



**LI-ION TRAINING
PART 1
INTRODUCTORY LESSON**

Энергия ДВИ
Энергия СВЕТ

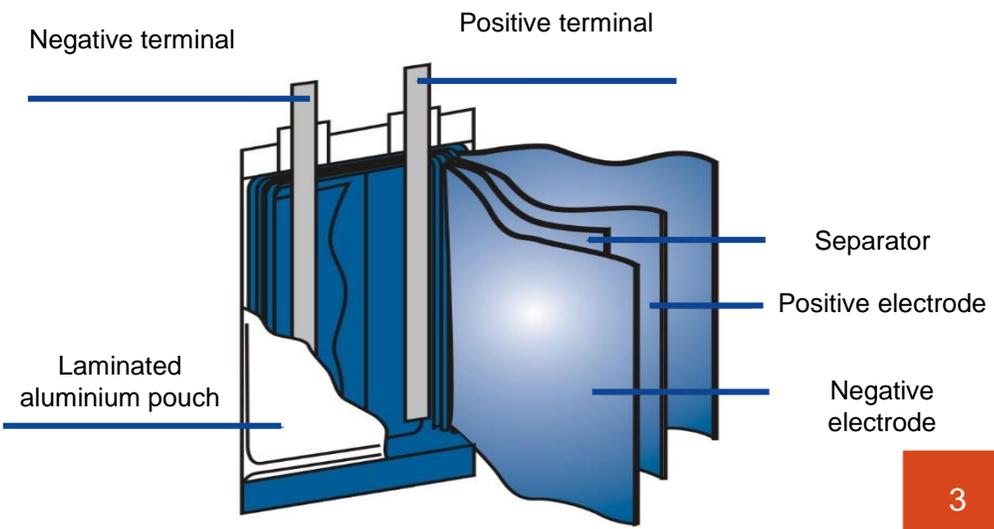
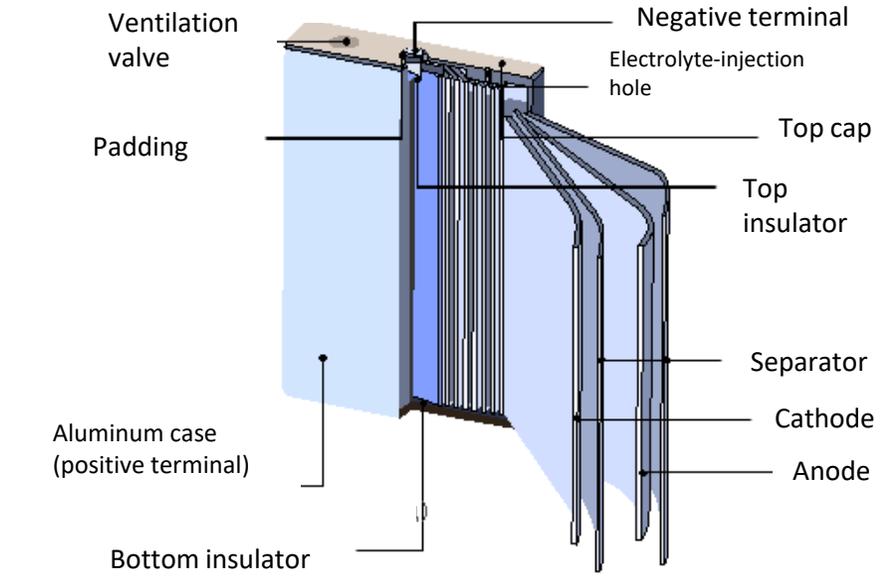
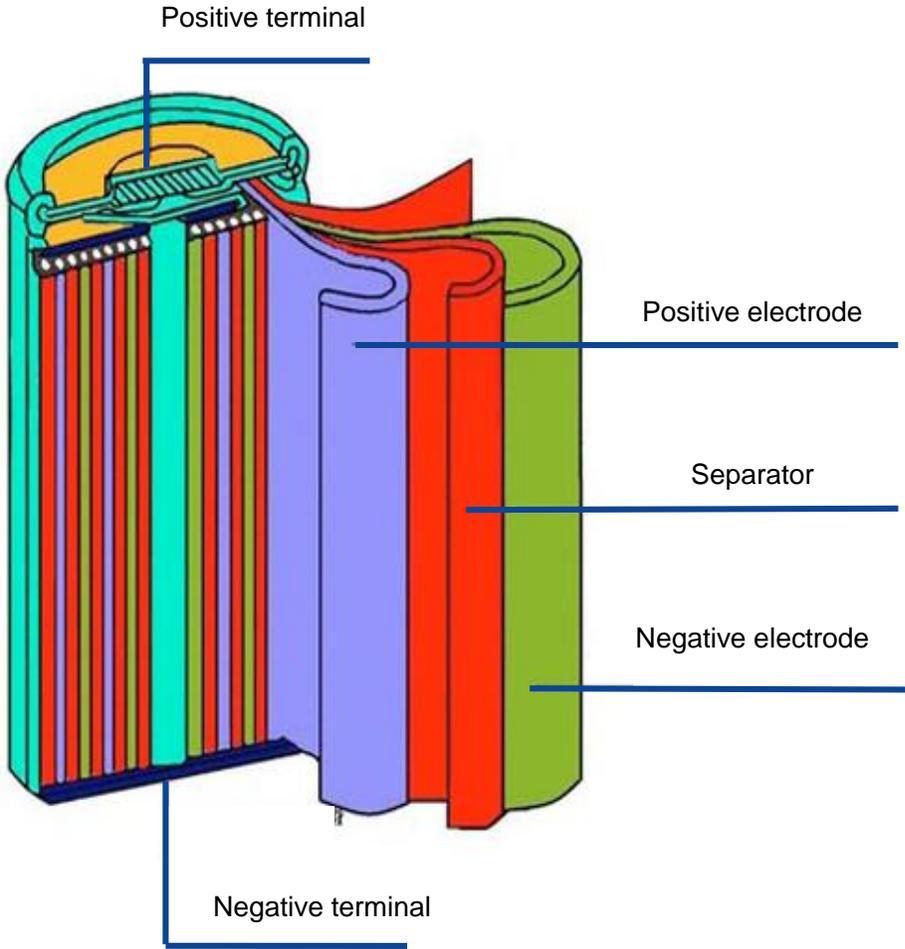
LI-ION BATTERIES

Nowadays, there is a worldwide trend of expanding the use and improving the characteristics of batteries.

A part of this trend is switching to Li-ion batteries.

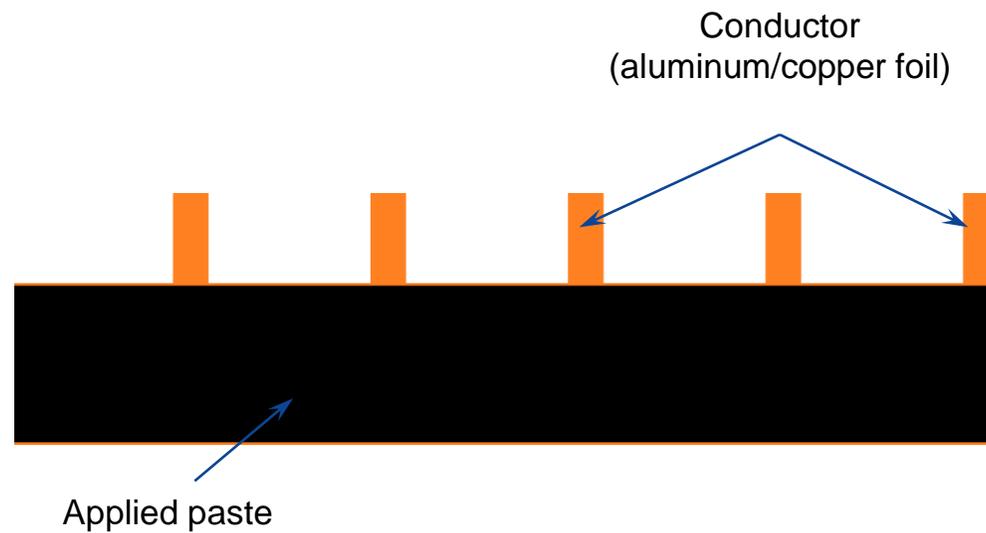


THE STRUCTURE OF LI-ION BATTERY

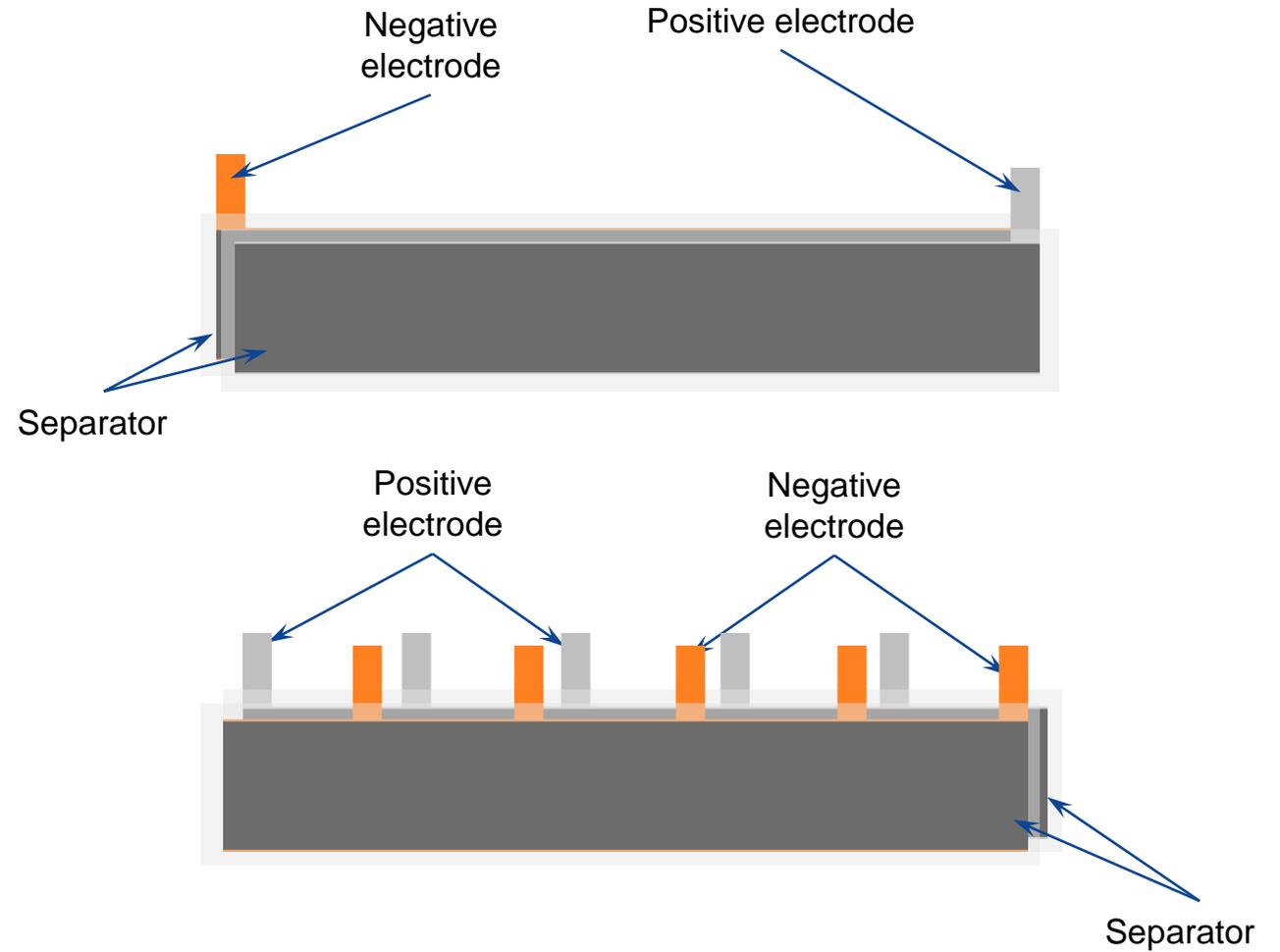


ELECTRODES

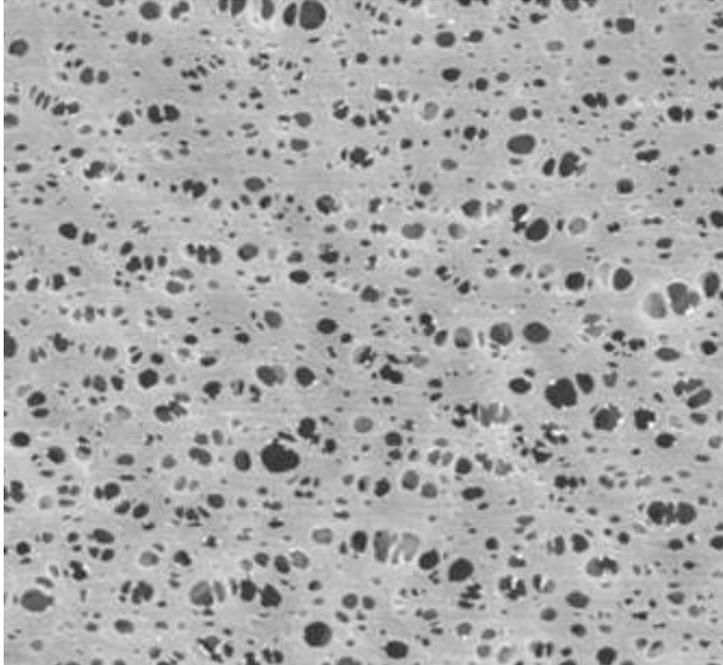
Electrodes of different geometry



Assembling options



SEPARATOR



A micrograph of a separator

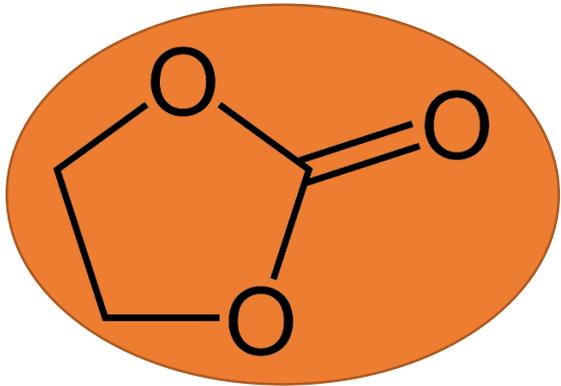


Separator assembling

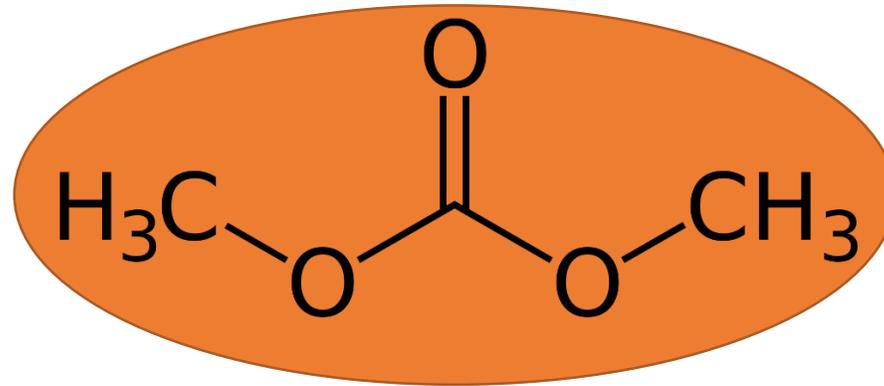


Damaged separator

ELECTROLYTE

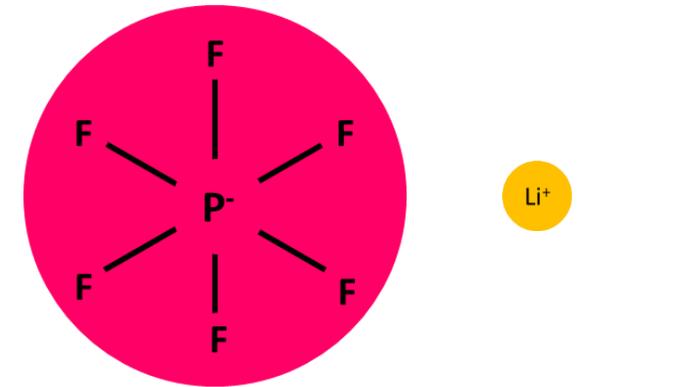


Ethylene carbonate



Dimethyl carbonate

Mixture of organic solvents



Lithium hexafluorophosphate

Lithium salt

LITHIUM-ION BATTERY DESIGN



Prismatic cell



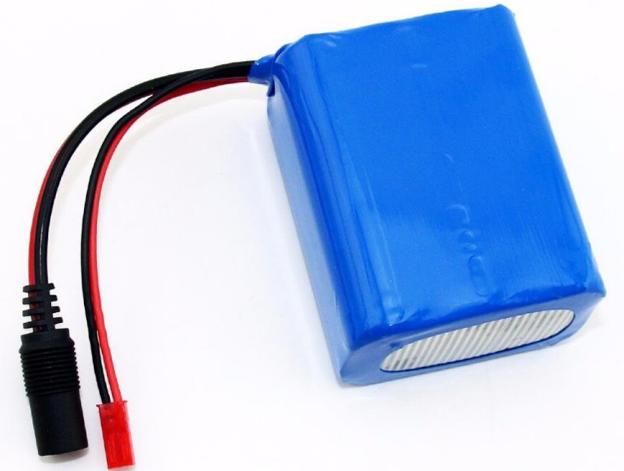
Cylindrical cell



Cylindrical cell battery module



Prismatic pouch



Prismatic pouch battery

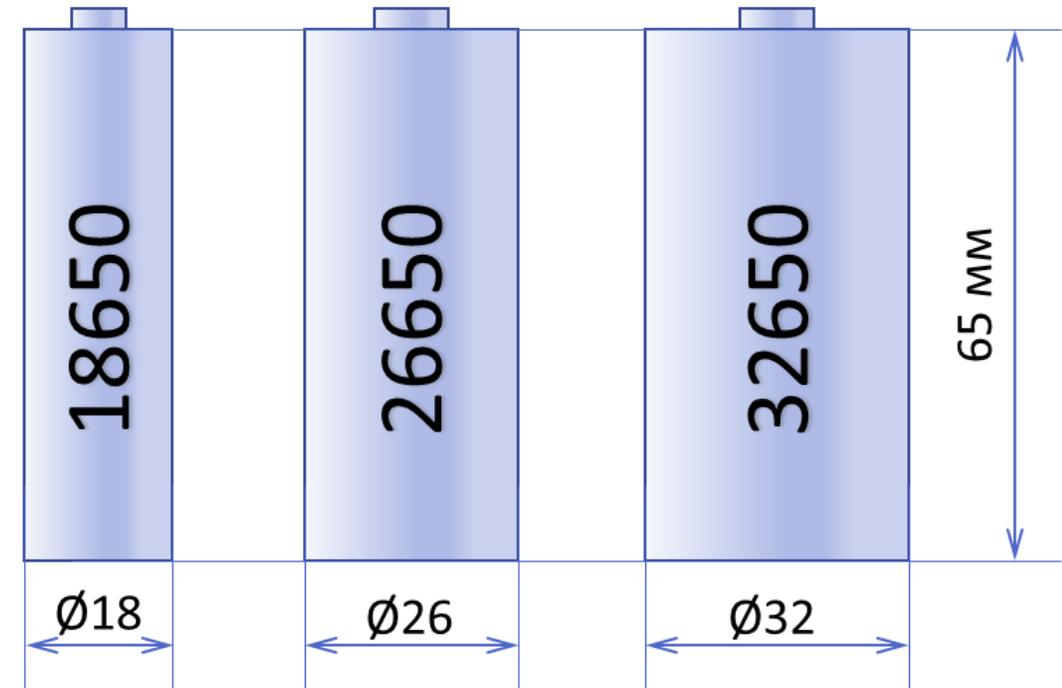
IDENTIFIERS AND ABBREVIATIONS

There is a standardized range of dimensions for cylindrical elements.

Size. There is a range of standard cases for cylindrical cells.
Size 18650 – 18 mm diameter, 65 mm length.

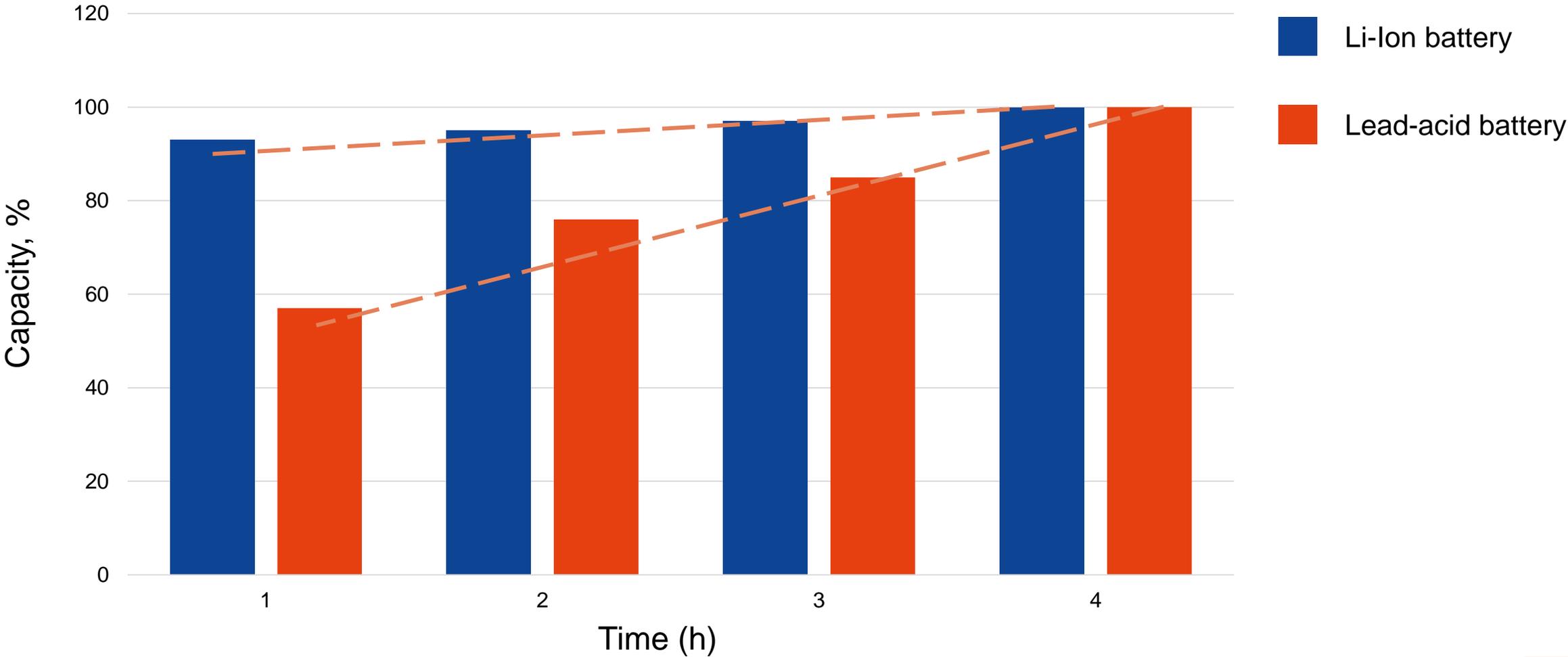
Rated capacity. Li-Ion manufacturers can specify a rated capacity from 1000 mAh up to 3000 mAh, with an 10 mAh interval, for the same case.

Rated voltage. The generally accepted voltage value that is indicated on the battery case.



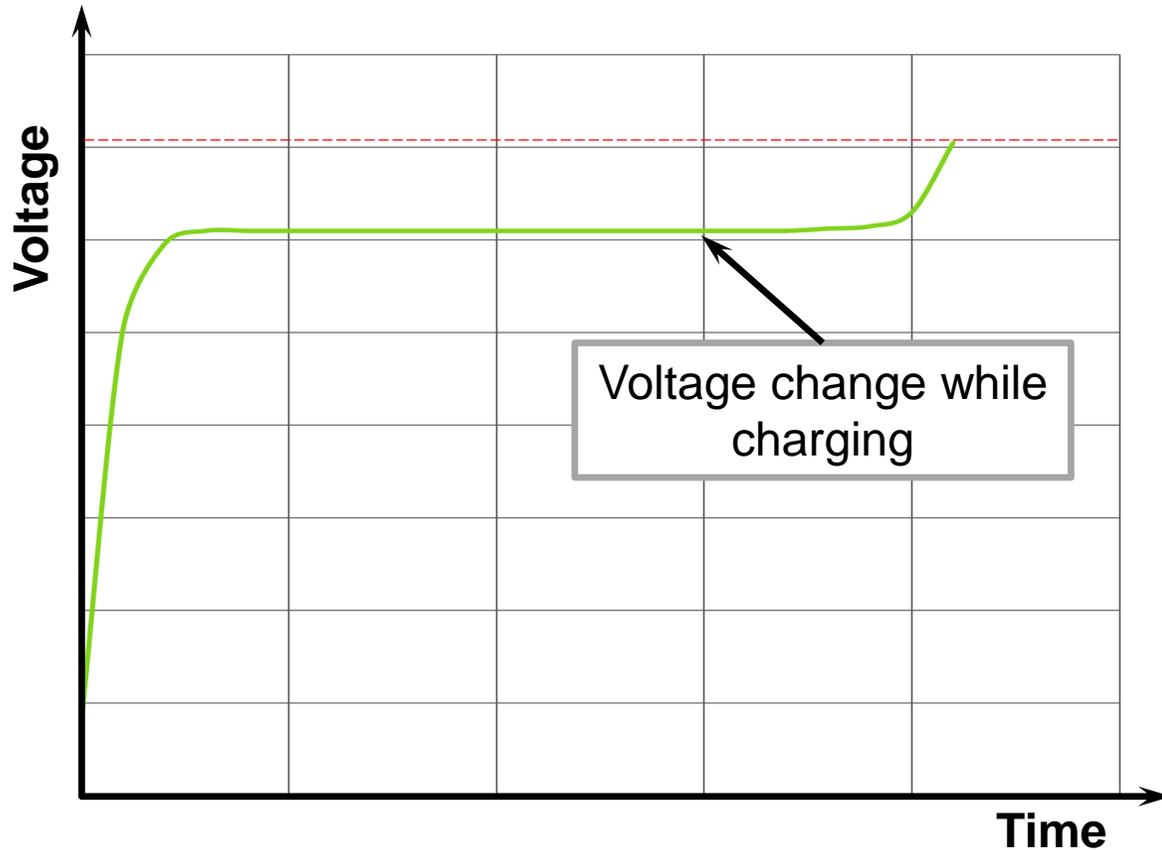
Size 18650 – diameter 18 mm, length 65 mm.

CAPACITY DEPENDING ON THE DISCHARGE CURRENT

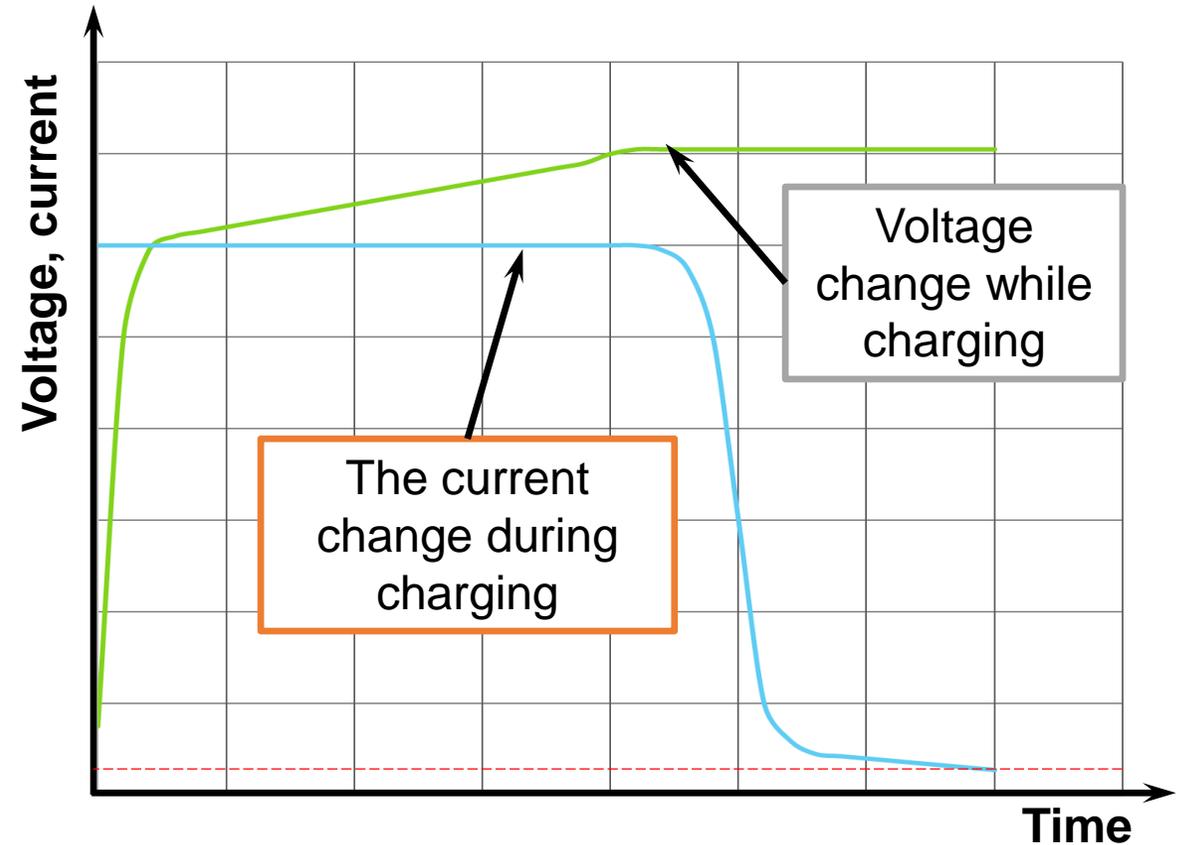


LITHIUM-ION BATTERY CHARGE

Charge with a constant current value, the end of the charge occurs when the set voltage value is reached



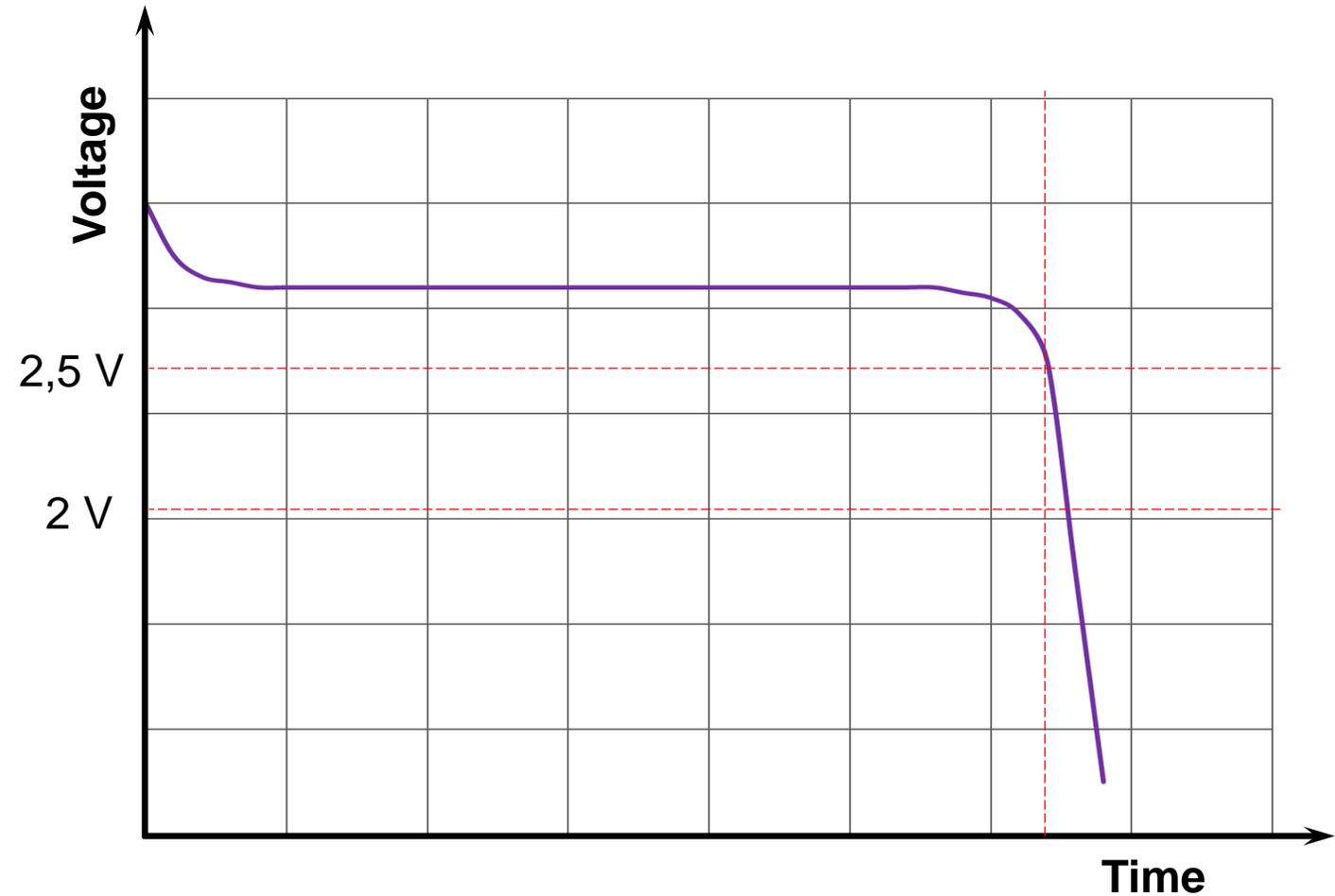
A constant voltage charge with a limitation of the maximum charge current, the end of the charge occurs when the set value of the minimum current is reached



LITHIUM-ION BATTERY DISCHARGE

The lithium-ion battery can be discharged up to 2 V.

However, manufacturers recommend and specify in the guidelines the voltage of not lower than 2,5-3 V.

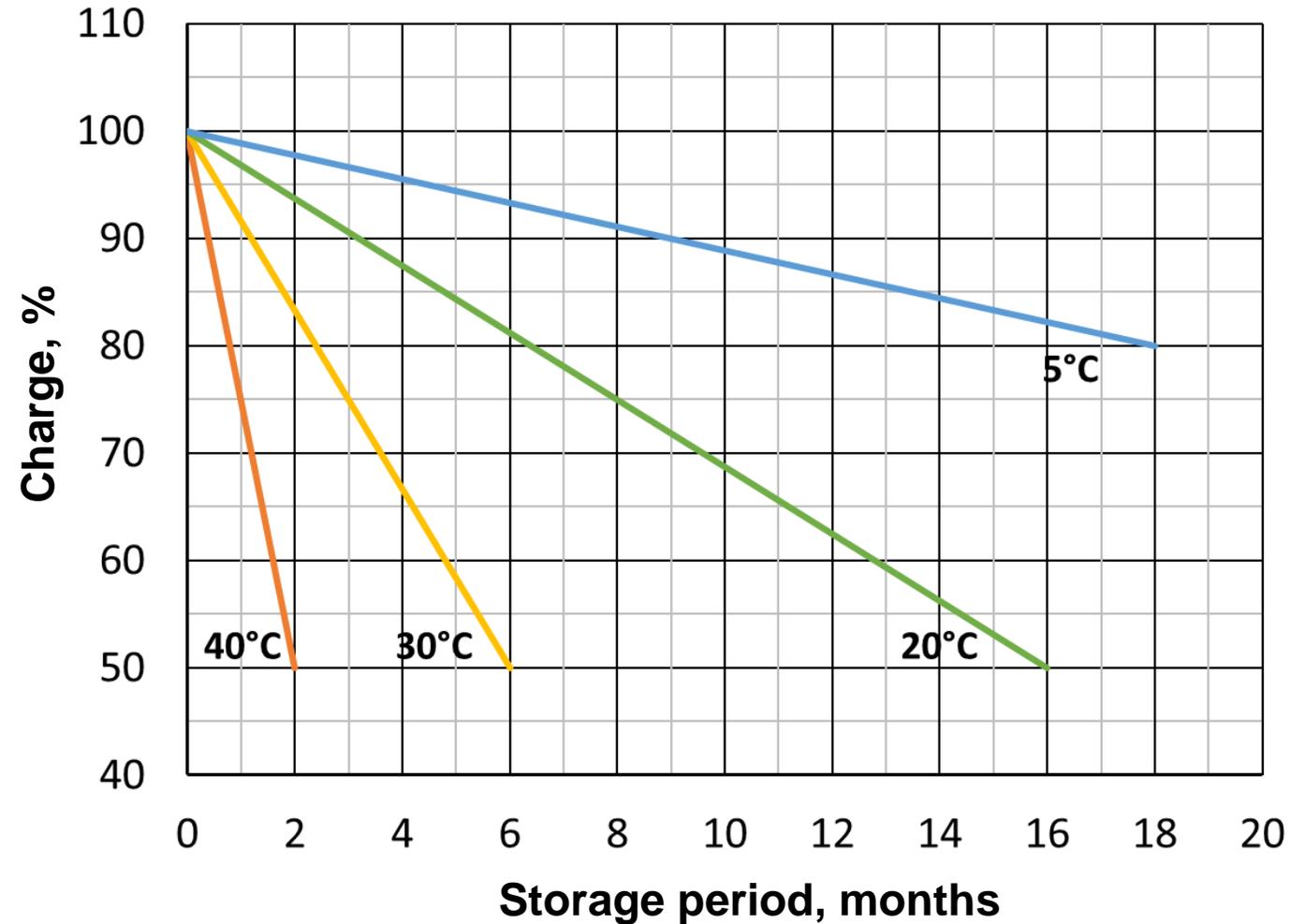


THE IMPACT OF TEMPERATURES

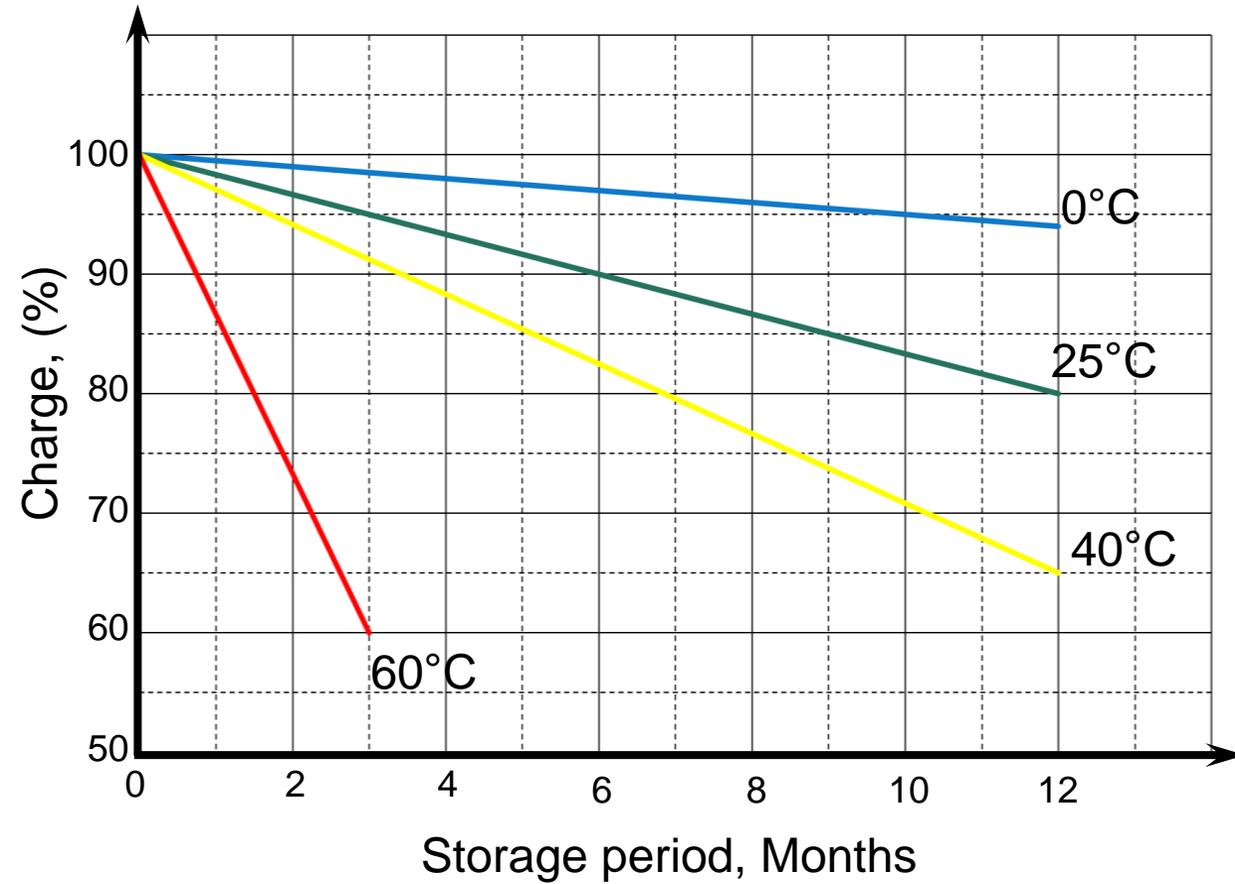
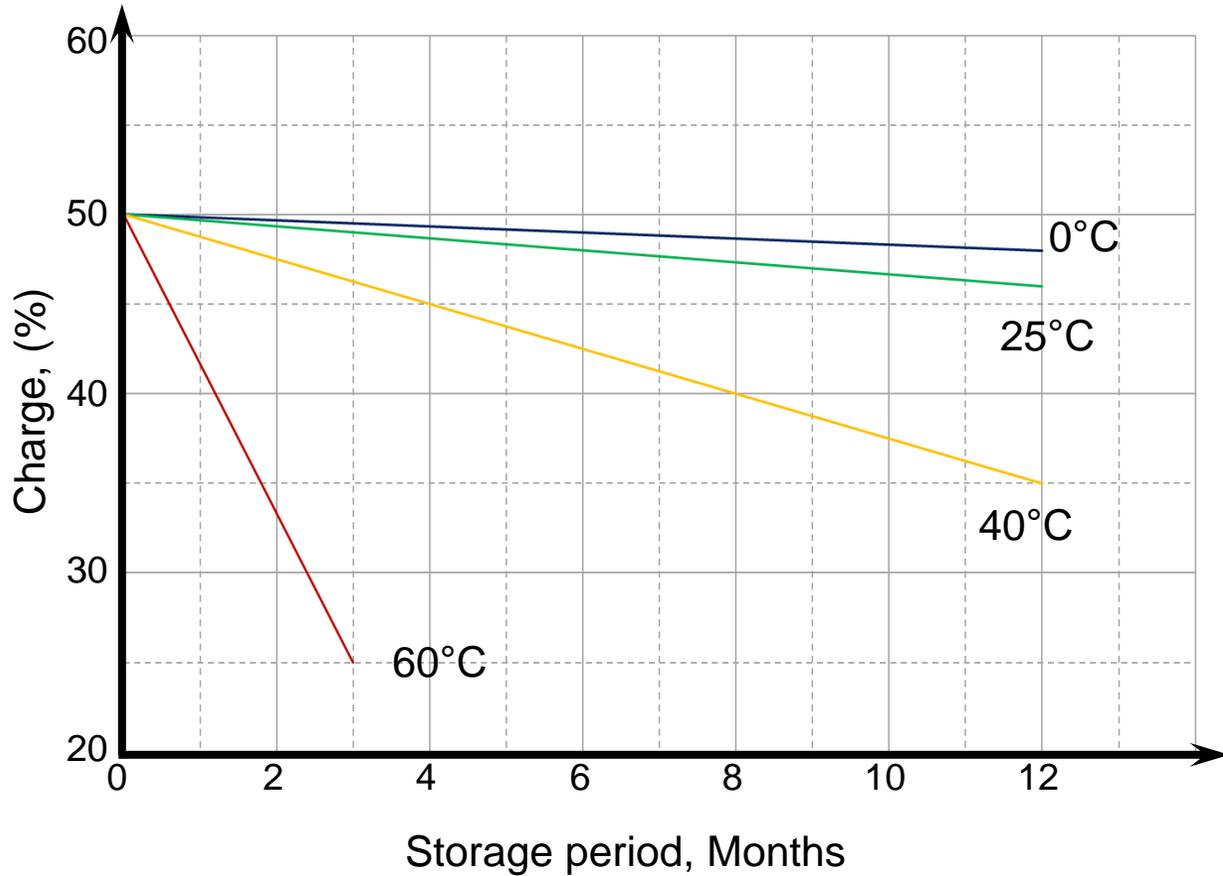


LEAD-ACID BATTERY STORAGE

Self-discharge



STORAGE OF LITHIUM-ION BATTERIES



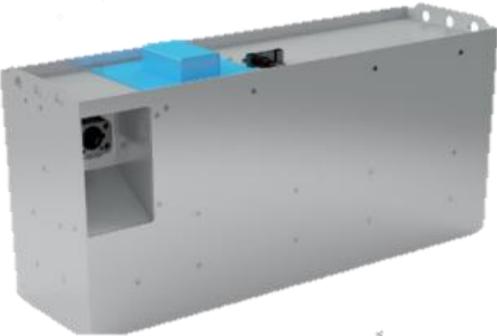


**TRACTION BATTERIES FOR
WAREHOUSE AND CLEANING
EQUIPMENT**

TRACTION LI-ION BATTERY STRUCTURE



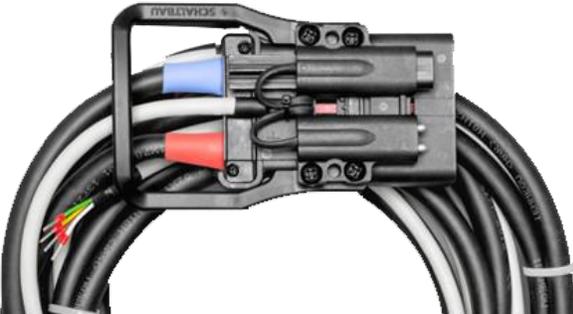
Li-ion cells



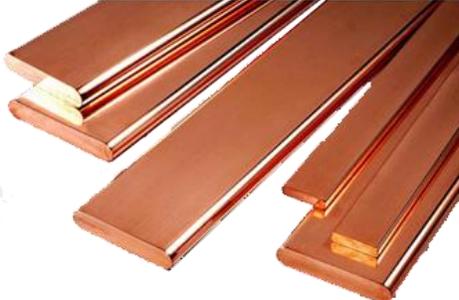
Battery case



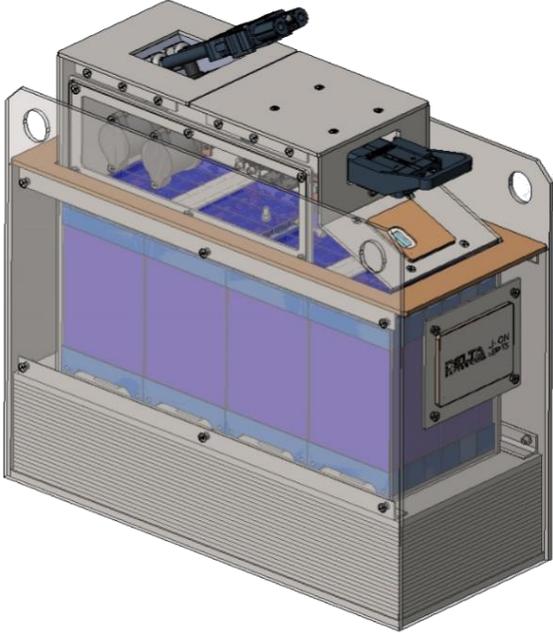
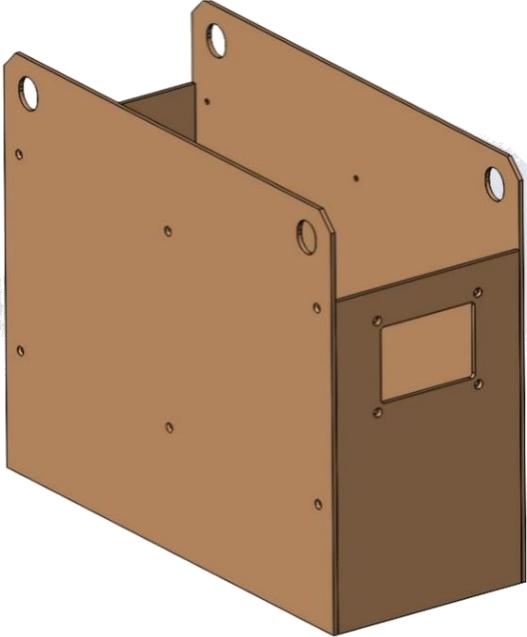
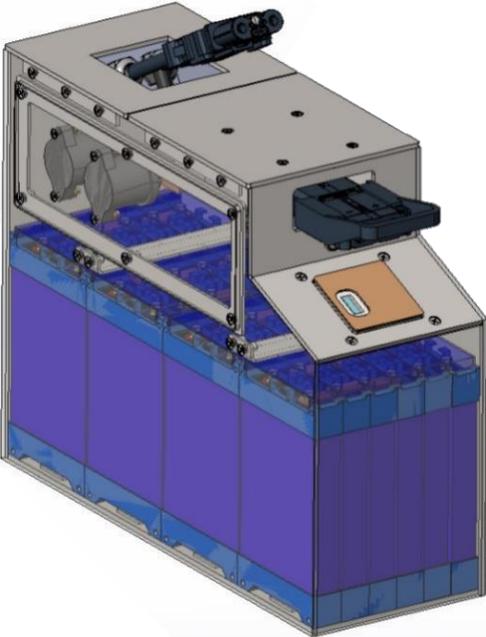
Battery Management System



Other components



TRACTION LI-ION BATTERY ASSEMBLY





TELECOM MODULES

TELECOM MODULES

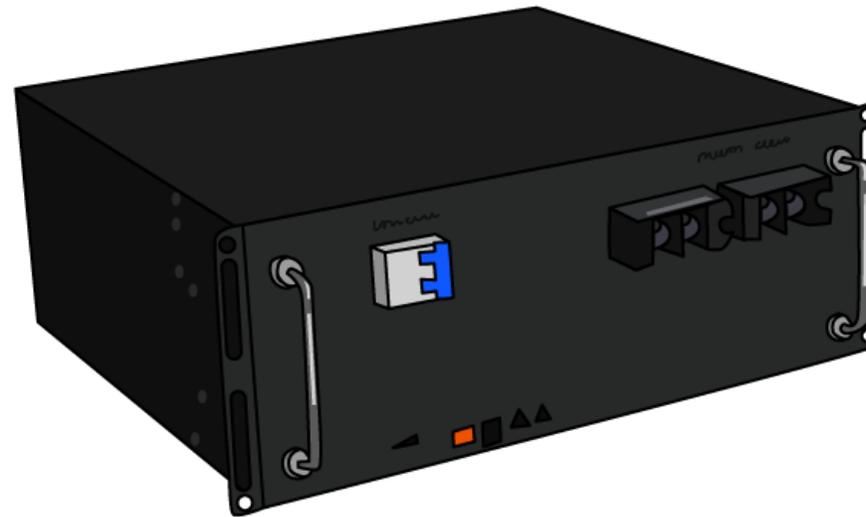
- Module voltage: 48 V
- To increase the capacity, parallel switching is used
- A wide range of operating temperatures: -20...+60



LI-ION BATTERY FEATURES

Possibility of heating
(operation in up to -40 °C)

Battery communication



1U-5U
Dimensions

Operating mode
from 0 to +55
°C



LITHIUM FOR UPS

LITHIUM FOR UPS



Specifications

- Rated voltage 254-768 [V]
- Rated module capacity from 40 up to 200 [Ah]

Features

- The number of parallel connected cabinets is unlimited



LI-ION OPERATION WITH UPS

UPS



BMS (Battery Monitoring System)



UPS to BMS
communication using
communication
protocols

Regulation of:

- Charge
- Voltage
- Level of self-discharge

Li-Ion batteries





**LI-ION HOUSEHOLD
SYSTEMS**

POWERWALL SPECIFICATIONS

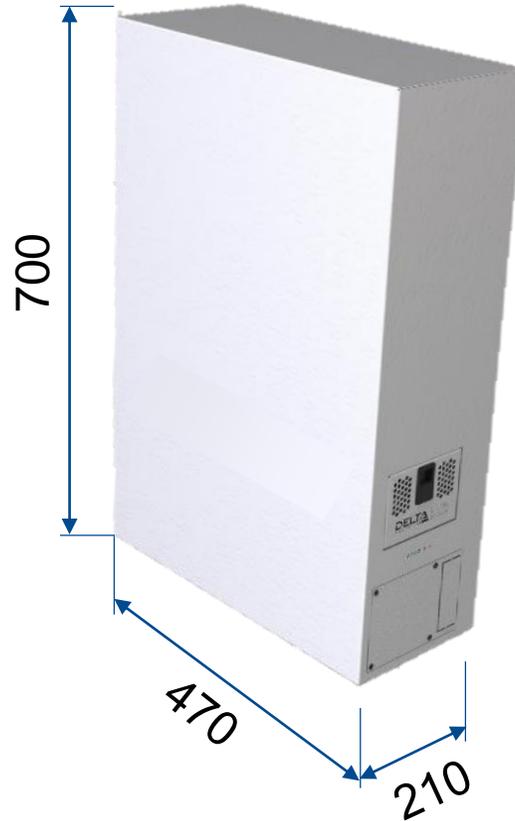


Example:

The rate of electricity consumption per month per person in Moscow* is 80 kWh, or 2.67 kWh per person per day.

Thus, the capacity of POWERWALL 5 kWh should be enough to supply electricity to an apartment with two tenants for an entire day.

*considering the use of a gas stove



Model	DELTA POWERWALL 4.8KWH 48V	DELTA POWERWALL 5.12KWH 52.1V
Battery type	Li-Ion	
Cell type	LiFePO4	
Rated voltage	48,0 B DC	51,2 B DC
Rated capacity	100 Ah	
Stored energy	4,8 kWh	5,12 kWh
Maximum charge voltage	54,4 B DC	58,0 B DC
End of discharge voltage	41,2 B DC	44,0 B DC
Rated charge current	20 A	
Maximum charge current	50 A	
Rated discharge current	50 A	
Max. discharge current	100 A	
Dimensions	700 x 470 x 210 mm	
Weight	65 кг	67 кг
Operating temp.	0 °C~45 °C	w/ relative humidity 60±20 %
Storage temp.	-10 °C~60 °C	w/ relative humidity 60±20 %
Protection class	IP20	
Service life 25 °C	Over 15 years	
Num. of cycles DoD 80 %/25 °C)	> 6000 cycles	



**THANK YOU FOR
YOUR ATTENTION**