

Battery Guide
2021



BOSCH
Invented for life

THE eBIKE RECHARGEABLE BATTERY GUIDE

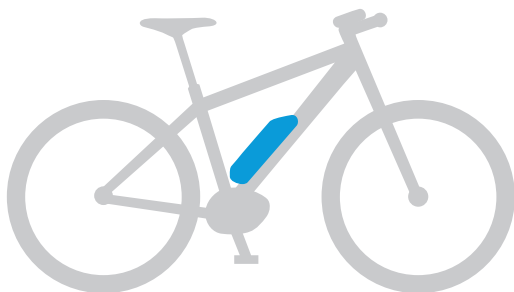
FEEL THE FLOW

Bosch eBike Systems | EN
bosch-ebike.com



Contents

Succinctly stated



PowerPacks and PowerTubes are the energy sources for the Bosch Active Line, Active Line Plus, Cargo Line, Performance Line and Performance Line CX eBike systems. Useful tips on how to determine their range, optimise their efficiency and maximise their service life are provided on the following pages, as well as pointers on safety and handling.

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Bosch batteries and chargers

More energy for travelling

Bosch batteries are an efficient, long-life energy source. They combine impressive mileage, a long service life and low weight (approx. 2.5 to 3.5 kg) with an ergonomic design and convenient handling. The high-quality lithium-ion batteries have a Battery Management System (BMS) that detects significant potential sources of error and effectively protects cells against overload. DualBattery is the perfect solution for touring eBikers, long-distance commuters, eCargo bikers and eMountain bikers. The combination of two Bosch batteries delivers up to 1,250 Wh and can be installed in various battery combinations* from the manufacturer. The system switches intelligently between the two batteries during both charging and discharging.

* DualBattery is not available in combination with PowerPack 300 and PowerTube 400.





Bosch batteries

Powerful in every design



Frame battery

Sporty & dynamic: when used as a frame battery, the PowerPack 300, 400 or 500 sits close to the centre of gravity of your eBike to ensure optimal weight distribution.



PowerPack Frame

- ▶ **PowerPack 300**
- ▶ **PowerPack 400**
- ▶ **PowerPack 500**



Integrated rechargeable battery

Stylishly elegant: there are two versions; horizontal or vertical. Both are installed directly by the manufacturer depending on the eBike's design. Available in 400, 500 or 625 versions.



- ▶ **PowerTube 400**
- ▶ **PowerTube 500**
- ▶ **PowerTube 625**

PowerTube



Rack battery

Comfortably convenient: on step-through models, the rack battery frees up space and allows the rider to mount and dismount safely. Available in three variants: 300, 400 or 500.



PowerPack Rack

- ▶ **PowerPack 300**
- ▶ **PowerPack 400**
- ▶ **PowerPack 500**



DualBattery

Double the power: combining two Bosch eBike rechargeable batteries provides an energy content of up to 1,250 Wh.*



- ▶ **2 x PowerPack**
- ▶ **2 x PowerTube**
- ▶ **PowerPack + PowerTube**

DualBattery

* DualBattery is not available in combination with PowerPack 300 and PowerTube 400.

Bosch chargers

Reliable power sources



Bosch chargers are handy, lightweight and robust. The sealed housing makes them extremely stable. Wherever your journey may take you: with the 2 A Compact Charger, 4 A Standard Charger and 6 A Fast Charger*, Bosch has developed three models that can charge Bosch eBikes quickly and reliably. All Bosch chargers operate silently and can also charge the Bosch PowerTube. They also feature a practical velcro fastener for stowing the cable tidily.





Compact Charger, the faithful companion

The Compact Charger is the ideal charger for all eBikers who are constantly on the move. It weighs less than 600 g and is 40 % smaller than the Standard Charger – small enough to fit into many saddlebags. The Compact Charger can also be used in the USA, Canada and Australia with mains voltages of 100 to 240 V with a corresponding adapter.



Standard Charger, the all-rounder

The robust and functional Standard Charger features a unique balance between performance, size and weight and is suitable for every possible use.



Fast Charger, the fastest option

The Fast Charger is the fastest Bosch eBike charger and will recharge a Bosch eBike battery in the shortest possible time. After just three hours, the powerful PowerPack 500 and PowerTube 500 are fully charged. The Fast Charger needs just over one hour to charge a battery to 50% capacity. This makes it the perfect charger for fast charging while on a trip. The Fast Charger is ideal for eBikes that are regularly in use and frequently charged, in particular for DualBattery with up to 1,250 Wh.

* Charging current is limited to 4 A for the PowerPack 300 and Classic + Line batteries.

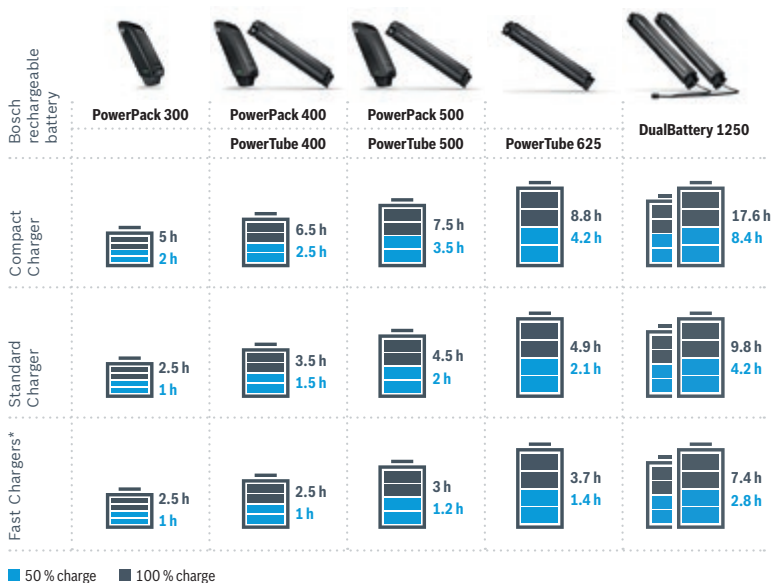
Charging time

As fast as you like



Charging time depends on the battery capacity and the charger type. The following diagrams show how quickly the various batteries can be charged using each specific charger.

A comparison of the charging times of each charger model:



* Charging current is limited to 4 A for the PowerPack 300 and Classic + Line batteries.



Range

What is the range of a single battery charge?

This is a common question for many eBikers. There is no definitive answer. The number and variety of influential factors is simply too great. Sometimes a single battery charge will take you less than 20 kilometres, while at other times it will take you much further than 80 kilometres. However, following a few simple tips can help maximise the range of the battery.










Product line ranges

Extending your range

The range graphs show how far the product lines can get with different batteries under favourable conditions (average value). The range will be reduced in unfavourable conditions.

		 Favourable conditions*	 Difficult conditions*
 Rider	Cadence	50–70 rpm	70–90 rpm
	Total weight (Total weight consisting of rider incl. eBike and luggage)	105 kg 150 kg (Cargo Line)	115 kg 170 kg (Cargo Line)
	Rider type/ rider performance	Average	Average
 eBike	Bosch eBike system	Drive Unit, battery and Intuvia	Drive Unit, battery and Intuvia
	Shifting system	Derailleur system	Derailleur system
	Tyre tread	Trekking tyres	MTB tyres
	Bicycle type	Touring bike	MTB
	Terrain type	Hilly	Low mountain ranges
 Environment	Surface	Mainly dirt tracks and off-road trails	Dirt tracks and off-road trails
	Starting up frequency	Bike ride with occasional standing starts	Bike ride with regular standing starts
	Wind conditions	Slight wind	Moderate wind

Active Line



Active Line Plus



Cargo Line



Cargo Line Speed



Performance Line



Performance Line Speed

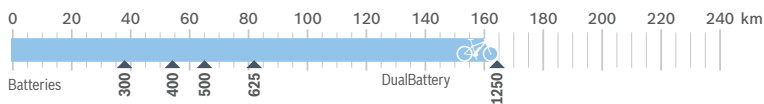
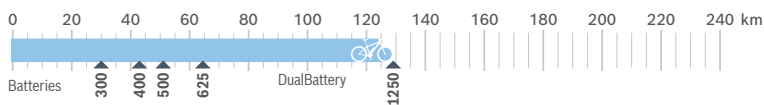
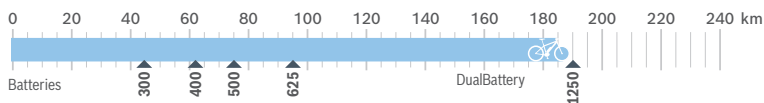
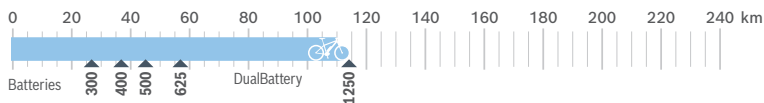
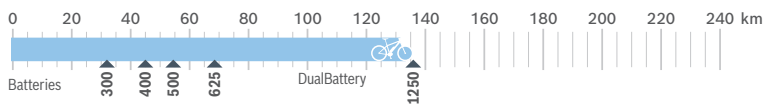
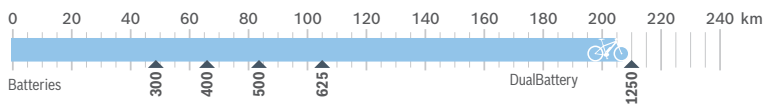
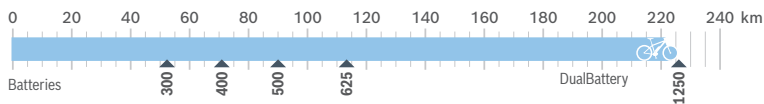


Performance Line CX



* The ranges are typical values of new rechargeable batteries, which may vary if one of the conditions listed above changes.

Range of the various Bosch batteries in mixed mode*



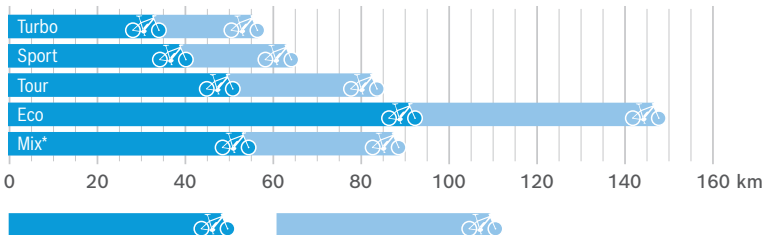
* Average of combined use of all four modes and favourable conditions.

Range and riding modes

How they relate

The range of the Bosch eBike system is largely dependent on the level of support used. A choice of five different riding modes is available. The graphic shows their effect on the range in favourable (light blue) and difficult (dark blue) conditions.

Range based on the example of the Active Line with PowerPack 500 or PowerTube 500 taking account of different riding modes



Difficult conditions**

Favourable conditions**

For a definition of conditions, see p. 14.

* Average of combined use of all four modes and both difficult and favourable conditions.

** The ranges are typical values of new rechargeable batteries, which may vary if one of the conditions listed above changes.



Turbo

Direct, maximum power support up to the highest cadences for sporty riding.



Sport

Powerful support for universal use. For both sporty riding and fast commuting in urban traffic.



eMTB*

Progressive support for a natural riding sensation and optimal control on demanding terrain.



Tour

Uniform support for rides with long ranges.



Eco

Effective support with maximum efficiency for the highest range.



Off

No support (all on-board computer functions can still be accessed).

* Depending on the eBike type, the eMTB mode replaces the Sport mode in the Performance Line and the Performance Line CX.

Easier planning

The Bosch Range Assistant

The range of the Bosch batteries is dependent on various factors. Range is influenced by the rider and the chosen support mode, as well as the drive unit or battery installed in the eBike. Environmental factors such as temperature, wind conditions and riding surface also play a key role in how far you can get on a battery charge. Our **range assistant tool** makes it possible to estimate a typical range under various parameters. The online tool will show important information regarding battery range in a visually appealing way.

Calculate the range yourself:
bosch-ebike.com/range



Tips and tricks for longer riding enjoyment

Cadence – Cadences above 50 revolutions per minute optimise the efficiency of the drive unit. In contrast, very slow pedalling is very costly in terms of energy.

Weight – Mass should be minimised by keeping the total weight of the bicycle and luggage as low as possible.

Starting & braking – As with a car, frequent starting and stopping is less economical than long distances at almost constant speed.

Gear shifting – Correct shifting also makes eBiking more efficient: It is best to start off and tackle inclines in a low gear, then shift to a higher gear in accordance with the terrain and speed. The on-board computer provides shift recommendations*.

Tyre pressure – Rolling resistance can be minimised by correct tyre pressure. Tip: In order to maximise the range, inflate the tyres to the maximum permissible tyre pressure.

Motor performance indicator – Monitor the motor performance of the Intuvia, Kiox and Nyon on-board computer and adapt your riding style accordingly. A longer bar indicates a higher power consumption.

Rechargeable battery & temperature – With decreasing temperature, the performance of a rechargeable battery is temporarily reduced, as the electrical resistance increases. In winter, you can therefore expect a reduction in the normal range.

* Except Purion, SmartphoneHub and COBI.Bike.

Handling, care and service life

Technology can be
this simple

The Bosch batteries are seated securely in their mounts, even when travelling over rough terrain. However, they are easily removed for storage or charging purposes. Simply open the lock and remove the battery from the mount.

With their low weight, handy ergonomics and precise fit between battery and mount, Bosch batteries can be easily and intuitively inserted. The rechargeable battery locks into its mount in a manner that is noticeable and audible, so that it is seated securely in the frame or on the eBike.





Handling

It is so easy to charge PowerPacks and PowerTubes

Charging on the pedelec – PowerPacks and PowerTubes are particularly easy to charge directly on the pedelec. You just need to insert the charging plug on the charger into the charging socket in the battery mount and insert the power plug into the wall outlet. Done.

PowerPacks – All PowerPacks are equipped with an ergonomic handle. It enables the PowerPacks to be conveniently inserted, removed, carried and charged.



PowerTube – A convenient function means that the PowerTube moves approx. 2 cm out of the frame when unlocked, making it easier to handle. In addition, a safety mechanism prevents the battery from falling out. The battery is also protected by the frame.

Removing the battery



Opening the frame cover (if any)



When the battery is unlocked using a key (depending on the manufacturer), it automatically drops into the restraint support



Push the top of the battery to detach it the from the restraint support – the battery then drops into your hand



Removing the battery from the frame

Inserting the battery

The battery is inserted by following steps 1 to 5 in the reverse order. Depending on the manufacturer, the key must be turned (5) to insert the battery. Finally, the battery must be checked for a secure fit.



Care

How to increase the service life of the battery

The Bosch battery is an important eBike component. With the correct handling and care its service life can be lengthened.



Charging – The batteries should be charged at room temperature in a dry location where a smoke detector is installed.

Storage during winter – Store the batteries in a dry location at room temperature. Fully charging or fully discharging results in higher loading of the battery. The ideal charge status for lengthy periods of storage is approx. 30 to 60% or two to three LEDs on the battery indicator.

Cleaning & care – A damp cloth is recommended to clean the battery. The plug poles should be cleaned occasionally and lightly greased. The battery should first be removed before cleaning the eBike. To protect the electronic components, the batteries must never be cleaned with a direct jet of water or high pressure hose.

Winter use – During winter use (particularly below 0° C) we recommend charging and storing the battery at room temperature before inserting the battery in the eBike immediately before riding it. For longer journeys in cold conditions, it is advisable to use thermal protective covers.

Service life

Tips for maximising your charge

The service life of Bosch rechargeable batteries is influenced mainly by the type and duration of use. Like every lithium-ion battery, a Bosch rechargeable battery also ages over time, even if you do not use it. Over time it loses capacity.



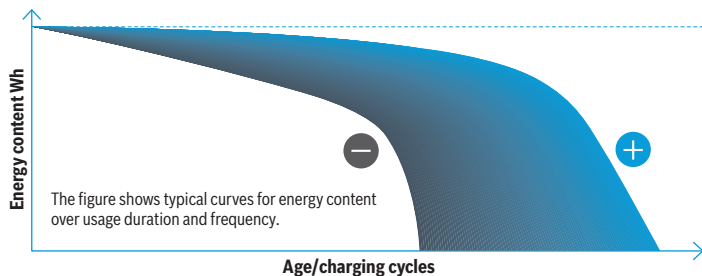
Factors that shorten the service life:

- ▶ Heavy-load use
- ▶ Storage at over 30°C ambient temperature
- ▶ Prolonged storage in a fully charged or fully discharged state
- ▶ Parking the eBike in direct sunlight



Factors that extend the service life:

- ▶ Low-load use
- ▶ Storage at a temperature between 10 and 20°C
- ▶ Storage at approx. 30–60% charge status
- ▶ Parking the eBike in the shade or a cool location



When travelling

Safety while on the go

Lithium-ion batteries store large amounts of energy. That's why some precautions are necessary during transport.





Transport

A safe start to the holidays

By Car

If the eBike is being transported with a bike rack, remove the battery first and place it in a safe location inside the car.

Flights

Air transportation organisation IATA has forbidden the transportation of eBike batteries on passenger planes. We recommend renting a Bosch eBike battery at your destination. You should check in advance whether the airline will transport eBikes without a battery.

By Train

In trains with bicycle compartments, there is usually no issue about carrying pedelecs (up to 25 km/h). You often need to get an extra bike ticket and make a reservation for the eBike. The eBike battery must remain permanently installed during the journey and must not be charged. Before starting your journey, you should contact the respective service provider for precise information on the transport conditions. In some cases, it is not possible to take them on all routes.

On commuter services and long-distance buses

On commuter services, for example on light rail services, it is often permissible to take a bike on board at regional off-peak times, provided you have purchased a bicycle ticket. It is advisable to check with the relevant transport authority before travelling. The policies for transporting pedelecs on long-distance buses varies from company-to-company. In this case you should also enquire in good time before starting your journey.

Safety

Safe handling of batteries

Bosch batteries are lithium-ion cells, which are developed and manufactured to the state-of-the-art. In their charged state, these lithium-ion batteries have a high energy content. The constituents of lithium-ion cells are flammable under certain conditions. The operating manual contains instructions on safe handling.

Double the protection – Each individual cell in a Bosch rechargeable battery is protected by a rugged steel cup and held in a plastic or aluminium housing. The housing must not be opened. Any impacts, dropping and excessive heat must also be avoided at all costs, as they could damage the battery cells and cause flammable contents to leak.

Safe charging – In conjunction with the battery management system integrated in the battery, Bosch chargers protect the battery against overload during charging, damage caused by extreme overcharging and short circuits. Bosch batteries are to be charged exclusively with original Bosch chargers because these are designed exclusively for eBikes with Bosch drives and the

components ensure a perfectly coordinated charging and discharging process. The battery storage recommendations are even more important for charging: batteries must not be charged in the vicinity of heat sources or flammable materials. We recommend storage in uninhabited rooms with smoke detectors that are not designated for use in escape routes. After charging, batteries and chargers should be disconnected from the power supply.

Storage – Excessive heating and direct sunlight must be avoided. Bosch batteries and chargers must not be stored in the vicinity of heat sources or flammable materials. We recommend removing the battery from the eBike for storage pur-



poses and keeping it in rooms fitted with smoke detectors. Dry locations with an ambient temperature of between 10 and 20 °C are the most suitable. Bosch batteries must not be stored below -10 °C or above 60 °C.

Inspection – Using the Bosch DiagnosticTool, the bicycle dealer can check the status of the eBike, especially the battery, and determine the number of completed charging cycles.

Cleaning – To protect the electronic components, the batteries must not be cleaned with a direct jet of water or high pressure.

Disposal – Pedelec batteries are classified as industrial batteries and must not be disposed of as household waste or in the usual battery collection containers. Many specialist bicycle dealers will accept used or defective batteries free of charge and take care of their proper disposal.



Bosch eBike batteries must never be opened – not even if they are being repaired by third parties. Opening the battery always means interfering with the condition approved by Bosch and entails safety-related risks.

Further important information about safety risks and risks from battery repairs can be found on pages 32 and 33.

Benefits

Good reasons for choosing eBike batteries from Bosch

Efficient, durable, state-of-the-art technology – there is a good reason why Bosch eBike batteries are some of the most popular on the market:

No memory effect – The Bosch rechargeable batteries with lithium-ion cells can be briefly charged at any time regardless of their charge state. Interruptions of the charging process do not harm the battery. Complete discharge is not required.

Very low self-discharge rates – Even after prolonged storage, such as during the winter, it is possible to use the rechargeable battery without recharging it. For longer storage, a charge status of approx. 30 to 60 % is recommended.

Long service life – Bosch rechargeable batteries are designed for many rides, miles and years of service. The intelligent, electronic Bosch Battery Management System (BMS) protects against excessive operating temperatures, overload and deep discharge. The BMS checks every cell, extending the life of the rechargeable battery.

Rapid charging – Bosch chargers are available in a range of different sizes and performance levels, and enable rapid charging according to your needs.

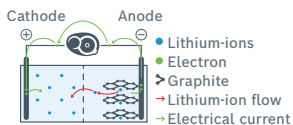
Easy to remove – Bosch batteries can be removed in just a few hand movements. The battery can therefore be charged and stored away from the eBike. This simplifies winter use, for example. As the battery delivers less power at low temperatures, in winter it should be stored at room temperature until shortly before starting the journey.

Extremely efficient – Bosch batteries represent an economic drive solution. It costs no more than 0.15 € to fully charge a large PowerPack 500 (assumption: green electricity rate of 30 cents per kWh).

Competent service – Bosch batteries are well-protected and require hardly any maintenance. However, should help be needed, a competent service team is available to provide assistance.

The eBike battery

How do lithium-ion batteries actually work? Where are they used? How powerful is an eBike battery? Our infographic has all the answers.



How a lithium-ion battery works

While the eBike is **in motion** the electrodes move from the negative anode via the drive unit to the positive cathode. The lithium ions provide balance. The reverse process takes place when the battery is charged.



Service life

In its service life, an eBike battery can take you a distance equivalent to **1½ times around the world**.

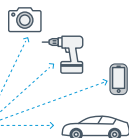
A Bosch eBike battery contains **40 lithium-ion cells (PowerTube 625: 50 cells)** and, depending on its specification, provides between approx. 300 Wh and 625 Wh of energy.



Weight

Bosch batteries are amongst the **lightest eBike batteries on the market** and weigh between **2.5 and 3.5 kg**.

Lithium-ion battery applications



Commuting by eBike

The energy-related costs* per 25km in a car are around **2.75€** and about **0.06€** with an eBike.



The intelligent **Bosch Battery Management System** controls the battery's recharging and discharging functions and protects the cells from overload.

Recycling

Used eBike batteries will be accepted by many dealers free of charge and sent for **recycling**.



Precious raw materials are **re-used**.



That's why it is important to take **used and faulty batteries** back to the dealer.

* Petrol price: ø 1.35 €/l; Green energy: 0.30 €/kWh. Thus, it only costs €0.15 to charge a battery with 500 Wh. Sources: ADAC battery test; Federal Environment Agency; Lithium-ion battery handbook

Questions & Answers

Everything you need to know about batteries

▶ **What should I do if water gets into the battery mount?**

The mount is designed in such a way that water can drain off and the contacts can dry. To ensure that this happens, the mount and plug area should be kept clean. The contacts have a coating that protects the surface against corrosion and wear. Terminal greases or technical Vaseline may also be used if required.

▶ **Can batteries be “reconditioned”?**

Some providers claim they can recondition batteries. Bosch strongly advises against this because the safety and optimum interaction with the Battery Management System cannot be guaranteed in this case. In addition, there is a safety risk and opening or modifying the battery may void any warranty or guarantee claims.

▶ **What happens to defective batteries?**

Heavily damaged batteries should not be touched with bare hands as electrolyte may leak out, causing skin irritation. Damaged batteries are best stored in a safe place outdoors with the connection contacts taped over before being taken to the dealer for disposal.

▶ **What are the important points in winter?**

If the eBike is not used in winter, the battery should be removed and stored as described on page 28/29. The eBike itself can also be stored outside, provided it is protected from snow and rain. The best option, however, is a garage or basement.

▶ **I have found a used battery for the Bosch eBike system online. Can I use it?**

When purchasing used batteries, always make sure that they have not been damaged by their previous owner. Damaged or repaired batteries are offered online from time to time; these pose a high risk and can lead to dangerous malfunctions. Sometimes illegal or stolen goods are available online as well. If applicable, no ownership can be acquired with such goods in a legal manner, in accordance with § 935 BGB [Bürgerliches Gesetzbuch, German civil code].

▶ **Can I use replacement batteries from other manufacturers?**

Original Bosch spare parts are the only way to guarantee your safety. The Bosch eBike system components are perfectly adapted to one another and provide maximum efficiency and safety.

► **Are chargers from other manufacturers safe to use?**

Bosch chargers are adapted specifically to the Bosch eBike System and have the correct software for charging and managing the Bosch battery efficiently. Using a different charger may reduce the service life of the batteries or cause other damage or malfunctions in the eBike system.

► **Can Bosch batteries be opened to replace individual cells?**

Bosch eBike batteries must never be opened – not even if they are being repaired by third parties. Opening the battery always means interfering with the condition approved by Bosch and entails safety-related risks. There is a risk that the Bosch eBike battery, once opened, may catch fire during assembly due to crushed or incorrectly routed cables, detached components or poor quality electrical connections.

After opening, the seal of the housing can no longer be guaranteed, so that the ingress of water or dust can lead to damage to the monitoring electronics (Battery Management System) or to the cells. Here, too, there is a risk that the Bosch eBike battery could catch fire due to a short circuit.

These dangers also exist at a later point in time if an eBike battery, once opened, is used again.

For safety reasons, rechargeable batteries must generally satisfy the requirements of EN50604-1 and UN-T 38.3 if they are to be transported commercially. The test schedule according to UN-T 38.3 entails various safety tests on a prescribed number of rechargeable batteries that push the test specimens to their limits. Tests include, for example, overload tests, impact tests, short circuit tests, vibration and thermal tests, etc.

Even the simple replacement of original battery cells with apparently identical individual cells as part of a repair poses a threat to safety-relevant components. This would necessitate re-testing according to the safety test regime described above, however these tests cannot be carried out on individual repaired batteries.

Test bench measurement R200

Making battery performance comparable



In addition to greater range, safety and comfort, the focus is increasingly on comparability. In order to be able to measure the eBike range in a standardised way, Bosch eBike Systems has joined forces with the Zweirad-Industrie-Verband (ZIV) bicycle industry association and other companies from the bicycle industry to develop a suitable test. For the first time, the “standardised range test R200” will enable manufacturers, dealers and customers to compare the range of different eBikes on an objective basis.

The same conditions for transparent values

Until now, the results of field trials relating to eBike range have depended heavily on the rider and the external conditions such as rider weight, tyres, air pressure, surface, weather, etc. The R200 measurement method enables the performance of eBikes to be compared by using a uniform support factor of 200% (hence the name: R200) is measured. This means that the tested drive system supports an average rider performance of 70 watts with 140 watts. This corresponds to a medium to high support factor.



R200 provides practical comparison

For objective test purposes R200 also sets values for average speed (20 kilometres per hour) and average cadence (60 rpm). Typical exemplary values were also set for other factors, such as weight, terrain type, surface, starting up frequency and wind conditions. The defined parameters represent the mean real riding conditions, making the standard as realistic as possible. The result of the test is a specific indication of how many kilometres an eBike will cover under these standard conditions. Because of the different frame and bike specifications, manufacturers need to test each model individually using the R200 process.

R200 is performed on qualified test benches. The operator simply has to enter the values from the list of requirements. The first manufacturers have already commissioned test institutes Velotech and the ETI at the Karlsruhe Institute of Technology to test the performance of eBikes according to the R200 measurement method.

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