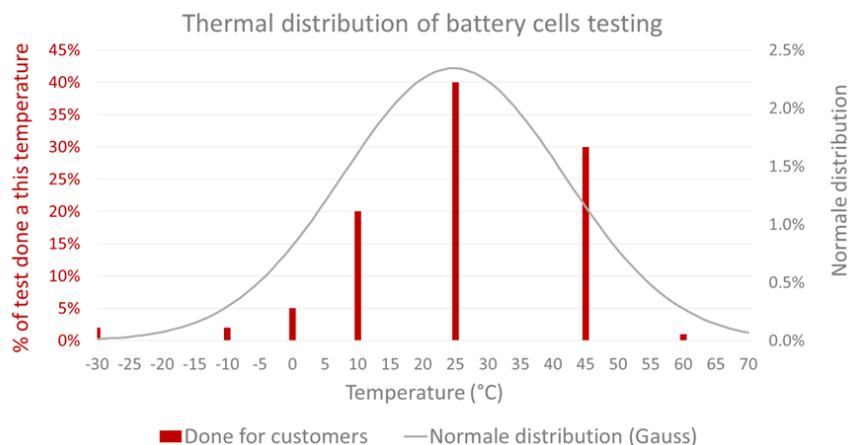


## BATTERYCRAFT

The FEV Batterycraft was developed to respond to the battery testing needs for the automotive industry. It consists of the FEV standard in terms of safety, accuracy, performance, and efficiency. These high-end devices offer a wide range of highly accurate and dynamic sink/source devices with integrated safety systems and performance level D. They feature many options such as high flexibility to parallelize and serials channels by software, isolation monitoring and cable resistance compensation.

FEV offers a very flexible and open solutions that is compatible with all major hardware components available on the market. This means we can adapt to existing equipment and refurbish test cell into e-mobility application, this also means that we always look for the best solutions to fit the need of our customer even if it is not in our standard range of products.

With over 15 years of testing done for customers we have an extensive understanding of what is essential and what is nice to have in a test center. One common example is for the climatic chambers: We see on the gaussian distribution plotted below that more than 90% of tests are done at positive temperature. This means that in 90% of the time the more expensive extreme performance climatic chambers are not at all needed. Having commissioned multiple turnkey battery test center projects worldwide, we have developed partners from suppliers to integrators that give us the ecosystem we need to play around



with different configurations and size the equipment performances to the customer's real needs, avoiding overengineering components and unnecessary extra costs. Everything is considered from the workflow optimization to the real power needs, to the optimal electromechanical design, to the global efficiency of the test center. Finally, FEV continues to virtualize testing through the innovative tool coupling and simulation tools giving you the possibility to run complex battery models in real time to be able to run much more scenarios by simulation and reduce the development time.

**EFFICIENT BATTERY DEVELOPMENT**

**AND TESTING CENTER: EDLP**



## **FEV STS FINALIZES THE CONSTRUCTION OF THE WORLD'S LARGEST TEST CENTER FOR HIGH VOLTAGE BATTERIES FOR PASSENGER AND COMMERCIAL VEHICLES.**

FEV has built the world's largest development and test center for high-voltage batteries used in commercial and passenger vehicles. This center, which belongs to FEV, is located in Sandersdorf-Brehna which sits in a triangle between Halle, Dessau and Leipzig. It includes the most advanced battery testing technologies currently available, such as a 350 kN shaker and FEV MORPHEE® and FEVFLEX™ software, enabling tests to be thoroughly automated.



## Durability Testing

- > 19 Walk-in chamber: 0 - 1000 V / 1200 A / 400 kW channels
- > 7 standard chambers of 800 Liter each
- > 22 standard chambers of 2500 Liter each
- > Temperature range: -40°C to + 120°C

## Environmental & Mechanical Testing

- > 1 Shaker
- > 5 Standard rooms for salt & climate chambers
- > 3 Walk-In climate chambers
- > 3 large & 1 small salt mist chambers
- > 1 Vacuum chamber
- > 1 flush water chamber
- > 1 dust chamber
- > 1 dip tank
- > 1 IP tests area
- > 1 rock fall test

## Abuse Tests

- > 4 Bunker
- > 1 Fire Hall
- > 1 Workshop & Preparation Area

This huge test center was made by FEV STS, and shows a lot of solutions that we can propose, develop and adapt to the needs of customers. How? Mainly, thanks to MORPHEE, its Automation System, FEV STS can adapt its offer to all equipment available on the market. This flexible solution coupled with the proven equipments, the eDLP is now the flagship of all FEV test center, and is the largest high voltage battery development and test center in the world!

The 12,000 square meter complex contains facilities for the electrical testing of both modules and complete high-voltage batteries. This includes a test chamber volume of approximately 600 m<sup>2</sup>, distributed over 54 climatic chambers with an electrical output of 30,000 kW. The new development center will thus have the largest operational, independent battery testing facility in the world. Systems for validating all (international) environmental and 2 mechanical tests, as well as four bunkers will be installed. A fire hall for abuse tests, along with an associated disassembly and diagnosis workshop complete the spectrum. Together, these facilities cover every evaluation necessary for series production. The shaker enables combined mechanical and electrical tests in ambient conditions ranging from -40 to 100°C.

This center is the direct result of FEV's experience and thinking in the field of automotive battery testing: for the last 15 years, FEV has been creating battery test bench solutions for its own centers and those run by other companies. It offers both standardised hardware solutions and software engineering adapted to each center and each test bench.



Are you interested in innovative, pioneering software solutions?

Contact us!  
FEV Software and Testing Solutions  
sales@fev.com | www.fev-sts.com

