DENIOS

ENVIRONMENTAL PROTECTION
& WORK SAFETY

Safely storing and testing lithium batteries

- Storage rooms
- Test rooms
- Service

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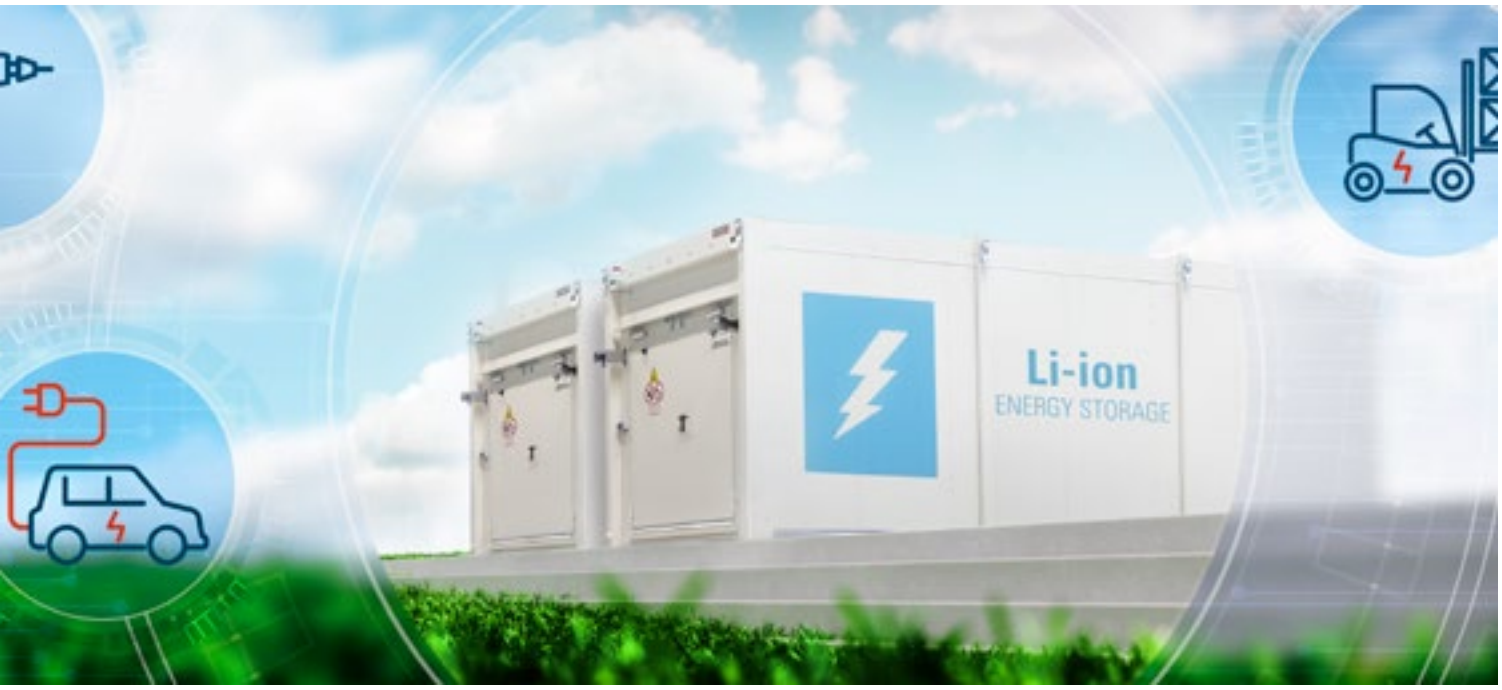
Safely storing and testing lithium batteries

Safe and easy working with lithium

Lithium-based batteries offer high performance with a compact design. These advantages mean they are being increasingly used in applications such as mobile, electronically operated devices or vehicles. Alongside these advantages, this technology also poses safety risks. In particular, there is an increased risk of fire and bursting. As yet, there is no unified legislation on accident prevention. Safety measures need to be taken depending on the individual case, to avoid and limit damage and to guarantee insurance cover. This is where DENIOS can help. As a manufacturer of technical room systems and as international hazardous substance and fire protection experts we have been supporting and advising our customers for over 30 years. We are the first manufacturer to produce fire-rated rooms in steel, which can withstand a fire test for 120 minutes.
But it's not just safety which our customers appreciate. Our technical room systems are convenient and practical to use, year after year.
We offer a wide range of equipment and service options:
For your safety and convenience.



Storing or testing: how you use it makes a difference

For your safety we have developed our technical room systems to a high standard. We don't differentiate here between storing and testing. When it comes to the worst case scenario, all our systems need to do the same thing - withstand the extreme fire load.

The difference comes in the way you use it:
when used for storage, the technical room systems is filled with goods or they are removed from storage. Doors are opened and closed. Goods need to be easy to reach, lift and transport. They must be protected from external and climatic influences. The use of the room, transport routes and access are the priorities.
When used for testing, other aspects such as the manageability of the test object, the test process including test equipment and data collection need to be considered in the design of the room.

Whether you are storing or testing lithium batteries, the right room solution is a DENIOS one:

- Storage rooms (from page ➡ 8)
- Test rooms (from page ➡ 16)

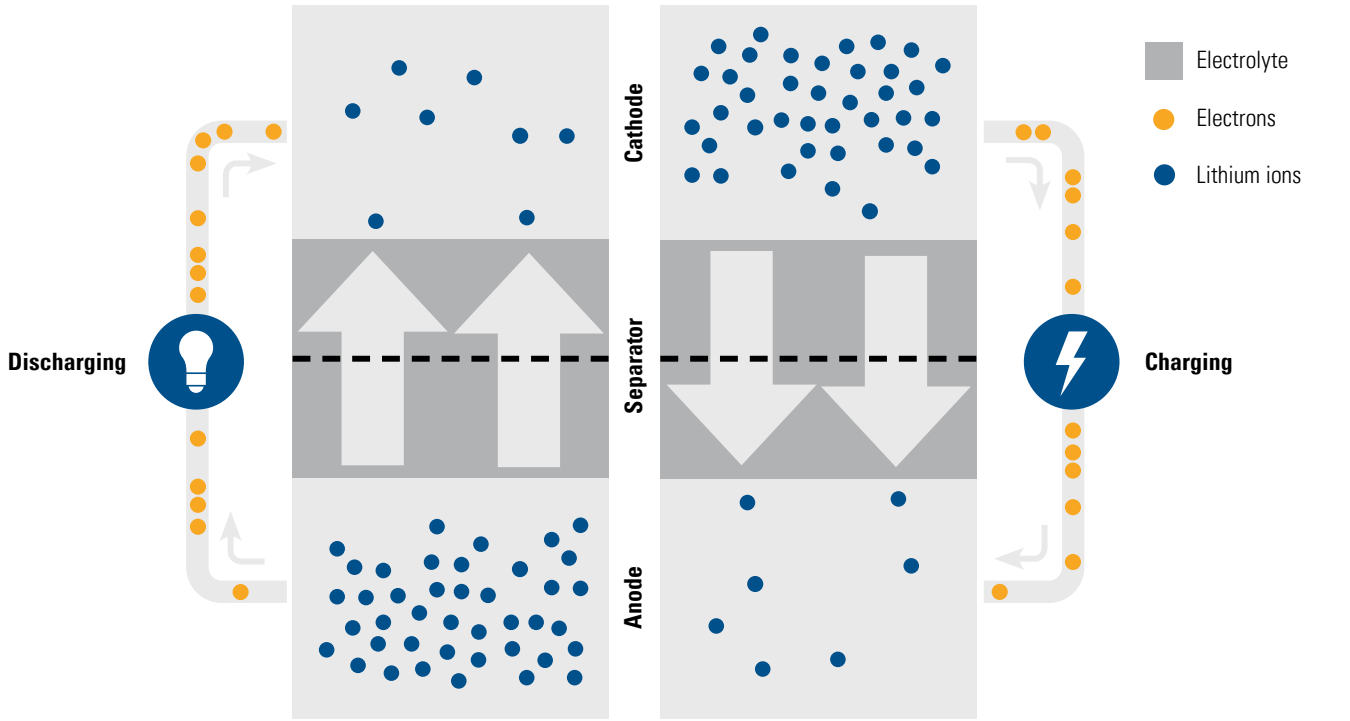
When does a technical room systems become a project?

DENIOS offers standard technical room systems designs with a wide range of equipment options. While for a storage room it's easier to use standard equipment, test rooms are usually individually designed by our experienced engineers. Your technical room systems will be a project if an individual, non-standard solution is needed. One of our experienced engineers will take charge of your project right from the start and will be available as a direct contact from the initial offer phase to final acceptance. We have many years of experience with legal requirements, approval authorities and insurers and will work alongside you throughout the project. We offer professional project management so that you always know what steps have been planned and what stage your project is at. This means we can supply a technical room systems which best meets your requirements. You can find more information on DENIOS project management on page ➡ 18.

Basic principles for handling lithium batteries

Companies looking into the "Safely storing and testing of lithium batteries" often face the following questions: How do we assess hazards and risks when handling lithium batteries in our business? What legal regulations are there? What requirements do our insurers have? Where can we get help from with a safety design? We are happy to give you all the basic information you'll need.

Design and operation of a lithium cell



In order to be able to evaluate the potential hazards associated with lithium batteries, understanding how they work can be very helpful. Important to know: There are many different types of batteries where lithium is used in a pure or bonded form. Lithium cells are basically divided into primary (non rechargeable) and secondary (rechargeable) cells. A battery pack is made up of several cells depending on capacity. Each lithium cell has a positive and a negative electrode, the anode and the cathode. Between them, there is an ion-conducting electrolyte. This ensures the transport of the lithium ions between the electrodes during the charging and discharging processes. The best known form of lithium battery is the lithium-ion battery, where a liquid electrolyte is used. The separator is also an important part of the device. It prevents direct contact between the anode and cathode and therefore prevents a short-circuit. During the discharging process lithium ions and electrons are released on the anode side. The electrons flow through the external circuit and perform the electrical work. At the same time, the lithium ions cross through the electrolyte fluid and the separator over to the cathode. When charging, the process is reversed.

Depending on the system, the design of a lithium battery and the materials used may vary. In a lithium polymer battery the electrolyte is bound in the molecular structure of a polymer foil. There is therefore no need for the special separator. Lithium polymer batteries are only able to supply low discharge currents. The polymer foil however allows for a flat design, which is useful in mobile telephones and laptops for example. The thin film lithium cell is an energy storage device where the electrolyte is replaced by an ion-conductive gas. This allows lithium metal to be used and therefore provides an extremely high energy density. This technology is currently an important part of lithium battery research.

Hazards and risks when handling lithium batteries

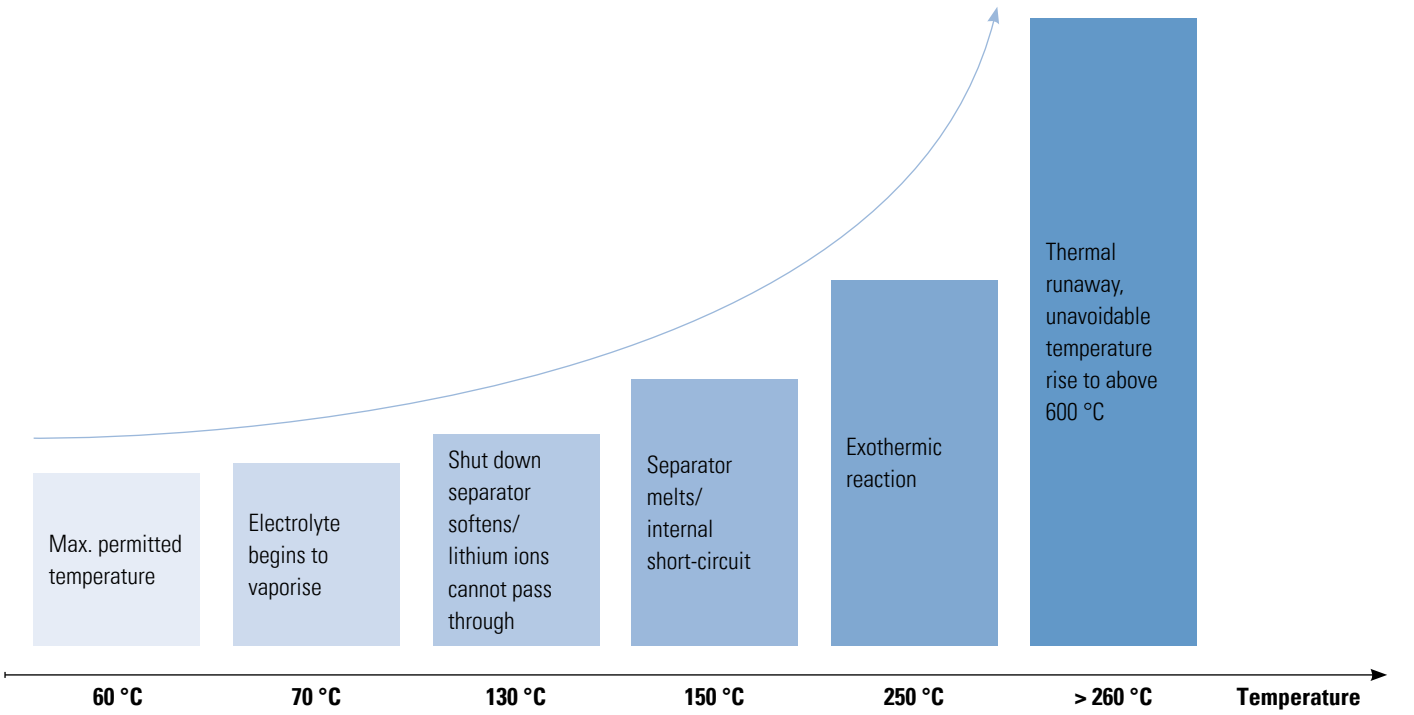


Image: Example of how temperature changes in the event of an incident

Lithium batteries can present a considerable safety hazard, for example if they are incorrectly handled or stored. In addition, factory defects or contamination cannot always be ruled out. The problem is if anything happens, the consequences are often disastrous. The risk lies in the construction of the battery itself. Where materials with a high energy density come into contact with highly flammable electrolyte, these create an extremely dangerous mix. If cells overheat there is a risk of thermal runaway. This is an extremely exothermic reaction, which can ignite the stored lithium and cause a metal fire. The high levels of heat energy then vaporise the electrolyte fluid, creating additional heat and combustible gases. If the ignition temperature for a gas is exceeded, it will ignite and set fire once again to the highly reactive lithium. Thermal runaway in just one cell is enough to heat up the neighbouring cells in a battery block so that a devastating chain reaction is created. Once set in motion, it only takes a few minutes until the battery will burn and explode.

The outbreak of fire is not the only risk involved with lithium batteries. If there is a reaction, there is a risk of hazardous substances such as hydrochloric or hydrofluoric acids being released from inside the cell. This may appear in the form of vapour for example, which could injure workers through skin contact or inhalation. When a fire is extinguished the extinguishing water can dilute the acids, they can seep into the ground (if there is no suitable containment device) and cause environmental damage. Thermal runaway can be triggered by many things, from thermal loads, mechanical damage or factory defects. In general the following applies:
The potential risk associated with lithium batteries increases as the amount of energy which can be stored by the batteries increases, and as the number stored increases.

Safety regulations according to performance class (VdS 3103: 2016-05 (2))

	Low performance Computer, multimedia, small electrical devices	**Mid-range performance** Pedelecs, electric bicycles, electric scooters larger garden equipment	**High performance** Automotive, off-grid large equipment
Lithium metal batteries:	≤ 2 g Li per battery	> 2g Li per battery and ≤ 12 kg gross per battery	> 2g Li per battery and > 12 kg gross per battery
Lithium-ion batteries:	≤ 100 Wh per battery	> 100 Wh per battery and ≤ 12 kg gross battery	> 100 Wh per battery and/or > 12 kg gross per battery

General safety regulations:

- Observe manufacturer's instructions (technical product datasheets)
- Protect battery poles from short-circuit
- Protect from mechanical damage
- Do not expose to direct and long-term high temperatures or heat sources (including direct sunlight)
- Ensure structural or spatial separation (min. 2.5 m) from other combustible materials, if there is no automatic extinguishing equipment present
- Ensure damaged or faulty batteries are removed immediately from storage and production areas (until they are disposed of store them at a safe distance or in a fire-rated, separate area)
- Only store batteries with a UN 38.3 test certificate (prototypes should only be stored in exceptional circumstances and with a risk assessment)

Specific safety regulations:

■ none *Where larger volumes are stored together (volume over 7 m³ or more than six Euro pallets) the notes for mid-range performance batteries apply*	■ Storage in fire-rated, separated areas or with a safety distance (spatial separation of 5 m) ■ Avoidance of mixed storage with other fire accelerant products ■ Monitoring of the storage area with a suitable fire alarm system with connection to a permanently-manned location ■ If fire extinguishing equipment is present: inclusion of information on suitable extinguishing media in the technical product datasheets *Where larger volumes are stored (area covered > 60 m² and/or height > 3m) the notes for high performance batteries apply*	Protective measures to be agreed with insurers for individual cases, e.g. ■ Storage in fire-rated, separated areas or with a safety distance (spatial separation of 5 m) ■ Separation and limitation of quantities ■ Automatic extinguishing equipment

The route to an optimum safety design

Storing lithium batteries often presents companies with a dilemma. You have a legal obligation to evaluate hazards in your company and address them using suitable protective measures. However, there are currently no legal regulations which we can turn to which specifically deal with lithium batteries. So it is up to the company itself to determine and implement suitable measures. This is not only problematic from a liability point of view. Commercial insurance cover is also largely dependant on a suitable safety design.

In general it is recommended that lithium battery devices are treated as hazardous substances and that their handling is arranged accordingly, e.g. a risk assessment is carried out to decide on suitable measures, specific safety instructions are produced and workers are trained in the correct ways of working with the hazardous media.

In addition, due to the large number of different battery types, it is not currently possible to determine general protective measures and designs which will be universally applicable. A technical note published by the German Association of Insurers (VdS) gives a general assessment and notes on accident prevention for lithium-ion batteries in production and storage areas. Lithium batteries are classified in three different performance classes according to the VdS recommendations: Lithium batteries with a low performance, mid-range performance and high performance. Generally applicable and performance-class-specific safety regulations are given for their storage. The infographic on the left hand page gives an overview.

In addition, operational and constructional circumstances, processes and organisational constraints need to be considered in a risk assessment. It makes sense that each individual case must therefore be looked at separately. It is advisable to cooperate at an early stage with the fire service, insurers and approval bodies to create a unified safety concept for your individual storage situation. As experts in hazardous materials storage and fire protection, we are also happy to help.

Solutions from DENIOS – Custom solutions instead of run-of-the mill

Don't experiment - especially when storing lithium batteries! Depending on the storage situation you need to assess which hazards will occur and with what probability and what the consequences would be. There is no standard solution - your individual requirements must be precisely assessed and the safety concept created accordingly. It is best to involve insurers early on in the constructional preventive concept - and to choose a manufacturer with decades of proven experience in hazardous substance storage and fire protection. The following pages contain information on our comprehensive range of products for storing and testing lithium batteries. Tried and tested. Made to measure. Safe.

Info

Have you seen it? Our online advice tool has more basic information and practical tips for handling lithium batteries.

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Storage rooms

Safely storing lithium batteries

The hazard potential of incorrectly handling lithium batteries is extremely high. Deep discharge, fire, chemical reactions, explosion of batteries in the worst-case scenario – each individual situation means a risk for workers, companies and the environment. And this may result in considerable financial losses and production downtime. A combination of constructive protective measures and active safety modules provide the best solutions for storing hazardous goods. We are happy to support you in selecting the best combination for your needs. For over 30 years we have provided expert advice on the safe storage of hazardous goods and offered the highest levels of fire protection (to REI 120/ F120).

If no fire-rated separate areas are needed because safety distances can be observed, we also offer storage rooms for lithium batteries without fire protection. We would be happy to advise on other possibilities. Just get in touch!

Constructive safety with approval from the authorities

DENIOS offers various technical room systemss for the fire-rated storage of lithium batteries:

- The spacious racking system RFP (page ➡ 10)
- The compact racking system BMC-S (page ➡ 11)
- The walk-in storage system WFP (from page ➡ 12)

All systems are manufactured with a sturdy, double steel frame design and are approved as an entire system, with fire protection from 90 (REI 90/F90) up to 120 minutes (REI 120/F120) from inside and from outside. They are therefore suitable for installation directly next to the external wall of neighbouring buildings or for use as a fire-rated separate area, e.g. in a production hall. They can be moved when empty and so can be repositioned on your site if necessary. With an integral spill pallet in steel, the storage rooms are set up to contain any leaked electrolyte and contaminated extinguishing water. All equipment which could be a potential source of sparks can be provided with appropriate protection if an Ex zone is needed. Pressure release panels can be fitted in the roof to ensure active safety in the event of an incident. Take a look at the comprehensive range of equipment available from page ➡ 26.

Configuring your hazardous goods store

Use our comprehensive equipment options to customise your storage system – for increased safety and convenience (from page ➡ 26).
Our sales team will be happy to give you on-site advice on how to design your hazardous goods store efficiently. Our digital configurator will be used to plan your technical room systems - just a few clicks and your requirements are met. You'll be able to see a visual representation of your store straight away. You can then make any individual adjustments you need.

If you would like to change the design in a more fundamental way or start from scratch, DENIOS would be happy to create a custom solution for you. We have an example of what an individually designed storage room can look like (see page ➡ 15).

DENIOS storage rooms are also useful for testing. If your requirements need a customised solution however, take a look at our individual technical room systems TSR (see page ➡ 16).

The spacious racking system RFP

Storage racking system RFP is the best option when larger quantities or larger-scale lithium batteries need to be accommodated. An integrated heavy duty rack with adjustable shelves allows the best possible use to be made of the inner room. The loading surfaces are removable hot dip galvanised grids. They suit the most varied storage options, e.g. individual storage or storage in boxes, on pallets or special carrier frames. The system offers the best possible access via 2-wing doors and optimal use of the room height for easy loading and unloading.

Fire-rated storage rooms
RFP 615.30, climate controlled

DIBt GENERAL CONSTRUCTION APPROVAL DIBt Deutsches Institut für Bautechnik, Berlin
Z-38.5-292 (for Germany)

IBS REI90 CLASSIFICATION report No. 316 102 803-A
Fire protection (in Europe)

LABORATORY ASSESSMENT Efectis REI 120
No. EFR-17-00 1909-B

Example variants (additional variants on request)

Model	Dimensions * (W x H x D mm)	Bay dimensions, high rack (W x D mm)**	Weight* (kg)
RFP 315.20	3660 x 2630 x 1800	2917 x 1235	Approx. 2500
RFP 315.30	3660 x 3575 x 1800	2700 x 1235	Approx. 3100
RFP 615.20	6882 x 2630 x 1800	2x 2917 x 1235	Approx. 4400
RFP 615.30	6882 x 3575 x 1800	2x 2700 x 1235	Approx. 5600

Note: Dimensions and weights may differ depending on optional equipment.
We reserve the right to make technical changes. * without add-on equipment ** bay height may vary

Equipment options

Use our comprehensive equipment options to customise your RFP and BMC-S storage system – for increased safety and convenience (from page ➡ 26).

Installation options:

Storage racking system RFP is suitable for installation on a customer-provided concrete foundation pad. A concrete pad can be provided separately if access underneath for a hand operated electric stacker is required. In this case the system can be installed on a strip foundation. For the wide version, the store is fitted with two concrete pads of the same size.

Fire-rated storage racking system RFP 315.30, access underneath with concrete pad

Extra deep design

Do you need a lot of space? Storage racking system for lithium batteries can be made in extra deep versions if required (approx. 2500 mm inside).

Fire-rated storage racking system in extra deep design for increased capacity

The compact storage solution BMC-S

The space-saving solution for storing lithium batteries: storage racking system BMC-S offers high DENIOS standards with minimal footprint. BMC-S is available with a variable number of fixed or pull-out shelves – for optimum use of the inner space according to your needs.

Example variants
(additional variants on request)

Model	Dimensions * (W x H x D mm)	Bay dimensions (W x D mm)	Weight* (kg)
BMC-S 180-2	1848 x 2463 x 1300	1542 x 1012	Approx. 1330
BMC-S 180-4	1848 x 2463 x 1775	1542 x 1487	Approx. 1500

Note: Dimensions and weights may differ depending on optional equipment. We reserve the right to make technical changes.

* without add-on equipment

Fire-rated storage racking system BMC-S 180-4 with shelving

DIBt GENERAL CONSTRUCTION APPROVAL
DIBt Deutsches Institut für Bautechnik, Berlin
Federal Water Act Z-38.5-287

iBS REI90 CLASSIFICATION
report No. 14061104-A REV2
Fire protection

LABORATORY ASSESSMENT
Efectis
REI 120
No. EFR-17-00 1909-B

The walk-in storage solution WFP

You need a store for smaller sized modules, which don't need a forklift for loading and unloading. You might want to safely store a larger piece of equipment or an electric vehicle (e.g. prototype and test equipment). The storage room needs to fulfil an additional function - for example as an analysis laboratory, a convenient place to charge batteries or as a temporary store for dispatch or for storing faulty batteries. The walk-in HazMat store is the convenient solution for all these scenarios.

Thanks to its fire protection approval, the technical room systems can be integrated directly into your infrastructure without the need for safety distances, either indoors or outdoors. In six sizes and with a convenient room height, there's plenty of room for equipment inside and loads of storage space. Various door options and a comprehensive range of additional equipment enable the WFP to adapt to almost any situation. The low entry height of 147 mm and precise roof drainage are just two of the additional advantages of this considered design, making long term storage easy.

Walk-in fire-rated storage racking system WFP-X 22 with racking

DIBt GENERAL CONSTRUCTION APPROVAL DIBt Deutsches Institut für Bautechnik, Berlin
Z-38.5-292 (for Germany)

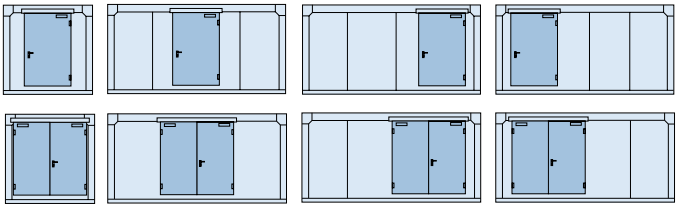
IBS REI90 CLASSIFICATION report No. 316 102 803-A
Fire protection (in Europe)

LABORATORY ASSESSMENT Efectis REI 120
No. EFR-17-00 1909-B

Tel: 01952 270 1338 www.denios.co.uk sales@denios.co.uk

Door variants

A 1-wing or 2-wing door can be fitted on the short side of the WFP 6, and either on the short or long side for larger technical room systemss. The door is located centrally as standard. For the WFP 14 and WFP 22 it can be positioned on the left or right if required. For 2-wing doors a door sequence controller ensures the reliable and safe closure of the doors (important in the event of a fire).



Door positioned centrally

Door positioned off-centre

Door dimensions

- 1-wing door: 1165 x 1950 (W x H mm) BRM 1250 x 2000
- 2-wing door: 1915 x 1950 (W x H mm) BRM 2000 x 2000

Door sequence controller, standard

For 2-wing doors, the door sequence controller ensures reliable closure of the doors. We use EI_2 90-C class doors in D, AT and CH. For countries such as FR, ES, PL and IT we use EI_2 120 and for NL EI_1 60 are used.

Walk-in fire-rated storage racking system WFP-X 10, climate controlled

Example variants (additional variants on request)

Model	Floor area inside (m^2)	External dimensions* (W x H x D mm)	Internal dimensions (W x H x D mm)	Weight* (kg)
WFP-M 6	6.6	3018 x 2657 x 2784	2580 x 2280 x 2560	Approx. 2350
WFP-M 14	14.1	5938 x 2657 x 2784	5500 x 2280 x 2560	Approx. 3650
WFP-X 6	6.6	3018 x 2877 x 2784	2580 x 2500 x 2560	Approx. 2400
WFP-X 10	10.3	4478 x 2877 x 2784	4040 x 2500 x 2560	Approx. 3000
WFP-X 14	14.1	5938 x 2877 x 2784	5500 x 2500 x 2560	Approx. 3750
WFP-X 22	21.6	8858 x 2877 x 2784	8420 x 2500 x 2560	Approx. 4900

Note: Dimensions and weights may differ depending on optional equipment. We reserve the right to make technical changes.
* without add-on equipment

Equipment options

Use our comprehensive equipment options to customise your walk-in storage system WFP– for increased safety and convenience
(From page ➡ 26).

Storage of lithium batteries at KTM

KTM AG, based in Mattighofen, Austria, produces, develops and sells innovative offroad and street racing motorcycles under the brands KTM and Husqvarna Motorcycles. This globally-operating company has been successful for many years, thanks to a stable management team, highly-qualified employees, long term investment, participation in motorsport and innovative products. It has now developed into the largest manufacturer of motorcycles in Europe. KTM products are sold across the world by over 35 sales subsidiaries, three joint venture companies and 2350 independent dealers.

Challenge and project

A suitable HazMat storage container was needed for the storage of lithium-ion batteries. As there is no specific legislation for lithium-ion batteries, the project had to be developed by working together with KTM and the battery manufacturer and was designed to suit their requirements. An additional requirement was to ensure sufficient temperature-controlled storage capacity to prevent a loss of battery performance during storage.

The solution

DENIOS developed a solution based on its walk-in fire rated storage container. The basic requirements of the storage unit were met by its 7 m² floor area and integrated spill pallets. Although fire protection was not specifically required, building material class A insulation (EI120 insulation panels) were used. This also helped to achieve a year-round constant internal temperature of 20 °C, with external temperatures ranging from -15 °C to 35 °C. A combined heating and climate control unit was also used. As the creation of flammable gases when charging the batteries or in the event of a malfunction could be explicitly ruled out by the battery manufacturer, the additional equipment was not Ex-proof in design. The container was also fitted with a door hold-open device, fire water supply, access ramp, equipotential bonding and narrow mesh grids for improved manual-lifter accessibility.

Result and customer benefit

The customer benefited from DENIOS' experience in the construction of fire-rated storage containers for lithium-ion batteries. The collaboration between KTM, the battery manufacturer and DENIOS allowed a solution to be developed which met both the legal framework conditions (water law, German regulations ASchG, TRVB, GewO), and the special requirements for the storage of lithium-ion batteries. Additional safety was provided by the fire-rated (F90/ REI90) design, although this was not specifically required. Temperature-controlled storage prevented the loss of battery performance. In all, the customer was delighted with the planning and execution of this project, which led to additional work for DENIOS.

Storage of a crash test vehicle including lithium-ion batteries

When it comes to green mobility, technologies based on lithium batteries have an important role to play. But what happens if there is an accident? As lithium batteries have such a high level of potential danger, precise information needs to be gathered to be able to accurately assess the risks. Our customer runs several research projects on electric vehicles and vehicle safety. As part of these projects they carry out vehicle crash tests, where lithium-ion batteries are fitted to the vehicles involved. They approached DENIOS looking for a secure storage solution for the vehicles after the tests.

Challenge and project

The requirement for this project was the safe housing of a complete crash test vehicle - 24 hours a day. Especially at night, there was an increased risk from the unmonitored test system.

The solution

In order to house the complete vehicle together with the associated test equipment, the technical / safety room needed the following dimensions: 7400 x 3000 x 3000 mm (W x D x H). An Ex-proof roller door extended along the whole of the long side. In this way it was possible to position the crash test vehicle easily. From where the vehicle was stored, personnel could exit the container through a 1-wing T30 escape door.
On the opposite short side, a heavy duty rack offered sufficient room for the storage of Li-ion batteries. The racks were loaded via a 2-wing T30 door with upper door closer. The spill pallet offered protection in the event of any battery leaks. The inside of the technical / safety room was declared as Ex-Zone 1 by the customer.

All built-in equipment, for example the lighting, air recirculation heating and technical ventilation was therefore Ex protected. For the technical ventilation, a power monitoring system was installed for safety reasons. Gas warning equipment was also installed.

Result and customer benefit

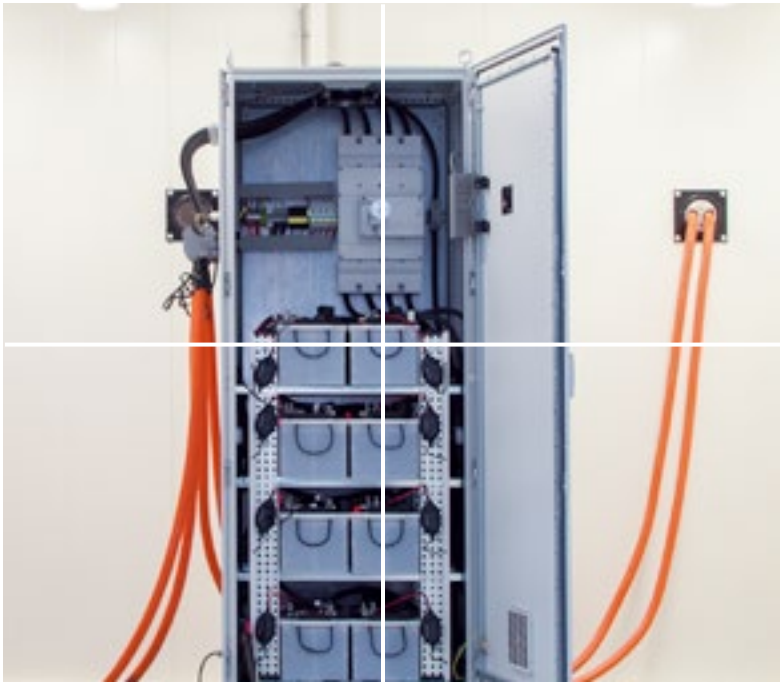
The customer received a dual function storage room which exactly met their individual requirements. The wide roller door allows vehicles to be positioned easily without any expensive manoeuvring. At the same time the room can be used for storing batteries, saving space. A separate 2-wing door allows employees easy access to the pallet racking.

Would you be interested in a similar solution?

We'll supply the right technical room systems for storing your lithium batteries. Just get in touch!

01952 822 241 info@denios.co.uk

Test rooms



Hazardous experiments need a safe test environment

Newly developed lithium batteries or products with built-in lithium batteries such as vacuum cleaners or electric vehicles have to be thoroughly tested before they are approved for sale. For example, the product tested is stressed beyond its load limits using special processes to enable conclusions to be drawn about the risks it poses or to ensure optimum compatibility between components and the product. These tests take place under special safety conditions. The commercial, application-specific safety and fire protection design is the basis for planning a safe test environment. Many additional aspects such as space requirement, set-up conditions, data capture for customer-specific evaluations etc are also considered when designing a room. For this reason lithium test rooms are almost always designed to customer-specific specifications.

Safety comes from experience

DENIOS is an experienced partner in the creation of customised test environments for lithium batteries. For over 30 years we have provided expert advice on the safe handling of hazardous substances and offered the highest levels of fire protection (to REI 120). As a manufacturer of technical room systemss we have shown over numerous customer projects for lithium batteries that our experience can be extremely helpful in this specific area. From the automotive or electrical industry, to accredited test institutes and research facilities, we offer custom solutions for the special requirements involved in the testing of lithium batteries. Many companies such as Phoenix Testlab and Voltavision rely on DENIOS expertise for this reason (from page ➡ 20).

DENIOS – Worldwide. Excellence.

Our partnership extends across borders. Across the world DENIOS is known as a manufacturer of technical room systems and as a HazMat and fire protection expert.

We create groundbreaking solutions with outstanding engineering expertise and customer care. In 2017 DENIOS was again named a Top100 Innovator.

How your individual test room for lithium-ion batteries is created

Groundbreaking solutions are created when customer and manufacturer work closely together. Close cooperation is our top priority, so our experts will support you with planning right from the start. When our quote is given, you'll already have a direct contact and easy communication options. With a diverse team of specialists, DENIOS offers an integrated range of services all in one system, and ensures continuous project management right from the start. **"Made by DENIOS"** represents the highest levels of quality, all from one supplier.

Needs analysis and advice – the foundation of your safe test environment

What do your risk assessment and fire protection design say? Which test procedures will be carried out? How will the test environment be integrated into your infrastructure and work processes? Well-directed questions help our engineers clarify what your optimum design could look like. Space requirements, installation location (indoors or outdoors), equipment, safety equipment – your individual requirements profile will be created from our needs analysis. You'll benefit from our expertise as fire safety experts, which we will pass on to you and will use to create your design, allowing your employees and equipment to be protected in the best way possible.

Professional project management

Our aim is the precise implementation of your project, on-time, ensured by our specialist staff. We will create an individual technical room systems, customised to your individual requirements, in a step by step process in accordance with our integrated service concept (see page ➡36).

In addition to the Factory Acceptance Test (FAT), you may also monitor the progress of production phases in person. We have many years of experience with legislation, approval authorities and insurers and will work alongside you throughout the project. We will create a plan together to gain approval for your test environment's structural, environmental, EX and fire protection aspects - a vital prerequisite for insurance.

After the project has been completed, you will receive comprehensive project documentation as well as tested structural analysis calculations. We also support you while your product is in operation. Our Customer Service will ensure that your investment retains its value. With a service and maintenance plan which is tailored to you and your product, we guarantee a high quality, long lasting solution.

Info

In the automotive field, the EUCAR Hazard Level is used for classifying risk when testing lithium batteries. This information is generally included in the risk assessment. The resulting safety design will then determine suitable equipment for your test room.

The EUCAR Hazard Levels (basic description)

Level 0	No effect / No damage
Level 1	Passive safety
Level 2	Defect / Damage
Level 3	Leakage / Loss of mass < 50 %
Level 4	Discharge / Loss of mass > 50 %
Level 5	Fire or flames
Level 6	Burst, parts ejected
Level 7	Cell explodes

The TSR - the individual room solution for your test environment

DENIOS prides itself on building rooms which perfectly meet your requirements and offer the highest levels of safety. A standard solution often lacks the optimum features for testing lithium batteries. This is why we manufacture test environments almost exclusively to customer-specific requirements. These individual designs are classified together under the description technical safety room (TSR for short). Your benefits: during design and production we can therefore take advantage of many proven standard elements. So you'll be able to benefit from the combination of cost effective standard production and individual design.

Simulation – the core function of your test room

The simulation of loading situations for lithium batteries requires various process-dependent functions to be available in the test environment. Alongside individual equipment options, test rooms from DENIOS offer the possibility of simulating or supporting various loading situations inside the room:

- Simulation of extreme environmental conditions by loading up to the permitted temperature limits (e.g. -20°C to + 60°C), as well as testing behaviour during temperature variations
- Effect of increased humidity on the test pieces, e.g. formation of condensation
- Loading with minimum and maximum power supply, looking at upper and lower voltage limits
- Shock testing
- Acoustic tests (shaker)
- Corrosion and corrosive gas testing
- Electromagnetic compatibility testing
- Battery cyclic conditioning
- Long term loading tests
- Altitude simulation

Equipment options

Use our comprehensive equipment options to customise your test system – for increased safety and convenience (from page ➡26).

And size? Whatever size you want!

The variable dimensions of the TSR mean that it can be designed exactly for the space you have available and the required application. As a compact solution there are numerous space-saving applications which can fit in any position. The low net weight means that its position can also be easily changed (e.g. following internal re-organisation). Large scale solutions are also possible: from combined storage and test facilities to multi-room complexes with covered-over logistics and access areas.

Connection-ready to turnkey solutions - we'll do everything for you

We are also happy to install your equipment into the system for you, or you can fit your own internal equipment on our premises.

Info

If you are looking more for a standard room solution, take a look at our systems for storing lithium batteries (see page ➡ 8). These can also be used for testing, if no customer-specific adjustments need to be made.

Test stand for stationary lithium batteries

Voltavision GmbH in Bochum, Germany is an independent R&D company, operating test equipment for high technology systems in the electromobility and renewable energy sectors. The size of the units tested ranges from lithium-ion batteries for electrical equipment right up to "large" stationary batteries. It was for these large applications that Voltavision and DENIOS developed a test room together, which had a customised test room volume and allowed testing of lithium batteries over a wide temperature range.

Challenge and project

The energy revolution needs rethinking - in many respects. More and more energy is supplied by renewable sources such as wind farms or solar installations. Energy is often produced at sites and at times of the day when it can't be used directly. This also means that electrical batteries are becoming an increasingly relevant issue. Comprehensive tests to determine the effects of a wide range of environmental factors on module life are needed.

Professional bodies have made many recommendations, but there are no laws or regulations in the proper sense which constructors and operators can use as guidance. Safety designs are therefore based more on insights than standards.

In this case, the risk assessment was based on the critical need to create a separate fire compartment to house the test unit. A fire-rated system which would resist a fire load from inside or outside for 90 minutes was required. Standard climate control chambers available on the market did not meet this requirement.

The solution

Working together, Voltavision and DENIOS developed a fire-rated test stand (F90/REI90) for stationary lithium batteries. Very large batteries, within the permitted test volume of up to 30 m³, can be subjected to defined thermal and electrical conditions. A temperature range of - 20 °C to + 60 °C, e.g. for artificial ageing processes, can be simulated under standardised test conditions. The batteries are tested for cycling stability and calendar life. A comprehensive safety design was also taken into consideration. The inclusion of corresponding sensors allowed continuous room monitoring. Whether it's gas detection or temperature sensing - accident prevention is vital!

A pressure release panel in the roof allows for controlled pressure equalisation in the event of an incident. High performance technical ventilation also ensures that any harmful and potentially explosive gases are removed from the room. And if the worst should happen, contaminated cooling water is collected in a spill pallet. An acid resistant, anti-static inliner gives an additional level of safety. A separate connection is provided for emptying the WHG spill pallet. This ensures that cooling water can be properly disposed of.

Result and customer benefit

An innovative, turnkey solution offering repeatable measurement results! All this was done without a separate climate chamber in the test room!

Would you be interested in a similar solution?

Do you need to test large lithium batteries at various temperatures? Do you want to do this without extra construction costs and within existing buildings? Our technical room systemss offer the perfect solution. Just get in touch!

01952 822 241 info@denios.co.uk

Battery test laboratory with interim storage

Electromobility is the latest trend - and with it comes the difficult search for the best batteries. They must withstand adverse environmental conditions on the road, extreme temperature variations, damp and salt, vibrations and impacts without succumbing to EMC interference or becoming a source of interference themselves. These features are being investigated at Phoenix Testlab in the battery test laboratory. By their own account, when Phoenix Testlab opened the battery test laboratory in Spring 2011 they had created one of the most important and technologically advanced specialist centres in the field.

Challenge and project

Phoenix Testlab is an independent test laboratory and certification body for technical products. A provider of technical services, it supports its customers with their products right from design to market entry. The service not only encompasses technical testing of products, but also the international management of approval and licence processes.

At its headquarters in Blomberg, Nordrhein-Westfalen in Germany, the company was looking to test lithium-ion batteries and modules which are used in electromobility and solar technology. A new battery test laboratory was needed for this project. As the performance of the high-performance batteries for electric vehicles was to be tested, the safety of employees, the test environment and the test pieces was a central concern.

The following tests were to be carried out:

- Temperature and climate change testing
- Vibration and shock testing
- Corrosion and corrosive gas testing
- Electromagnetic compatibility testing
- Battery cyclic conditioning

The solution

Based on its technical / safety rooms, DENIOS developed a system for the monitored interim storage of batteries in close cooperation with the customer. F90 fire-rated systems with DIBt approval were used.

These systems were fitted with suitable safety equipment for the risks associated with lithium-ion batteries, e.g. climate control equipment, technical ventilation and pressure release panels.

Result and customer benefit

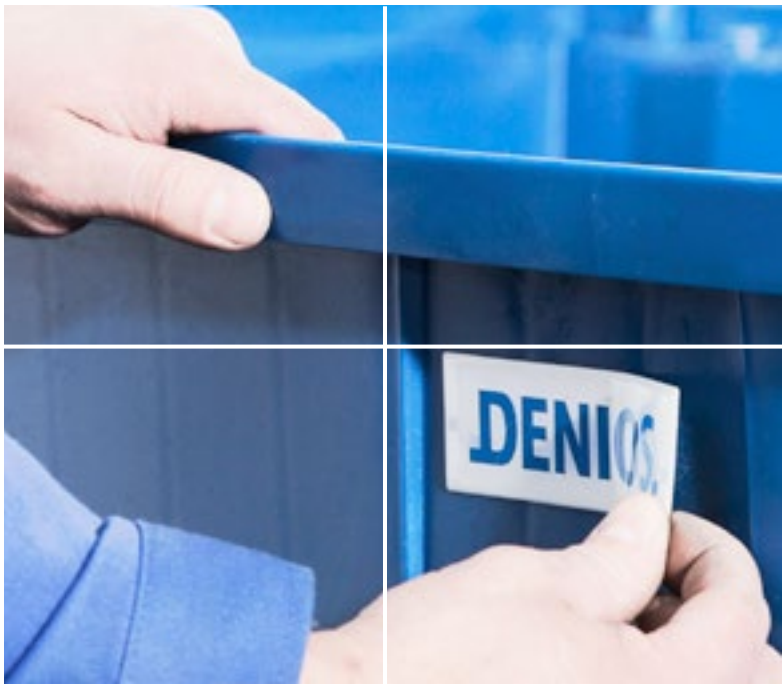
This tried and tested solution allowed Phoenix Testlab to create an effective process chain, ensuring the highest levels of safety for their employees.

Would you be interested in a similar solution?

Extensive projects and tasks often need large scale solutions. Do you need a large facility with covered-over access and logistic areas? We can supply this - as a turnkey project. Just get in touch!

01952 822 241 info@denios.co.uk

Equipment



Comprehensive, safe

At DENIOS we have always supported our customers and partners with the changing requirements for handling hazardous materials and work safety. We began building our expertise in this area as far back as 1986, developing our sector-specific know-how for a wide range of industries. Today we offer a comprehensive portfolio of services to help protect people, the environment and company values effectively.

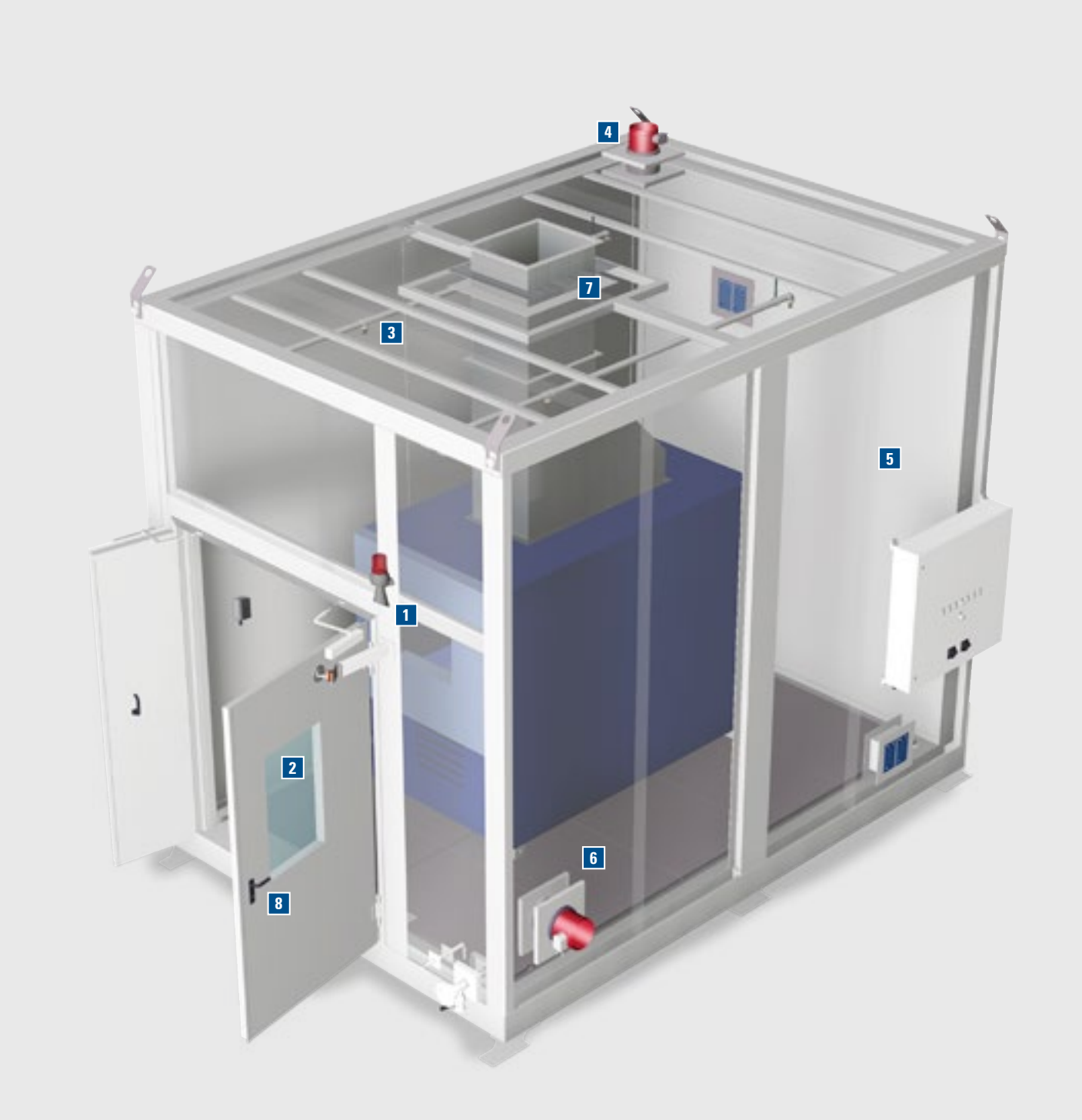
We aim to optimise your technical room systems to exactly meet your requirements in an uncomplicated and efficient manner. As a manufacturer we know exactly what our customers need and have included the right modules in our comprehensive range of equipment and accessories. Choose suitable options for your safety and convenience from a wide range of proven components.
In addition we offer over 10,000 proven standard products in our main catalogue to complete your safety design. Whatever you need to make your work safer and more convenient, DENIOS has the right solution.

You'll find more information on equipment and services for the "safely storing and testing of lithium batteries" on the following pages.


"Our range of services and products and the standard of our customer care are second to none."

Safe equipment modules

DENIOS technical room systems offer up to 120 minutes fire protection from inside and outside as standard (REI120/F120). We are the first manufacturer to ensure comprehensive legal certainty across Europe. The modules required for the safety equipment of your technical room systems will be selected depending on your operational, legal and insurance requirements. Individual requirements can be taken from your risk assessment, your safety design, your ATEX assessment and other specifications, for example for noise emissions. A needs analysis looking at your specific requirements and specifications is used during discussions to jointly determine the optimum system for you, ensuring the highest levels of operational safety. As legislators require that safety-technical equipment should be regularly inspected, the expert DENIOS manufacturer's service team (from page ➡ 38) will keep you safe in the long term.



1 System monitoring and alarm systems
Comprehensive monitoring is vital as an addition to mechanical safety precautions. Whether it's gas detection, temperature monitoring or early fire recognition, the provision of potential-free contacts for relaying to the (works) fire brigade offers the best levels of safety. An alarm function can be provided using visual warning lights and /or acoustic sirens with additional notification via smartphone.

2 Personal safety
The walk-in systems have a viewing window to ensure safety for employees working in the room. Video surveillance can also be installed.

3 Water cooling or alternative extinguishing systems
Your extinguishing system and the equipment in your technical room systems need to be compatible. In the event of an incident, if cooling with water is to be used, contaminated cooling water can be collected in the spill pallet. The floor must therefore be permeable to water, e.g. with a grid design. An acid resistant, anti-static PE inliner in the spill pallet gives an additional level of safety in the event of an incident. A separate connection is provided for emptying the spill pallet. The cooling water can then be properly disposed of. If a spill pallet is not needed and a floor selected which is not permeable to water (e.g. double, heavy duty or linoleum flooring) a different cooling or extinguishing system must be implemented. Aerosol extinguishers can be used at any time. We would be happy to work with you to determine appropriate equipment and extinguishing systems.

4 Technical ventilation
To ensure permanent air extraction from your fire-rated storage container, the air exchange is ensured by high performance technical ventilation, in accordance with local technical requirements. This ensures that the possible risk of harmful or even explosive gases being created is taken care of. The air flow is monitored by a flow controller in accordance with the law. We will also be happy to fit additional technical ventilation, which switches on automatically in the event that the air extraction limits are exceeded.

5 Noise protection for test rooms
Your technical room systems can be soundproofed. If a high level of noise is expected inside the room when tests are carried out, soundproofing can be important for immission protection.

6 Climate protection - customised climate solutions
The room climate can be clearly defined so that your stored goods or sensitive technology can be optimally housed. Technical ventilation and climate control technology can be set up to work together to ensure your requirements are met.

7 Pressure relief panels
Pressure release panels can be provided in the roof to ensure active safety in the event of an incident. Controlled pressure equalisation prevents serious situations such as the destruction of the room, employees being at risk from doors blowing off or an uncontrolled release of energy. The pressure release device closes again automatically when the pressure wave has been dissipated to seal the technical room systems. Fire protection properties are retained.

8 Protection from external influences
DENIOS technical room systems offer optimum protection for your technical installations from external influences such as wind, rain and lightning but also from unauthorised access and damage. The standard intrusion protection with resistance class RC 1-4 can be extended with break-in alarm, video surveillance and access control systems.

Explosion-proof design
As the operator of the technical room systems you will need to use an explosion protection document to define any Ex zones. If an Ex zone is defined, all equipment which could represent a potential source of sparks in the Ex zone can be supplied in the corresponding Ex design.

Info

Permanent operation of safety equipment must be guaranteed and documented during regular professional maintenance. As each component can have a significant effect on the construction as a whole, DENIOS offers comprehensive customer service for your room system. We're your service partner with manufacturer's expertise (see from page ➡34).

Comfort for your technical room system

Modules for extra convenience

Working in your room system is made easier by the right choice of convenient equipment. This not only makes you happier and saves you effort, but can save you time and money when your system is set up for efficient use. There's a wide range of equipment modules to choose from. We can offer advice and work with you to choose the optimum complete system for your needs. If required, we'll deliver the whole room system ready to use. Perfectly simple - from start to finish.

Tel: 01952 270 1338 www.denios.co.uk sales@denios.co.uk

1 Room access
DENIOS walk-in room systems offer good accessibility thanks to a low entry height of 147 mm. Access can be made even easier using a ramp.

A door hold-open system can be added to any room system. This uses electromagnets to hold the doors open. When the door closing button is operated or an alarm is triggered, the power to the electromagnet is cut. A door sequence controller is used to close 2-wing doors.

2 Making use of the space
A racking system offers flexibility in the number and arrangement of the shelves. Using a roller conveyor can help if you have heavy loads, allowing work processes to be optimised and reducing the risk of accidents.

The walk-in room system offers almost limitless ways to use the space. The inner room can be fitted with shelving, the floor can be used for storage or as a work area. The walls can be used for mounting components using anchor bars. Wheeled trolleys can be used to move heavy loads around inside the room system. Narrow mesh grids ensure a pallet truck can be used.

Partitions and complete dividing walls can be built in so that you can separate your hazardous goods store into various storage areas (which can even have different levels of access authorisation). What other ideas do you have for using the space inside your room? Just get in touch! We'll find the solution together.

3 Electrical equipment
There are practically no limitations set on the electrical equipment for your room. From the installation of sockets, for charging batteries for example, and additional lighting inside and out, to provision of interfaces for data capture or the professional integration of your IT technology, we're able to meet all your needs. Our DENIOS connect app offers you Smart Services meeting Industry 4.0 (see page 31).

In the standard version, the central power connection uses a sub-distribution unit. With a more elaborate electrical set-up, or if required, we can provide a switch cabinet with control and operating elements. Room sensors can be fitted by the customer and easily connected via a data transfer point, or can be fitted by us during production (see page ➡30). Displays and operator panels can be fitted inside or outside the room system to show measurement data. Whenever we make breakthrough points for cables or piping, these are protected against water penetration and contamination. Safe fire protection is also ensured.

4 Transportability
Room systems are fitted with removable crane eyes as standard. These ensure safe and easy handling with a crane and are also used to secure the container during transport on the lorry.

5 Paint
All DENIOS room systems are painted in RAL 9002 (grey white) as standard. This colour is especially suitable for preventing the absorption of sunlight and consequent heating of the external surfaces. This gives better protection for a climate controlled room from the influence of external temperatures. Other colours are of course available on request.

Monitoring your technical room systems

Sensors - safety with continuous system monitoring

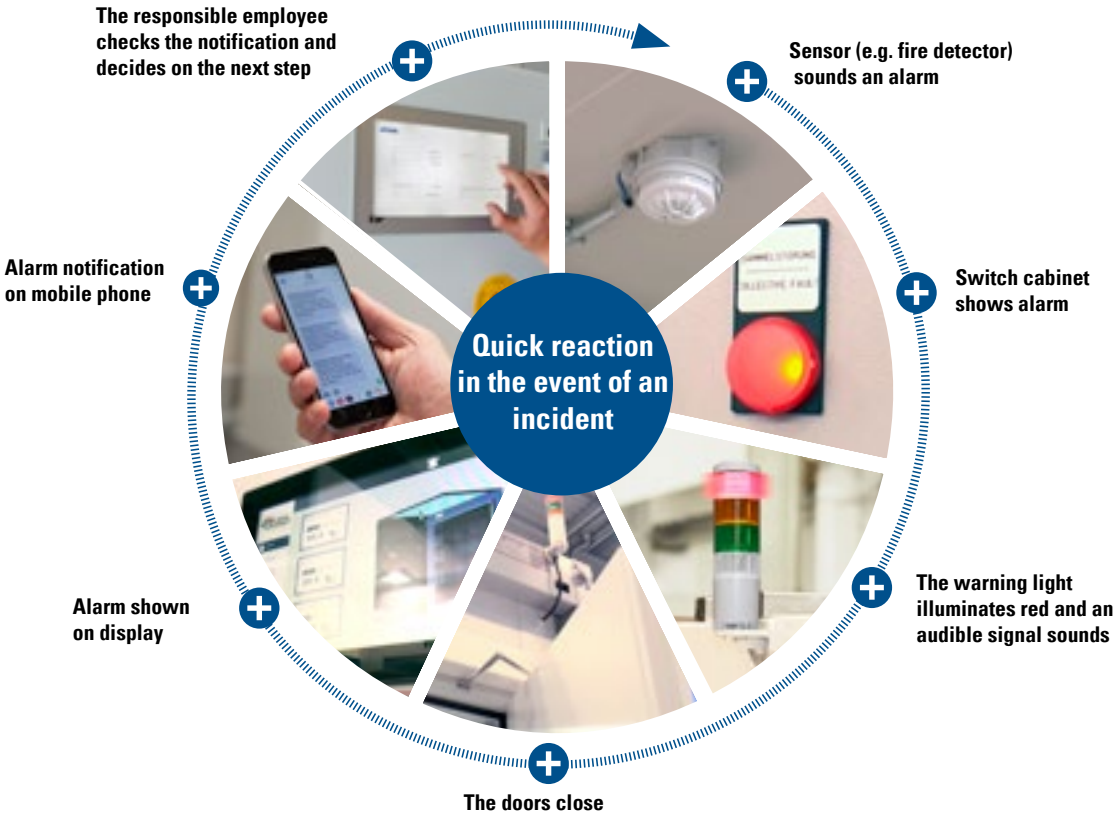
Regardless of which hazardous substances you are handling, the earlier an incident can be detected and countermeasures taken, the more likely it is that damage can be limited or even prevented. Complete system monitoring is therefore essential. With a DENIOS room system this task is covered by a multitude of technical systems: numerous sensor-based monitoring systems continually capture actual values and compare them with setpoint values. Deviations are recorded as early as possible so system-side measures can be quickly implemented, for example the automatic door closing system or extinguishing system in the event of a fire, or automatic switching on of a second technical ventilation system if air extraction limit values are exceeded. Visual and / or acoustic alarm signals are triggered immediately so you can react quickly and take appropriate action. In addition there's an option to have a local mail server installed. In the event of an incident you would then automatically receive a notification on your device of choice (e.g. smartphone, tablet, laptop or desktop PC). This can gain you valuable reaction time, for example if your employees are not always on site.

Customised processing of measurement values and data

Evaluate and process your measurement data exactly how you want. All sensors have potential free contacts ensuring a suitable interface to customer connections, for example for integration into your processes or for logging measured value history. Of course the currently recorded measured values can be viewed on the system itself by responsible employees at any time. An integrated touch panel gives a convenient overview of the data.

Our solutions for sensor equipment:

- Temperature monitoring
- Fire and smoke sensors
- Monitoring of relative humidity
- (Air) pressure sensors
- Gas detectors for various gases
- Air extraction monitoring
- Leak sensors
- (Infrared) video surveillance



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HazMat management 4.0 with the DENIOS smart app

We're opening the door to a new world of smart products! DENIOS connect is not just about access to the most important control and monitoring systems for personal room systems. DENIOS connect is also the gateway to intelligent services and important information on professional solutions for environmental protection and workplace safety. Come on in!

DENIOS connect

Info

Smart Safety Services

DENIOS connect has a host of smart services and functions for your DENIOS room system. Benefit from the advantages of HazMat storage 4.0 and optimise your costs, increase efficiency and process stability.

How it works: So that DENIOS connect can provide you with important information, services and additional specialist knowledge 24/7, product data, customer data and information from the DENIOS database are linked together to form a smart network.

- **Product data:**
  Sensor data, process data and notifications for your room system are captured continuously.
- **Customer data:**
  A connection to the DENIOS SAP system enables direct access to your order data and delivery information.
- **DENIOS database:**
  Information, expertise and products are linked by our comprehensive database.

All data is securely transferred to the DENIOS Cloud and intelligently networked to provide you with a full range of services:

Maintenance
Overview of the maintenance log with smart memory function.

Condition Monitoring
Secure monitoring of your room system including fault alarms.

Manuals Documents
Quick access to operating instructions, approvals, certificates and documentation concerning your room system.

Warehouse Management
Comprehensive monitoring of storage location occupancy and HazMat inventory with automatic safety check in accordance with TRGS 510.

My Services
Order replacement parts and accessories, check your order history and get individual advice.

NEW: fire resistant
Inside and out
Outside: 90 min, inside: 60 min + 30 min with fire suppression

Safety cabinets for lithium batteries

For small quantities of lithium batteries of low to mid-range performance, an effective safety design is still needed for storage and charging. As the store is likely to be located inside a building, fire resistance of the body of the storage cabinet should be ensured from inside and outside. Based on our many years of experience working together with customers DENIOS has developed a new generation of safety cabinets: SafeStore is designed for the storage of lithium batteries. SmartStore is ideal for monitored charging of batteries and as a quarantine store for condition monitoring of critical lithium batteries.

Safety equipment for fires

If a fire breaks out in the building where lithium batteries are stored in a DENIOS safety cabinet, the fire brigade has a minimum of 90 minutes to evacuate people without the fire being escalated by ignition or explosion of the lithium batteries in the closed cabinet. The cabinets are classified to Type 90 in accordance with EN 14470-1 for fire resistance from outside.

If faulty lithium batteries cause a fire inside the DENIOS safety cabinet, the fire resistance duration of the closed cabinet body from inside to outside is a minimum of 60 minutes. This has been proven by fire tests to DIN EN 1363-1. SmartStore also has a high quality fire suppression safety system (resistance >30 minutes), so that the two stages taken together give a fire resistance duration of over 90 minutes from inside to outside.
The other components in the safety system are a visual condition indicator (red/green) above the doors, a smoke detector with alarm contact for the building control system, a temperature sensor (trigger temperature 70 °C), the control electronics and the technical air extraction (extraction unit) for preventing heat exchange in the interior of the cabinet. All electrical cabling is wired to a terminal box on the cabinet. Connection is to the 230 V mains power.

For both cabinet models, a spill pallet is provided in the base for collection of any leaks from burning batteries.

SmartStore safety cabinet for charging lithium batteries

Info

Let DENIOS advise you. Our head office and sales team will be happy to offer further information.

Electronic fire suppression system

Charging station in safety cabinet

Tel: 01952 270 1338 www.denios.co.uk sales@denios.co.uk

Dimensions and equipment

With cabinet dimensions of 1193 x 615 x 1953 mm (W x D x H) and three to six storage levels, the safety cabinets offer plenty of space. The durable, self-closing wing doors ensure that the cabinet is always safely closed after every use.
Shelving designs:

- Heavy duty grid shelves (GS)
- 180 kg max. load capacity per shelf
- Variants available 3, 4, 5 and 6 shelves
- Spacing options:

  3x GS = (from bottom to top) approx. 480, 480, 465 mm
  4x GS = (from bottom to top) approx. 350, 350, 350, 340 mm
  5x GS = (from bottom to top) approx. 255, 290, 290, 290, 245 mm
  6x GS = (from bottom to top) approx. 225, 225, 225, 225, 225, 210 mm

Each SmartStore shelf is fitted with a high quality protected extension board with a metal housing and 10 protected sockets per shelf (230V, 16A). If you want to use SmartStore for the storage of potentially critical lithium batteries, the safety cabinet can be ordered without the protected extension board on request.

SafeStore safety cabinet for storing lithium batteries

Online and in the catalogue: over 10,000 products are available

Your service partner

Comprehensive and worry-free: From advice to maintenance

We see ourselves as your partner, providing a comprehensive and worry-free service. And we take this seriously: for us, service means taking the best care of our customers before, during and after their purchase.

Before you decide on a room system, you need the certainty that it will exactly meet your needs and will also meet all the requirements of the law as well as from your insurers. We therefore offer comprehensive and personalised advice, on site if needed, and support you with additional full information on the desired solution. During the design and production phase, professional project management ensures that everything is covered. And of course we are there for you once your purchase has been made, with our professional maintenance service and many years of experience to help answer any questions or offer training.


Tel: 01952 270 1338
www.denios.co.uk
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DENIOS
"Good support makes
the difference."

Your service partner

Our service concept

One order - full support!

Our job is not just to supply an approved room system for your company's premises. Our service concept has a holistic approach and covers the whole order process. You'll receive excellent quality services, all from one supplier. As a manufacturer we are aware of our responsibility to our customers and ensure the highest levels of quality and best advice at every step along our journey together.

Step 1: Needs analysis and advice
Special projects need specialist advice. As requirements and risks can vary massively from company to company, a room system must always be adapted to suit your individual needs. Working together with you, our engineers will develop the optimum design for your storage or test system. Not everything can be solved by a telephone call. That's why it's important that we can offer personal advice, on-site if needed. As part of the professional needs analysis, we'll evaluate your individual company circumstances, requirements and processes. On the basis of this analysis we'll produce a customised design and firm quote. Efficiency benefits: many solutions are already part of our digital configurator. Your customised room system can be planned in just a few clicks. But individual solutions are not a problem. Personalised advice is always the best: one of our experienced engineers will take charge of your project right from the start and will be available as a direct contact from the initial offer phase to final acceptance.

Step 2: Design and project development
Our standardised room systems cover many application fields and already have General Technical Approval. This allows for quick design as well as easy processing with building authorities and insurers. But individual projects (e.g. tailor-made solutions) are also not a problem. As part of the design phase we can use proven modules to put together a customised solution. You'll be able to take advantage of the combination of cost effective standard production and individual design. We have many years of experience with legal requirements, approval authorities and insurers and will work alongside you throughout the project. Working closely with the customer, the room system is planned in accordance with applicable regulations. At the end of the design phase an approval drawing is produced. As soon as this has been checked and approved, your room system will go into production.

Step 3: Production and factory acceptance
Your room system will be manufactured in our own production facilities by certified specialists to meet international quality standards. Bought-in components undergo strict quality controls at goods-in. This means we can guarantee the same high level of quality for every product. Our room systems are pre-assembled in the factory and provided with all the necessary connections so that they are quick to set up at the customer's premises. A Factory Acceptance Test (FAT) checks your system conforms with all specifications and quality requirements. In addition to the FAT, you may also monitor the progress of production phases in person at any time.

Step 4: Transport to the installation site

Our worldwide logistics network ensures smooth travel arrangements for delivery. Whether we use our own DENIOS flat bed trailer or a trusted freight forwarder, we ensure your room system is transported safely and arrives on time. Even special transport (extra wide or extra high) and overseas deliveries are no problem. We will take care of all the arrangements including obtaining the necessary special permits. Appropriate transport packaging is of course ensured. If required we can also provide suitable lifting equipment for unloading and final assembly.

Step 5: Installation and commissioning

DENIOS technicians will ensure the professional installation of your room system and will work with you to complete the Site Acceptance Test including all installation and operational tests. Our standardised solutions can be commissioned immediately, as they have General Technical Approval. For customised projects approval from the authorities needs to be obtained. But there's no need to worry: right from the design and production phase, we are in continual contact with the relevant authorities, so individual approvals can be obtained with the minimum of fuss. Our specialist staff will then instruct the users directly on the product and comprehensive product documentation will be handed over. DENIOS room systems: set up, commission, stay safe!

Step 6: Maintenance and repair

If your room system is already in operation, you're not left on your own.
Our technicians know all there is to know about DENIOS systems and can take over regular maintenance for you. This leaves you free to concentrate on your business - we'll look after the rest.
More information on our maintenance services can be found on the following pages.

Your service partner

Customer service and maintenance

Securing your investment in the long term

With a DENIOS product, you can rest assured that you are safe. Right from the design and production stages all laws, standards and required certifications are taken into account. There's a simple way to make sure that you and your employees remain safe in the long term: regular maintenance. Equipment and tools for the storage and transport of hazardous materials are complex. In addition to design-based tests, the technical components also need to be regularly inspected. The functionality of each component can have an important effect on the construction as a whole. Regular inspections will increase your productivity and the life of your investment. You choose: for long term safety we offer an attractive maintenance contract - or you can book just a single inspection.

Maintenance from the manufacturer - advantages!

There's more than one good reason to choose maintenance direct from the manufacturer:

- Minimise the risk of downtime and extend the life of your equipment
- Repairs are carried out exclusively by qualified and trained DENIOS AG service technicians
- As the manufacturer we ensure high quality original parts are supplied quickly
- You'll save travel costs and time - our technicians always carry materials for small repairs
- Service with that little extra: our technicians will alert you to any changes in legislation and show you the necessary adjustments on currently available or future products. Our professional technicians will recognise possible accident risks straight away and be able to deal with them quickly and professionally.

It's all covered: Service from DENIOS

When our technicians come to your site, every important detail is taken into consideration. Is the air exchange rate still ensured? Do the fire protection flaps operate correctly? Are the sensors supplying all the necessary data? Only when all the safety-relevant components have been extensively tested will we assign the proverbial tick. The process may vary, depending on the product to be inspected. We take care to ensure the following are inspected on your storage or test system for lithium batteries:

- Inspection of general condition
- Visual inspection for damage and defects
- Safety testing of all functions
- Inspection of the switch cabinet
- Testing of the signalling technology (e.g. fire recognition, gas warning sensors)
- Inspection of heating and climate control technology
- Functional inspection of mechanical parts and doors
- Inspection of spill pallets for damage

Membership pays!

When you sign a maintenance contract, you'll have access to the following benefits:

- Regular service intervals mean that expensive repairs can be avoided
- Legal requirements for maintenance intervals are observed
- Maintenance of your insurance protection including limitation of company liability in the event of a loss
- Extra protection: we'll extend your warranty to 5 years*
- Precise control of costs: we offer an attractive all-inclusive bundle
- Don't worry about tiresome scheduling. With a maintenance contract, we'll remind you in good time when maintenance is due

Maintenance at an all-inclusive price

The security of long term maintenance with full control of costs - our all-inclusive maintenance bundle has everything you'll need for an all-inclusive price:

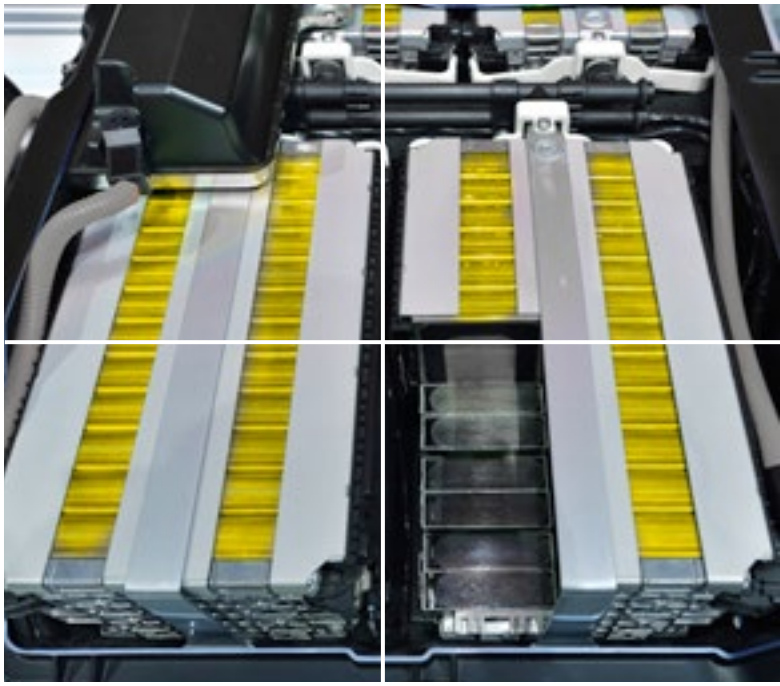
- ✓ Reminder service: making sure you don't miss an inspection date
- ✓ Regular inspection of your entire room system and the technical components
- ✓ **Costs for travel, expenses, overnight accommodation and incidentals already included**
- ✓ **Small repairs carried out directly on site, more involved repairs will be quoted for separately**
- ✓ Production of a service report and test report
- ✓ Fitting of the test plate

Get one now & start saving!

When you take out a service contract, you'll benefit from our attractive all-inclusive offers as well as an extended DENIOS 5 year* warranty . Get your Carefree Card today and apply for your DENIOS Premium Service Card.

* Applies if a service contract is taken out within the first year after delivery.

DENIOS
ENVIRONMENTAL PROTECTION
& WORK SAFETY



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