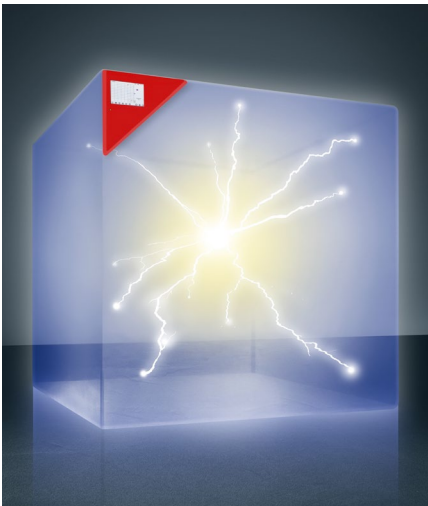


Battery test chambers



LIT MK series

Safety packages for aging,
performance, and stress tests



EUCAR hazard levels & standards

What classifications apply to handling energy storage devices?

The EUCAR hazard levels are used to assess the level of danger associated with handling batteries. They have been defined by EUCAR (the European Council for Automotive R&D) by classifying the hazards presented to batteries and describing the consequences of them. BINDER offers various packages with additional safety measures based on these effects on batteries.

Hazard level	Description	Classification criteria and effects	Package A	Package P	Package P Plus	Package S/ LIT MK series
0	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	Same as hazard level 1; however, the cell is damaged irreversibly and must be replaced.	•	•	•	•
3	Leakage, loss of mass < 50%	No venting, fire, or flame; no rupture; no explosion. Weight loss < 50% of electrolyte weight (electrolyte = solvent + conducting salt)		•	•	•
4	Leakage, loss of mass > 50%	No fire or flame; no rupture; no explosion. Weight loss > 50% of electrolyte weight (electrolyte = solvent + conducting salt)		•	•	•
5	Fire or flame	No rupture; no explosion (e.g., no flying parts)			•	•
6	Rupture	No explosion, but flying parts of the active electrode mass				•
7	Explosion	Explosion (e.g., disintegration of the cell)				

Battery test chambers

LIT MK series

Page 8

Safety packages

Page 12

A good decision: You are in safe hands with BINDER

Battery test chambers from BINDER are suitable for tests performed on lithium-ion cells and modules. Handling lithium-ion batteries can present a variety of potential hazards. System operators need to evaluate the level of risk and counteract it using an appropriate safety concept.

The LIT MK series of temperature test chambers from BINDER provides a controllable temperature range of -40°C to +110°C.

The units come with extensive safety equipment as standard so that tests on lithium-ion cells can be performed at an anticipated EUCAR hazard level of 6.

PRODUCT RANGE FOR BATTERY TEST CHAMBERS

Features	LIT MK series
› Page 8	
Model	
240 model	•
720 model	•
General data	
Temperature range [°C]	-40...110
Ethernet interface	•
USB interface	•
Forced convection	•
Controller and timer functions	
Controller display	TFT touch
Ramp function	•
Time delayed ON	•
Programming option	•
Class 1 temperature safety device	•
Class 2 independent adjustable temperature safety device	•
Temperature alarm, acoustic	•
Temperature alarm, visual	•
• Standard equipment	

ADVANTAGES AT A GLANCE



EVEN TEMPERATURE DISTRIBUTION

LIT MK series

Thanks to BINDER APT.line™ preheating chamber technology. Long-term operational stability even under full load.



OCCUPATIONAL SAFETY

LIT MK series

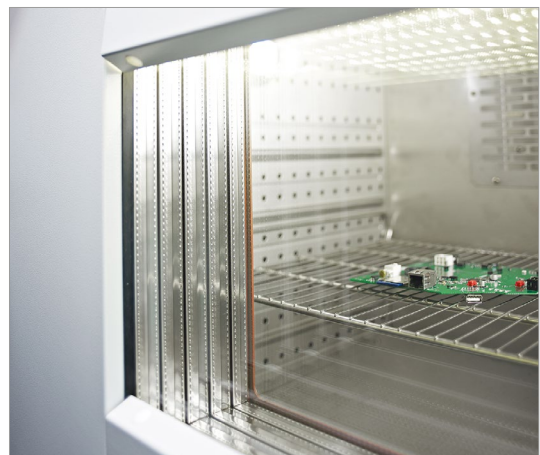
Extensive safety equipment allows tests to be performed safely on lithium-ion batteries.



PROGRAMMING AND DATA COLLECTION

LIT MK series

With the program controller featuring a color display and Multi Management Software APT-COM™ for remote programming through a PC.



EASY ASSEMBLY

LIT MK series

Thanks to large access area. The large heated viewing window with LED illumination provides a view of the test object.

LIT MK series | Battery test chambers with safety equipment for rapid temperature changes

Battery test chambers from BINDER are ideal for aging, performance, and stress testing in quality assurance and battery production. To ensure maximum safety, all the chambers in the LIT MK series are fitted with detection and fire suppression equipment as standard.



LIT MK 240 model

ADVANTAGES

- Safety thanks to extensive protective measures
- Homogeneous climate conditions thanks to APT.line™
- preheating chamber
- Extensive programming and data collection
- Excellent overview of the test object thanks to large heated viewing window

IMPORTANT FEATURES

- Temperature range: -40°C to +110°C
- Class 2 independent temperature safety device when temperature is set to +120°C
- Reversible pressure relief flap made of stainless steel installed in the middle on top of the unit
- Enhanced door-locking mechanism with reinforced brackets
- Monitoring of CO, H₂, O₂, and temperature in testing area atmosphere
- Inertization equipment
- CO₂ fire suppression equipment
- APT.line™ preheating chamber technology
- Programmable condensation protection for test material
- Heated viewing window with LED interior lighting

AVAILABLE SIZES

Model	Interior volume [L]	Online data sheets
LIT MK 240	228	> go2binder.com/en-LIT-MK-240
LIT MK 720	734	> go2binder.com/en-LIT-MK-720

i TIPS AND TRICKS

Make the most of our many years of experience that you can find in our technical papers:

Tips and tricks: > go2binder.com/en-tips-tricks
 Case studies: > go2binder.com/en-case-studies

OPTIONAL EQUIPMENT

Electromechanical door-locking mechanism

Electromechanical door-locking mechanism controlled in a time program or manually.



Access port with silicone plug

For introducing external measuring instruments. Large selection of different diameters and positions (left or top).



Notch-type access port in door

Notch-type access port in the door, 100 x 35 mm, makes it easy to guide measuring devices to the test object.



Services

You can access our installation, maintenance, calibration, validation, or warranty services by taking out a maintenance contract or by simply getting in touch when you need us. More information is available in the accessories and services chapter.



BINDER INDIVIDUAL

Using a BINDER series production product as a basis, we develop individual solutions as a single unit or in small batches. All products are tested, certified, and supplied with a full functional guarantee and warranty. More information is available in the accessories and services chapter.



► All extras online go2binder.com/en-options

TECHNICAL DATA

Description	LIT MK 240	LIT MK 720
Dimensions		
Interior volume [L]	228	734
Net weight of the unit (empty) [kg]	375	584
Permitted load [kg]	70	160
Permitted load of individual shelf [kg]	30	40
Wall clearance, rear [mm]	300	300
Wall clearance, side [mm]	200	200
Interior dimensions		
Width [mm]	735	1200
Height [mm]	700	1020
Depth [mm]	443	600
Housing dimensions not incl. fittings and connections		
Net width [mm]	1335	1794
Net height [mm]	1929	2005
Net depth [mm]	925	1186
Technical data: temperature		
Temperature range [°C]	-40...110	-40...110
Temperature uniformity dependent on set value [± K]	0.1...1.2	0.3...2
Temperature fluctuation dependent on set value [± K]	0.1...0.5	0.1...0.5
Average heating-up rate acc. to IEC 60068-3-5 [K/min]	5	4
Average cooling down rate acc. to IEC 60068-3-5 [K/min]	3.5	3.4
Electrical data		
Nominal power (400 V version) [kW]	5.6	8.7
Nominal power (480 V version) [kW]	5.6	8.7
Fixtures		
Number of shelves (std./max.)	1/6	1/11

ORDERING INFORMATION [art. no.]

Further details: Visit www.binder-world.com > Search > Enter the article number.

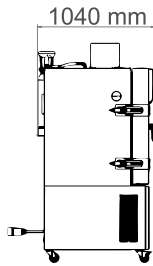
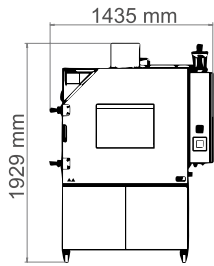
Nominal voltage	Option model	LIT MK 240	LIT MK 720
480 V 3~ 60 Hz	With voltage and frequency converter	9020-0404	9020-0405
400 V 3~ 50 Hz	Standard	9020-0402	9020-0403

EXCERPT FROM FULFILLED STANDARDS

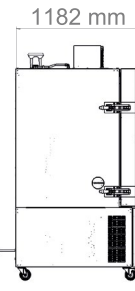
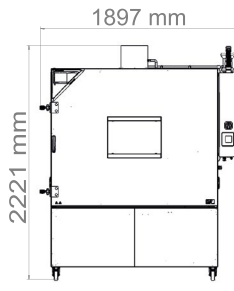
- IEC 62660-1
- ISO 12405-4
- IEC 62660-2

DIMENSIONS incl. fittings and connections [mm]

LIT MK 240



LIT MK 720



ORDERING INFORMATION FOR OPTIONS

Designation	Description	LIT MK 240	LIT MK 720	Art. no.
Analog output 4–20 mA	For temperature values (output not adjustable)	•	•	8012-1084
Dry-air purge, connection	To enable connection to the on-site compressed air network	•	–	8012-1089
		–	•	8012-1797
Heated access port	On left side, including locking latch and silicone plug 150 mm diameter	•	•	8012-1999
	Left			
Access port with silicone plug	30 mm	•	•	8012-1322
	50 mm	•	•	8012-1328
	80 mm	•	•	8012-1334
	100 mm	•	•	8012-1542
	125 mm	•	•	8012-1351
	Top			
	80 mm	•	•	8012-1536
	100 mm	–	•	8012-1530
	125 mm	–	•	8012-1533
	Electromechanical door-locking mechanism	Controlled via control contact in time program or manually	•	•
Calibration certificate, temperature	Measurement in center of chamber at specified temperature	•	•	8012-1143
	Temperature measurement incl. certificate, 15–18 measuring points at specified test temperature	•	•	8012-1581
	Temperature measurement incl. certificate, 27 measuring points at specified test temperature	•	•	8012-1602
	Temperature measurement incl. certificate, 9 measuring points at specified test temperature	•	•	8012-1560
Calibration certificate, expanded	For temperature; for extending the measurement in center of chamber to include another test temperature	•	•	8012-1124
Notch-type access port	Notch-type access port in door, 100 x 35 mm	•	–	8012-1850
		–	•	8012-1851
Locking latch for access port plug	For securing the silicone plug of an access port			
	100 mm diameter	•	•	8012-2015
	125 mm diameter	•	•	8012-2016
	30 mm diameter	•	•	8012-2012
	50 mm diameter	•	•	8012-2013
	80 mm diameter	•	•	8012-2014
Relay contacts, zero-voltage	For controlling 3 relay contacts via program controller, accessible via 6-pin DIN socket (max. 24 V – 2.5 A)	•	•	8012-1095

Designation	Description	LIT MK 240	LIT MK 720	Art. no.
RS 485 interface, 2-wire	Additional serial interface can be used parallel to Ethernet, for Multi Management Software APT-COM™	•	•	8012-1768
Temperature sensor Pt 100	Additional flexible Pt 100, interior, for displaying the temperature on the unit display	•	•	8012-1093
Door lock	Lockable door handle	•	•	8012-1861
Reinforced chamber base	For increasing the load capacity of the interior base			
	to 200 kg	•	–	8012-2009
	to 300 kg	–	•	8012-2010

ORDERING INFORMATION FOR ACCESSORIES

Designation	Description	LIT MK 240	LIT MK 720	Art. no.	
APT-COM™ 4 GLP Edition	For working under GLP-compliant conditions. Measured values are documented in a tamper-proof way in line with the requirements of FDA Regulation 21 CFR 11.				
	Version 4, GLP Edition	•	•	9053-0042	
APT-COM™ 4 PROFESSIONAL Edition	Convenient unit and user management which builds on the BASIC edition. Suitable for networking up to 100 units.				
	Version 4, PROFESSIONAL Edition	•	•	9053-0040	
Data Logger Kit	T 220: For continuous temperature logging from -90°C to 220°C. The kit includes 1 data logger, Pt 100 sensor with 2 m extension cable, and 1 magnetic fixture for mounting to the BINDER unit	–	–	8012-0715	
Data Logger Software	LOG ANALYZE software kit, configuration and evaluation software for all BINDER Data Logger Kits (incl. USB data cable)	–	–	8012-0821	
Shelf, perforated	Stainless steel	•	–	8009-0447	
		–	•	8009-0511	
Rack	Stainless steel	•	–	6004-0097	
		–	•	6004-0102	
Rack, reinforced	Stainless steel, with fasteners (1 set of 4)	•	–	8012-0605	
		–	•	8012-0684	
Rack accessories	Fasteners (1 set of 4) for additional security	•	•	8012-0620	
pH-neutral detergent	Concentrated, for gentle remove of residual contaminants; 1 kg	•	•	1002-0016	
Qualification documents	IQ/OQ documents – supporting documents for validation performed by customers, consisting of: IQ/OQ checklists incl. calibration guide and comprehensive unit documentation; parameters: temperature, CO ₂ , O ₂ , pressure, depending on unit				
		Digital in PDF format	•	•	7057-0001
	Hard copy inside folder	•	•	7007-0001	
	IQ/OQ/PQ documents – supporting documents for validation performed by customers, according to customer requirements, PQ section added to qualification folder IQ/OQ; parameters: temperature, CO ₂ , O ₂ , or pressure, depending on unit				
		Digital in PDF format	•	•	7057-0005
	Hard copy inside folder	•	•	7007-0005	
RS 485 / RS 422 interface converter	RS 422 cable set and RS 485 / RS 422 interface converter for connection to 10-way plug distributor				
	115 V option model	•	•	8012-0599	
	230 V option model	•	•	8012-0589	

BINDER INDIVIDUAL Safety packages

Package A | Package P | Package P Plus | Package S

BINDER offers test chambers for aging, performance, and stress tests.

Our BINDER INDIVIDUAL department can equip the following models with package A, P, P Plus, and S:

Series	56	115	240	400	720	1020
MK	–	•	•	–	•	–
MKF	–	•	•	–	•	–
MKT	–	•	•	–	•	–
MKFT	–	•	•	–	•	–
KB	–	•	•	•	•	–
KBF	–	–	•	–	•	–
KMF	–	–	•	–	•	•

• Available – Not available

Package A | For aging tests

This safety package is ideal for tests that present a low potential hazard level and is exactly in line with EUCAR hazard level 2.



MK 56 model with package A

AGING TESTS:

These involve testing at a certain temperature without the battery load cycle. They are performed within a safe temperature range for the battery.

SOLUTION

- Class 2 independent temperature safety device when temperature is set to 120°C
- Temperature range limited to 110°C on the controller



1 TEMPERATURE RANGE LIMITATION

Class 2 independent temperature safety device when temperature is set to 120°C

Package P | For performance tests

The equipment in this safety package is designed for tests on lithium-ion batteries and is exactly in line with EUCAR hazard level 4.



PERFORMANCE TEST:

Various battery-specific parameters, such as the load state, are tested with overlapping temperature ranges. These tests are performed within a safe temperature range for the battery.

KB model with package P

SOLUTION

- Class 2 independent temperature safety device when temperature is set to 120°C
- Temperature range limited to 110°C on the controller
- Stainless-steel pressure relief flap installed in the middle on top of the unit
- Enhanced door-locking mechanism with reinforced brackets
- Inert gas connections



1 TEMPERATURE RANGE LIMITATION

Class 2 independent temperature safety device when temperature is set to 120°C



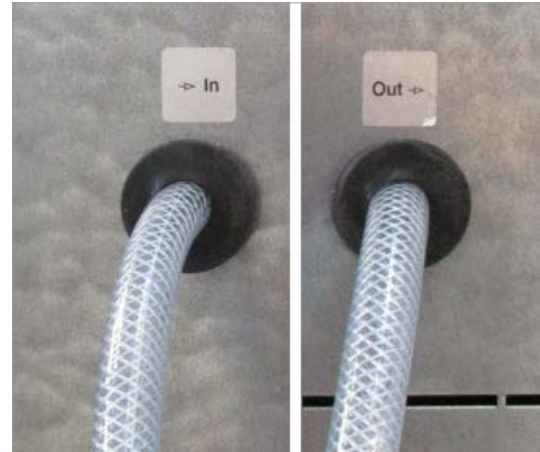
2 DOOR-LOCKING MECHANISM

Strong closing brackets on the side of the chamber to lock it shut



3 REVERSIBLE PRESSURE RELIEF FLAP

Pressure relief flap on the top of the unit with a diameter of 150 mm. Exhaust air vent can be connected to the customer's exhaust air



4 INERT GAS CONNECTIONS

Inert gas connections for flushing (e.g., for nitrogen)



FORMATION IN THE SERIES KB CLIMATE CHAMBER

Formation is the final – and highly important – production stage in the manufacture of lithium-ion cells. It involves charging and discharging the cell for the first time, creating boundary layers between the electrolyte and the active material within the cell. A quality control step can also be incorporated by means of an additional charging and discharging process. The formation process can take up to two days.

Click to read more:

> go2binder.com/en-battery-test-chambers

DRYING & VACUUM DRYING IN THE MANUFACTURING PROCESS

Components need to be dried as part of the process of manufacturing the lithium-ion cell. Our VD and VDL series vacuum drying chambers as well as our FED series drying chamber are ideal for this task.

Package P Plus | For extended performance tests

The equipment in this safety package is designed for tests on lithium-ion batteries and is exactly in line with EUCAR hazard level 5.



PERFORMANCE TEST:

Various battery-specific parameters, such as the load state, are tested with overlapping temperature ranges. These tests are performed within a safe temperature range for the battery.



MK model with package P Plus

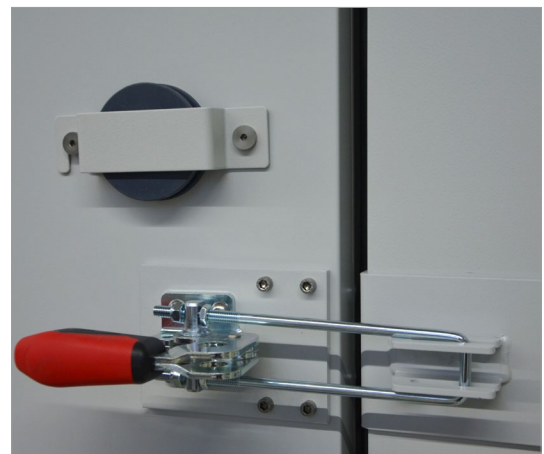
SOLUTION

- Class 2 independent temperature safety device when temperature is set to 120°C
- Temperature range limited to 110°C on the controller
- Reversible pressure relief flap made of stainless steel installed in the middle on top of the unit
- Enhanced door-locking mechanism with reinforced brackets
- Inert gas connections
- Temperature-monitored testing area
- CO₂ fire suppression equipment



1 TEMPERATURE RANGE LIMITATION

Class 2 independent temperature safety device when temperature is set to 120°C



2 DOOR-LOCKING MECHANISM

Strong closing brackets on the side of the chamber to lock it shut



3 REVERSIBLE PRESSURE RELIEF FLAP

Pressure relief flap on the top of the unit with a diameter of 150 mm. Exhaust air vent can be connected to the customer's exhaust air



4 INERT GAS CONNECTIONS

Inert gas connections for flushing (e.g., for nitrogen)



5 TEMPERATURE MONITORING

The temperature of the testing area is detected and monitored



6 WARNING INDICATOR LAMP

An audible and visual warning signal indicates if the fire suppression equipment has been activated



7 CO₂ FIRE SUPPRESSION EQUIPMENT

CO₂ fire suppression equipment activated either manually or if a specific temperature is exceeded



8 MANUAL ACTIVATION

Activation of the CO₂ fire suppression equipment

Package S | For stress tests

The extensive equipment in this safety package is designed for tests on lithium-ion batteries and is exactly in line with EUCAR hazard level 6.



MK 240 model with package S

STRESS TESTS:

Various battery-specific parameters, such as the load state, are tested with overlapping temperature ranges. These tests are performed at the limit of the safe temperature range for the battery. This category also includes tests with higher charging and discharging currents overlapping with constant or dynamic temperatures.



SOLUTION

- Class 2 independent temperature safety device when temperature is set to 120°C
- Temperature range limited to 110°C on the controller
- Reversible pressure relief flap made of stainless steel installed in the middle on top of the unit
- Enhanced door-locking mechanism with reinforced brackets
- N₂ permanent inertization
- Temperature-monitored testing area
- CO₂ flushing device
- Monitoring of CO, H₂, and O₂ in testing area atmosphere



1 TEMPERATURE RANGE LIMITATION

Class 2 independent temperature safety device when temperature is set to 120°C



2 DOOR-LOCKING MECHANISM

Strong closing brackets on the side of the chamber to lock it shut



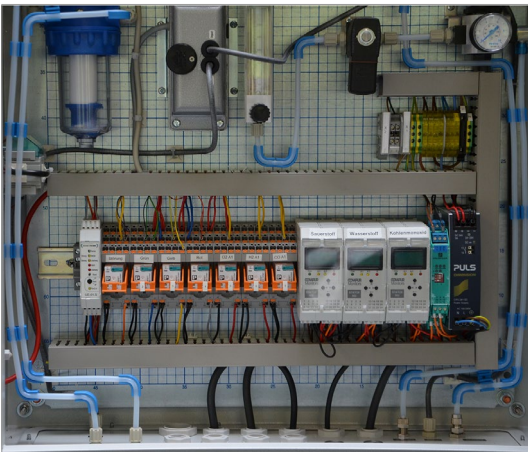
3 REVERSIBLE PRESSURE RELIEF FLAP

Pressure relief flap on the top of the unit with a diameter of 150 mm. Exhaust air vent can be connected to the customer's exhaust air



4 GAS DETECTION

CO, H₂, and O₂ are detected and monitored in the testing area atmosphere



5 INERTIZATION EQUIPMENT

Option of inertization in customer testing area; flow meter, needle valve, and solenoid valve included with equipment



6 WARNING INDICATOR LAMP

Audible and visual signals indicate various operating states



7 CO₂ FIRE SUPPRESSION EQUIPMENT

CO₂ fire suppression equipment activated either manually or if a specific temperature or specific gas detector threshold (O₂, CO, and H₂) is exceeded



8 MANUAL ACTIVATION

Activation of the CO₂ fire suppression equipment

BINDER INDIVIDUAL | Adaptations in line with customer requirements

Individual extras for your simulation chamber – BINDER INDIVIDUAL makes it possible. Even though the BINDER portfolio contains an incredibly wide variety of products and equipment options, some highly specific customer requirements still cannot be met by a unit manufactured in series production. We can, however, adapt these units to fit your individual requirements profile.

Battery test chambers can be converted by our BINDER INDIVIDUAL department according to special customer requirements, and equipped with additional functions.



Choice of racks and shelves, including those for heavy loads



Telescopic rails for simpler loading of the chamber



Access port protection in the event of overpressure for stable test conditions



Program sequence display using indicator lamps



Electromechanical door-locking mechanism controlled via time program or manual operation



Additional access ports available in almost all sizes and locations



Heavy-duty castors and supports provide reinforcement for particularly heavy loads.



Get in touch with BINDER INDIVIDUAL:
> go2binder.com/en-BINDER-INDIVIDUAL
Tel.: +49 7462 2005 0

Application examples | Tips and tricks and references

Aging and performance tests for cells and modules for lithium batteries (TÜV SÜD, Germany)

Extensive performance tests are carried out in order to determine the performance of the cells and modules (package P). The components are brought to the limits of their performance and load capacities by exposing them to constantly changing temperatures, with and without a current. The test object is exposed, for example, to temperatures of -5°C to 55°C in the BINDER KB series cooling incubator under continuous temperature changes.

Read more: > go2binder.com/en-TUEV-SUED-battery-testing



Source: TÜV SÜD



Source: TÜV SÜD

Battery research (University of Warwick, UK)

The University of Warwick in the UK is successfully using BINDER simulation chambers from Tuttlingen in its research work. The newly founded Energy Innovation Centre, part of the International Automotive Research Centre (IARC), is working on the development of batteries for hybrid and electric vehicles. The aim is for batteries to be made more powerful in the near future, and for this reason scientists also need better and better climate chambers. With BINDER chambers, they have most likely found exactly the product they need, “because the more powerful the batteries become, the more dangerous the tests in the laboratory will be”.

Find out more: > <https://youtu.be/a9nr-l8snBg>



Source: University of Warwick



Source: © WWU/MEET

Formation (WWU/MEET, Germany)

KB series climate chambers are used for the formation process. FED series drying chambers are also used to dry components of the cell as well as auxiliary equipment such as gloves.



Further application examples:
> go2binder.com/en-case-studies

BINDER products

CO₂ incubators

Incubators

Cooling incubators

Growth chambers

Ultralow temperature freezers

Drying and heating chambers

Safety drying chambers

Vacuum drying chambers

Constant climate chambers

Dynamic climate chambers

Battery test chambers

Multi Management Software



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