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Lithium-Ion Battery Test Chambers

In the field of mobile systems, lithium batteries have successfully proved their importance as energy storage. Even larger applications - such as electric vehicles - require storage systems, which not only offer a large volume of energy, but which also can produce large outputs. To test their reliability, lithium batteries are subjected to various tests in the field of environmental simulation. Weiss Technik is the global leader in Lithium-Ion battery test chambers.

Safety Options for Chambers

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 between 80 and 200 mm ø, depending on the expected volume of escaping gas.

Status display

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.

Permanent inerting using nitrogen or argon

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.

Oxygen measurement

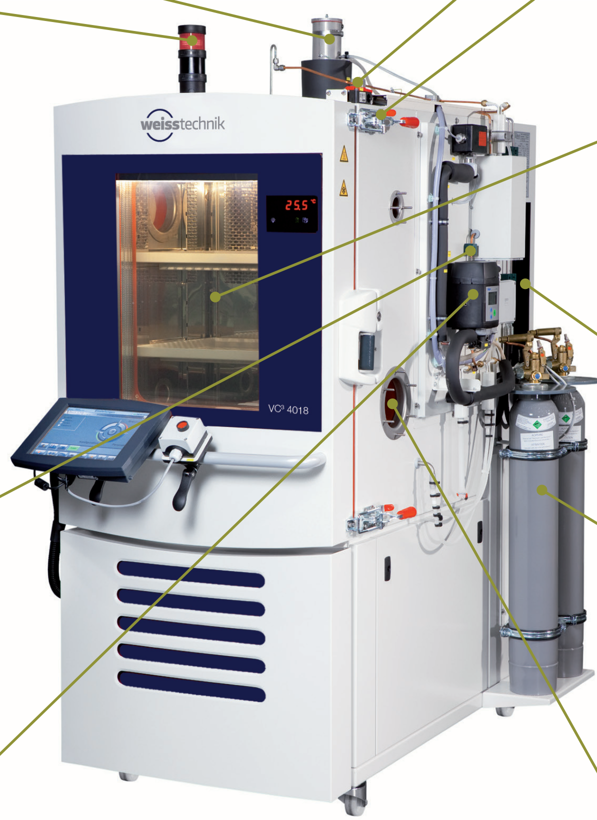
In combination with the permanent inertization using nitrogen or argon, the oxygen (O_2) measurement is used to monitor the O_2-concentration in the test space. It allows a controlled infeed of nitrogen or argon.

Fire alarm system

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, 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 a pressure resistant version and a rectangular burst disc is integrated into the ceiling.



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.

Fire detection via temperature measurement

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.

Flushing device for inertization 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 inertizes the test space and with liquid CO_2 also has a slight cooling effect.

CO_2 compressed gas bottles

As an addition to the flushing device for inertization 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.

Sealing plug and retaining clamp

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

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Hazard Levels

External influences, such as

- External heating
- Overcharging
- Deep discharge
- Excessive charging current
- External short-circuit

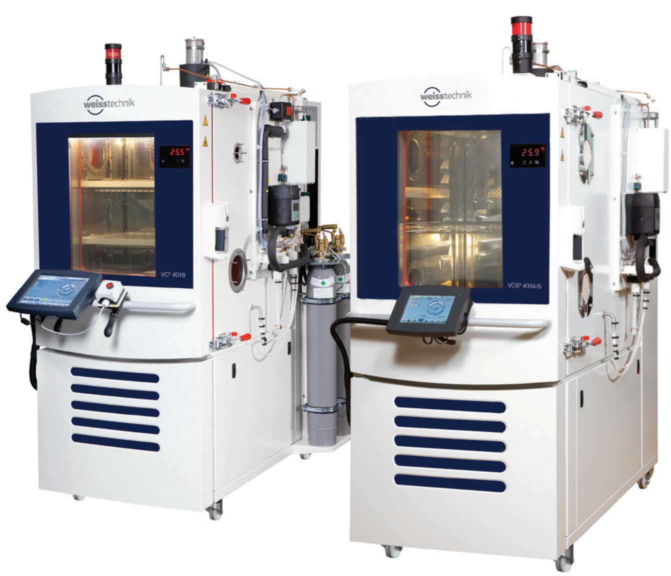
Internal events, such as

- Electrode-electrolyte reactions
- Electrochemical reactions

Impacts on the lithium battery

Hazard Level	Description	Classification Criteria & 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 use 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 were 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.



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