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a schunk company

Test Systems for Electrical Energy Storage

Illustration is similar, contains optional equipment

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Know-how for e-mobility – at full charge.

E-mobility is a worldwide automobile mega trend. In the field of mobile systems, lithium-ion batteries have successfully prevailed as energy storage device. Ever larger applications – such as electric vehicles – require storage systems, which not only offer a large energy content, but can also produce large power outputs. Specially designed for lithium-ion batteries, Weiss Technik offers reliable and safe solutions for most diverse test requirements. Test us.

All tests from a single source.

State-of-charge temperature and climate tests are carried out routinely to test the safety, reliability and performance of energy storage devices. Depending on the testing task, it might also be important to carry out further tests. That is why we offer our customers solutions to test various environmental factors, including extreme thermal, climatic and mechanical impacts.

Test equipment in all dimensions.

Depending on the testing task, it can be required to test individual cells, modules and battery packs or complete drive units with a Battery Management System (BMS). Our large selection of tried and tested standard test chambers is already well-equipped in series or will gladly be individually modified for you. Beyond that, we also plan and realise custom test chambers and rooms for entire drive units as a single-source provider.

Better test safely.

Laboratory hazards.

Testing lithium-ion packs, modules and cells with their increasing energy densities is a sensitive topic. During the temperature tests, overchargings or malfunctions of the batteries may occur. This can lead to the destruction of the batteries. Increasing storage sizes cause increasing impacts of possible failures and potential risks during tests with lithium-ion batteries. For this reason, safety in the laboratory, in particular the protection of the staff during such tests has the highest priority.

Framework conditions for energy storage tests.

Although there are binding specifications concerning battery tests for electric vehicles, it is crucial to have an experienced partner at your side who understands the requirements of battery testing. As TÜV-certified specialist for battery testing technology, we are therefore guided by the Machinery Directive and the requirements of the CE Declaration of Conformity. Furthermore, we take into account the ATEX directives and the EUCAR Hazard Standards for hazard assessment.

Tests under the influence of temperature			
External influences, such as	• External heating • Overcharging • Deep discharge • Excessive charging current • External short-circuit	**Internal events, such as**	• Electrode electrolyte reactions • Electrochemical reactions

Impacts on the lithium-ion battery		
Hazard Level	**Description**	**Classification criteria and effect**
0	No effect	No effect. No loss of functionality.
1	Passive protection activated	No defect; no leakage; no venting, fire or flame; no rupture; no explosion; no exothermic reaction or thermal runaway. Cell reversibly damaged. Repair of protection device needed.
2	Defect/damage	No leakage; no venting, fire or flame; no rupture; no explosion; no exothermic reaction or thermal runaway. Cell irreversibly damaged. Repair needed.
3	Leakage Δ mass < 50%	No venting, fire or flame*; no rupture; no explosion. Weight loss < 50% of electrolyte weight (electrolyte = solvent + salt).
4	Venting Δ mass ≥ 50%	No fire or flame*, no rupture; no explosion. Weight loss ≥ 50% of electrolyte weight (electrolyte = solvent + salt).
5	Fire or flame	No rupture; no explosion (i.e., no flying parts).
6	Rupture	No explosion, but flying parts of the active mass.
7	Explosion	Explosion (i.e. disintegration of the cell).

* The presence of flame requires the presence of an ignition source in combination with fuel and oxidizer in concentrations that will support combustion. A fire or flame will not be observed if any of these elements are absent. For this reason, we recommend that a spark source be used during tests that are likely to result in venting of cell(s). We believe that "credible abuse environments" would likely include a spark source. Thus, if a spark source was added to the test configuration and the gas or liquid expelled from the cell was flammable, the test sample would quickly progress from Hazard Level 3 or 4 to Hazard Level 5.
Source: Own illustration based on EUCAR

Best equipped as standard.

Comprehensive in basic configuration and accessories.

For an optimal protection of persons, test specimens, test equipment and the laboratory itself when testing electrical storage devices, our frequently tried and tested ClimeEvent and TempEvent standard test chambers are the best choice. They are easy to operate and available with test space volumes ranging from 40 to 2,000 litres. Here, a large selection of standard accessories is available to you.

Nearly limitless modifications.

Special testing tasks require special test chambers. This is why we modify the standard chambers according to the hazard assessment and requirement at hand. For example, by adding safety components such as a flushing device with a particularly high air replacement rate. In addition, we offer a wide range of special solutions, such as positioning the control technology above the test chamber, for heavy-duty gratings with a telescopic system and drawer systems for up to 12 batteries with a guide-through and plug-in connector panel.

Available safety equipment.

Safety equipment*	Hazard Levels				
	0-3	4	5	6	7
Status indicator	✓	✓	✓	✓	✓
Electrical door lock	✓	✓	✓	✓	✓
Reversible pressure release flap		✓	✓	✓	✓
Mechanical door lock		✓	✓	✓	✓
Sealing plug and retaining clamp		✓	✓	✓	✓
Particle blocker		✓	✓	✓	✓
Fire detection via CO gas measuring or temperature sensor			✓	✓	✓
Flushing device with N_2 or with CO_2			✓		
N_2 permanent inertisation				✓	✓
O_2 measuring unit				✓	✓
Burst disc					✓
Test system in overpressure-suitable design					✓

*For (modified) standard. Divergent safety equipment for special facilities. For further information please contact us.

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Our innovative Test Chambers are available as **weiss**technik or **vötsch**technik.

Comprehensive safety accessories equipped as standard.

- **Status indicator**

The signal lamp can be positioned variably on the device due to an adjustable magnetic foot. The red signal lamp flashes when a fault occurs. In addition, an acoustic signal is possible.

- **Reversible pressure release flap**

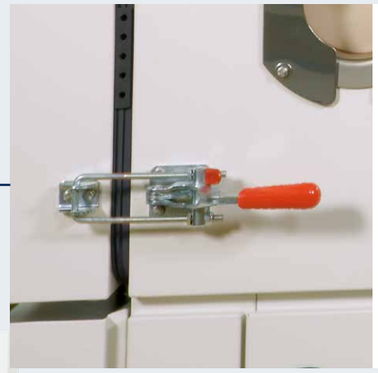
The venting duct is installed on the top of the cabinet. It is equipped with a mechanical, weighted pressure release flap. This can be dimensioned from 80 to 200 mm in diameter, depending on the expected volume of escaping gas.

- **Electrical door lock**

The test space door is locked via an electrical door lock during automatic and manual tests. In automatic mode the complete testing system can be switched off during a program interruption, in order to allow the unlocking of the test space door.

- **Mechanical door lock**

Two fasteners which mechanically hold the door closed are attached to the test space door in addition to the reversible pressure release flap.



- **Sealing plug and retaining clamp**

The entry ports are equipped with retaining clamps to secure the plug.

- **Fire detection via temperature measuring**

Fire is detected by an independent, freely movable Pt 100 temperature sensor. The sensor records temperature increases which are possibly caused by fire inside the test cabinet.

Our innovative Test Chambers are available as **weiss**technik or **vötsch**technik.

Numerous modifications.

- **N_2 permanent inertisation**

The door lock is activated for permanent inerting of the test space with nitrogen (N_2) or argon (Ar). A major flushing quantity reduces the oxygen concentration to ≤ 5 %. After the minimum flushing time has elapsed, testing is released and the system switches to a process-orientated small flushing quantity.

- **Flushing device for inertisation in case of fire**

When a fire is detected, the test space can be flooded with nitrogen (N_2) or carbon dioxide (CO_2). This flooding inertises the test space and with liquid CO_2 also has a slight cooling effect.

- **O_2 measuring unit**

In combination with the permanent inertisation using nitrogen or argon, the oxygen (O_2) measurement is used to monitor the O_2 concentration in the test space. It allows a controlled infeed of nitrogen or argon.

- **CO_2-compressed gas bottles**

As an addition to the flushing device for inertisation in case of fire, a compressed gas bottle, filled with 7.5 kg CO_2 and an aromatic additive, is attached to the side of the test cabinet. The CO_2 is filled into the test space in a liquid state. When it expands, cold gas and CO_2 snow is formed. Several bottles can be cascaded. Manual triggering is also possible.

- **Fire detection via CO gas measuring**

Detection of fire using a carbon monoxide (CO) measurement. An electrochemical sensor is used to measure the CO in the air with the help of a gas measuring pump and tempering of the sample gas. Contacts for alarms are made available on the test cabinet. In conjunction with this option, hydrocarbon (CH) and hydrogen monitoring (H_2) is also possible.

- **Pressure reduction unit using certified burst disc**

In case of damage to the battery, large volumes of gas can be released into the test space at a blow. To extract the gas rapidly, the chamber can be equipped with a pressure release system, connected to a waste air duct. For this, the test space container is manufactured in an overpressure-suitable design and a burst disc is integrated into the ceiling.

Our innovative Test Chambers are available as **weiss**technik or **vötsch**technik.

Maybe a bit bigger?

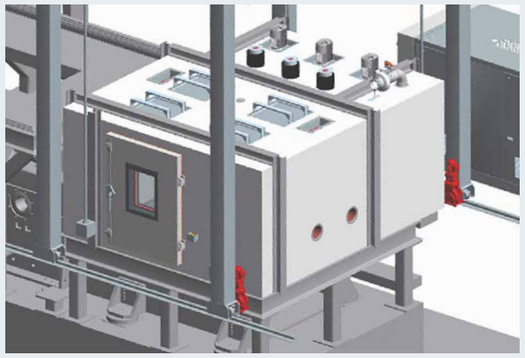
Always the right solution.

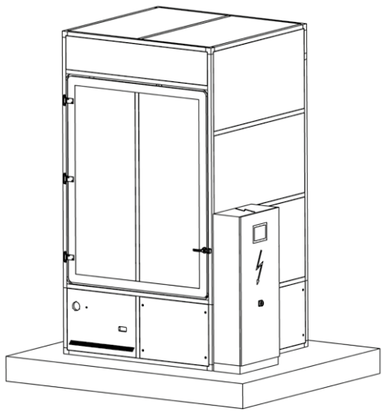
If the standard test chambers are not large enough for you or the test requirements call for a special solution, Weiss Technik offers you almost unlimited options. As a single-source supplier, we develop and implement test chambers and test rooms for modules, packs and complete drive units, with or without BMS. In terms of size, you have choices ranging from walk-in test chambers up to test rooms for entire vehicles.

We offer almost the entire range of battery tests. This includes temperature and climate tests, dust, corrosion and temperature shock tests, splash water tests as well as immersion tests. In addition, our programme includes test systems for damp heat tests, vibration tests and multi-axial shaker tables (MAST).

Worldwide unique.

In order to test really large battery packs under high loads, we have built a new and spectacular testing system, for example. The 17-m³ test room combines a climate test with special dynamic load tests and the capability of flooding the test chamber.





Flexible in all directions.

The 14-m³ test chamber was designed for a combined temperature vibration test with a multi-axial shaker table. The distinguishing features of this test system are the flexible, insulated test chamber walls, which can be raised and lowered by motor.

Realistic testing under harsh conditions.

Even large battery packs have to be tested under the most extreme conditions. That is why we built a testing system to dust entire vehicles. With this system, we can test which effects dust has on the batteries under different climatic conditions and where their potential weak points may lie.

Sophisticated safety concept.

In order to realise the optimal testing system, it is important to understand the test specimen and the testing task down to the last detail and to assess all possible hazards accurately. On the basis of this hazard analysis, we then derive the safety concept and plan all the trades required for the testing system. In doing so, we can draw on our large portfolio of standard components and our many years of experience.

What has to be tested?

It is important to analyse the test specimen to achieve the right testing system configuration. Of relevance to us are parameters such as dimensions, energy density and type of test specimen – is it a cell, a module or a pack? Beyond that, it is crucial, whether the test specimen is in prototype construction or already in series production.

What about the safety philosophy?

Every business has its own safety philosophy. It also applies to the planning and design of testing systems. For example, operator protection against electric shock or escaping HF gas. But above all, one decisive question is which safety reserves and degree of flexibility are required for the testing system in order to achieve maximum future safety.

What are the test conditions like?

Test environment and test conditions are important factors when designing a system. Is it located in a densely populated area or at a sufficient distance from any neighbours? Is it a single testing system or is it positioned next to other testing systems, and must measures be taken to avoid the popcorn effect? In addition, the question of whether semi-skilled personnel or only trained specialists will operate the system can influence its design.

Which other trades are needed?

As a general contractor, we plan and manage all trades such as bricklayers and fitters, electricians and metalworkers in such a way that a single source can realise the testing system

Available safety equipment.

Safety equipment	Hazard Levels				
	0-2	3	4	5	6
Status indicator	✓	✓	✓	✓	✓
Electrical door lock	✓	✓	✓	✓	✓
Reversible pressure release flap	✓	✓	✓	✓	✓
Insulation made of PU	✓	✓	✓	✓	✓
Insulation made of mineral wool	✓	✓	✓	✓	✓
Air purging unit		✓	✓	✓	✓
Particle blocker		✓	✓	✓	✓
Cooling with water spray		✓	✓	✓	✓
O_2, H_2, CH measuring unit		✓	✓	✓	✓
Sealing plug with retaining clamp			✓	✓	✓
Gas and pressure-suitable syphon			✓	✓	✓
Fire detection via CO gas or infrared sensor				✓	✓
Flushing device in case of a fire				✓	✓
Welded and heated access ports				✓	✓
Burst disc					✓
Test system in overpressure-suitable design					✓
Internal and external window protection					✓
Projectiles protection with thick sheet metal					✓

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