

Battery Guide 2020



BOSCH

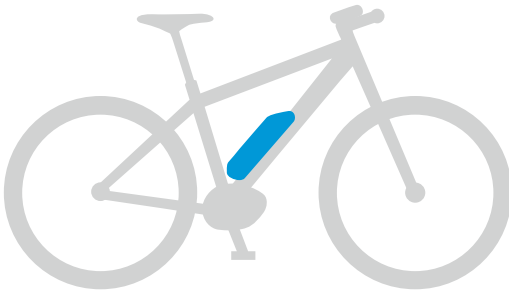
Invented for life

THE eBIKE BATTERY GUIDE

Bosch eBike Systems | EN
bosch-ebike.com



Contents



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 pointers on how to determine their range, optimize their efficiency and maximize their service life are provided on the following pages.

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Bosch batteries and chargers

More energy for traveling

Bosch batteries are an efficient, long-life energy source. They combine impressive mileage, a long service life and low weight approximately 5.5 lbs. (2.4 kg.) to 7.7 lbs. (3.4 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 overheating. DualBattery is the perfect solution for tourers, long-distance commuters, cargo bikers or 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 both during charging and discharging.





Bosch batteries

Powerful in every design



Frame battery

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



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

PowerPack Frame



Integrated rechargeable battery

Stylishly elegant: there are two types of PowerTubes (horizontal or vertical) that are designed into the bike by the manufacturer. This brings more variety to eBike design. Available in 400, 500 or 625 Wh versions.



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

PowerTube



Rack battery

Comfortably convenient: On step-through models, the rack battery frees up space and allows the rider to get on and off safely. Available in two different size variants: 400 or 500 Wh.



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

PowerPack Rack



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

Advertised battery capacity is an approximation. Due to many different factors, the measured capacity of the battery may vary slightly from the advertised battery capacity.

Bosch charger

Reliable power source



Bosch chargers are handy, lightweight and robust. The sealed housing makes them extremely stable. Bosch has developed two models that can charge Bosch equipped eBikes quickly and reliably wherever your journey may take you: 2 A Compact Charger and 4 A Standard Charger. 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 companion

The Compact Charger is the ideal charger for all eBikers who travel a lot. 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 Canada and Australia with mains voltages of 100 to 240 V.



Standard Charger

The all-rounder

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



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Innovation for All

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#streetflow

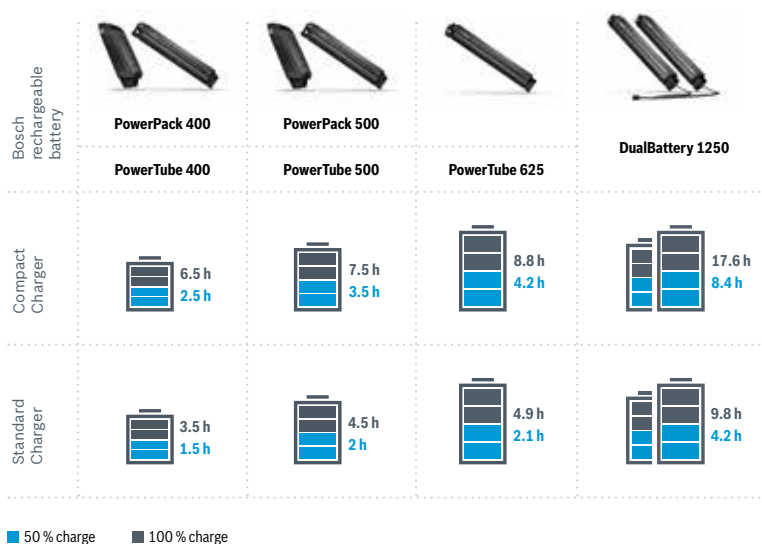
Charging time

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 recharged using each specific charger.

A comparison of the charging times of the charger models:





Range

What is the range of a single battery charge?

This is a common question for many eBikers. There is a vast number of influential factors that have an effect on the range. Sometimes a single battery charge will take you 14 miles (23 km), while at other times it will take you up to 90 miles (145 km). On page 14, we have listed a few simple tips which will help maximize the range of the Bosch battery.





Tips and tricks for longer riding enjoyment

Cadence – Pedaling above 50 revolutions per minute (rpm) optimizes the efficiency of the drive unit. In contrast, very slow pedaling is very costly in terms of energy.

Weight – The mass should be minimized by keeping the total weight of the bicycle and cargo from being unnecessarily high.

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 take inclines in a low gear, then shift to a higher gear in accordance with the terrain and speed. The Intuvia display provides shift recommendations.

Tire pressure – Rolling resistance can be minimized by correct tire pressure. Tip: In order to maximize the range, inflate the tires to the maximum permissible tire pressure.

Motor performance indicator – Monitor the motor performance indicator of the Intuvia and Kiox displays and adapt your riding style accordingly. A long bar means higher power consumption.

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

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 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 go on one battery charge. Our **range assistant** makes it possible to estimate a typical range under various parameters. The online tool will show important information on battery range in a visually appealing way.






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



Product line ranges

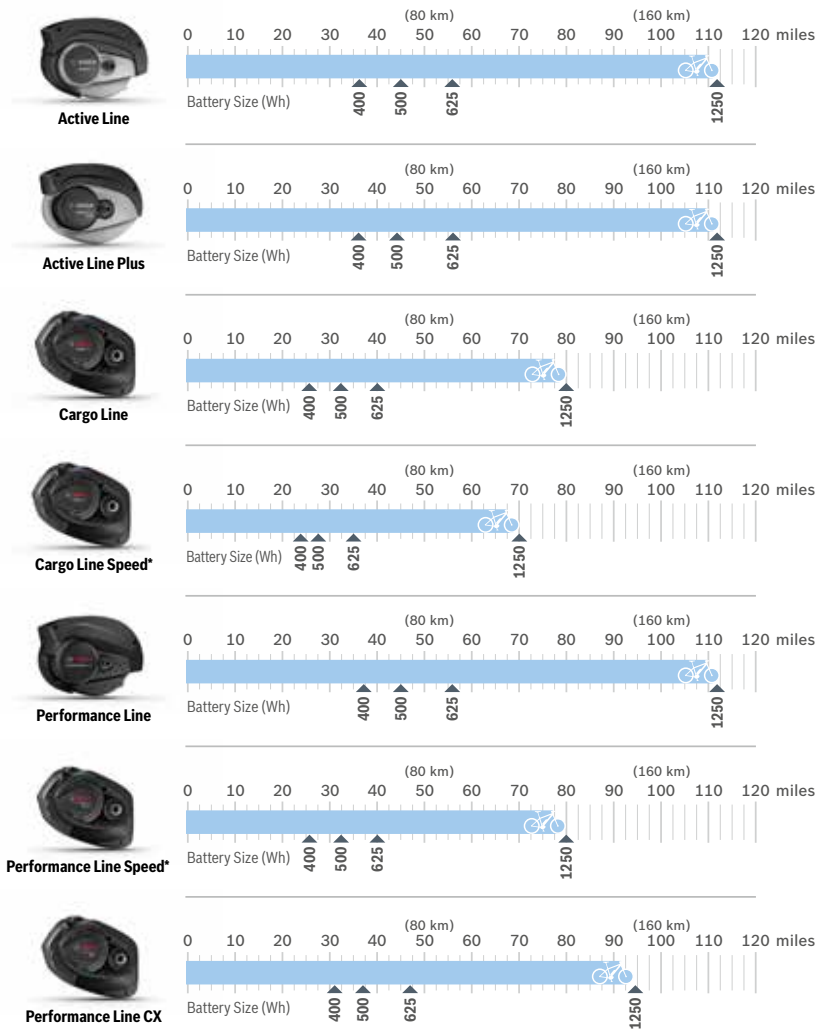
Extending your range

The range graphics on the right show the distances the product lines can support with different batteries in favorable conditions. The range will be lower in difficult conditions.

			
		Favorable conditions*	Difficult conditions*
 Rider	Cadence	50–70 rpm	70–90 rpm
	Total weight (Overall weight consisting of rider incl. eBike and cargo)	232 lbs. (105 kg.) 331 lbs. (150 kg.) for Cargo Line	254 lbs. (115 kg.) 375 lbs. (170 kg.) for Cargo Line
	Rider type/ rider performance	Average	Average
	Bosch eBike system	Drive Unit, battery and Intuvia	Drive Unit, battery and Intuvia
 eBike	Shifting system	Derailleur system	Derailleur system
	Tire tread	Trekking/hybrid tires	MTB tires
	Bicycle type	Touring bike	MTB
 Environment	Terrain type	Hilly	Low mountain ranges
	Surface	Mainly gravel and paved forest paths	Dirt tracks and off-road trails
	Starting frequency	Bike ride with occasional standing starts	Bike ride with regular standing starts
	Wind conditions	Slight wind	Moderate wind

* 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, which is the average of combined use of all four modes in favorable conditions.



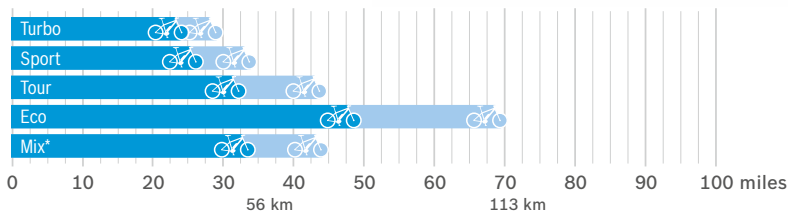
* These drive units are not available in Canada.

Range and riding modes

How they relate

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

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



Difficult conditions**



Favorable conditions**

For a definition of conditions, see p. 16.

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



Turbo

Direct, maximum support power up to highest cadence for sporty riding



Sport/eMTB

Powerful support for universal usage for both sporty riding and fast commuting in urban traffic

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

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



Tour

Uniform support for rides with long ranges



Eco

Effective support with maximum efficiency for the highest range



Off

No motor support, but all display functions can still be accessed

Handling, care and service life

Technology can be this simple

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

With their low weight, handy dimensions 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 eBike – PowerPacks and PowerTubes are particularly easy to charge directly on the eBike. Insert the charging plug into the charging socket in the battery mount and insert the power plug into the wall outlet. The battery may also be charged once removed from the bike, if it is more convenient.

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



PowerTubes – The PowerTubes move approximately 2 cm out of the frame when unlocked, making them easier to handle. In addition, a safety mechanism prevents the batteries from falling out. The batteries are also protected by the frame.

Removing the battery



Open the frame cover (if available).



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 from the restraint support – the battery then drops into your hand.



Remove the battery from the frame.

Inserting the battery

The battery is installed in the reverse order to steps 1 to 5. Depending on the manufacturer, the key may need to be turned to insert the battery (Step #5). Finally, check that the battery is secure in its housing.



Care

How to increase the service life of the battery

The Bosch battery is an important eBike component, and with the correct care you can optimize its life.



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 approximately 30% – 60% or 2 – 3 LEDs on the battery indicator.

Cleaning & care – We recommend using a damp cloth to clean the battery. The terminals should be cleaned occasionally and lightly greased. The battery should be removed before cleaning the eBike. Batteries must not be cleaned with direct water contact in order to protect the electronic components.

Winter use – During winter use, particularly below 32°F (0°C), we recommend charging and storing the battery at room temperature rather than inserting the battery in the eBike immediately before riding it. For longer journeys in the cold, it is advisable to use thermal protective covers.

Service life

Tips for maximizing your charge

The service life of Bosch rechargeable batteries is influenced primarily by the type and duration of use. Like any lithium-ion battery, a Bosch rechargeable battery also ages over time, even when not in use.



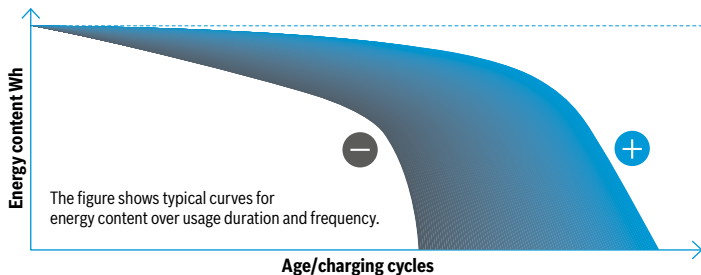
Factors that shorten the service life:

- ▶ Excessive use
- ▶ Storage at temperature over 86°F (30°C)
- ▶ Prolonged storage below 32°F (0°C) in a fully charged or fully discharged state
- ▶ Parking the eBike in direct sunlight



Factors that extend the service life:

- ▶ Low-moderate use
- ▶ Storage at a temperature between 32°F (0°C) and 68°F (20°C)
- ▶ Storage at approximately 30–60% charge status
- ▶ Parking the eBike in the shade or a cool location



Transport

Traveling safely with your eBike

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





A safe journey to your vacation destination

By car

The battery must be removed first and stored safely inside the car if the eBike is transported with a bicycle rack.

By plane

The air transportation organization IATA has forbidden the transportation of eBike batteries on passenger planes. We recommend renting a Bosch eBike battery upon arrival at your destination.

By train

In trains with a bike compartment, most eBikes may be transported without any hassle. All you need is a bike ticket. If you are not seated near the eBike during the journey, you should keep the display and battery safely with you at your seat.

By public transport and long-distance bus

Arrangements for the transport of eBikes vary depending on the transport provider. You should make inquiries ahead of time before starting your journey.

Safety

Safe handling of batteries

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

Double 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. Mechanical stress and excessive heat must also be avoided as they could damage the battery cells and cause flammable contents to leak out.

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 chargers are designed exclusively for eBikes with Bosch drives systems. The Bosch battery 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 charging batteries in uninhabited rooms. Fully charged batteries 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 disconnecting the battery from the eBike for storage purposes and storing it in rooms with smoke detectors. Dry areas with an ambient temperature of roughly 68°F (20°C) are the most suitable. Bosch batteries must not be stored below 14°F (-10°C) or above 140°F (60°C).



Inspection – The bicycle dealer can easily inspect the Bosch battery by using a Bosch DiagnosticTool which can determine the number of completed battery cycles.

Cleaning – In order to protect the electronic components, do not clean the batteries with direct water contact. A damp cloth is more suitable for this task.

Disposal – eBike rechargeable batteries are considered as industrial batteries and should not be disposed of as household waste or in the usual battery collection containers. Selected bicycle dealers will take used or defective batteries back for free and ensure 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 that has been approved by Bosch and thus introduces safety-related risks. For other important information relating to the safety risks and dangers associated with battery repairs, see pages 32 and 33.

Benefits

Good reasons for choosing eBike batteries by Bosch

Efficient, durable, state-of-the-art technology – there are good reasons why Bosch eBike batteries are some of the most popular on the market. Here are the most important:

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 approximately 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, overcharging 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 with just a few hand movements. The battery can therefore be charged and stored away from the eBike. This is important especially during the cold winter months when the battery delivers less power at low temperatures. Be sure to store the battery at room temperature until just before use.

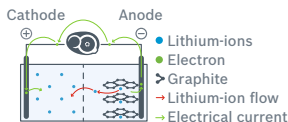
Extremely efficient – Bosch batteries represent an economic drive solution. It costs no more than 17 cents to fully charge a large PowerPack 500 (assumption: green electricity rate of 33 cents per kW/h).

UL Classified – Bosch rechargeable batteries feature the “UL Classified” quality mark from the prestigious Underwriters Laboratory for peace of mind.



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

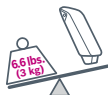
While the eBike is **in motion** the electrodes move from the negative anode via the drive unit to the positive cathode. The lithium ions provide balance. The reverse process takes place when the battery is charged.



Service life

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

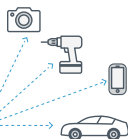
A Bosch eBike battery contains **40 lithium-ion cells (PowerTube 625: 50 cells)** and depending on its specification, provides between approximately 400 Wh and 625 Wh of energy.



Weight

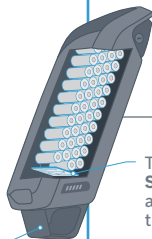
Bosch batteries are amongst the **lightest eBike batteries on the market** and weigh around **5.5 lbs. (2.5 kg.)**

Lithium-ion battery applications



Commuting by eBike

The purely energy-related costs* for **15 mi. (24 km)** in a car are around **\$1.47** and about **.07¢** with an eBike.



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

Recycling

eBike batteries will be taken back by the 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.

*Gas price: \$2.82 per gallon; Green energy: .33¢ per kWh. Therefore, it only costs .17¢ to charge a 500 Wh battery.
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 are supplied with a coating which protects the surface against corrosion and wear. Electrical contact grease 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 invalidate warranty 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 some important recommendations during the winter months?**

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, if 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. This can pose a high risk and can lead to dangerous malfunctions.

▶ **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 risks a shorter battery life and could cause the eBike system to malfunction.

► **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 that was approved by Bosch and introduces safety-related risks. There is a risk that the Bosch eBike battery, once opened, may catch fire during assembly due to e.g. crushed or incorrectly routed cables, detached components or damaged electrical connections due to a short circuit.

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.

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, overcharging 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 require re-testing according to the safety test procedure described above. However, these tests cannot be performed on individual repaired batteries.

Benchmark measurement R200

Comparable battery performance



In addition to greater range, safety and comfort, comparability is also gaining importance. In order to be able to measure the range capabilities of eBikes in a standardized way, Bosch eBike Systems has collaborated with the German bicycle industry association (ZIV) and other companies in the bicycle industry to develop a suitable test. For the first time, manufacturers, dealers and customers can objectively compare the range of different eBikes with the “standardized range test R200.”

Same conditions for unique values

In field tests regarding the eBike range, the results depend heavily on the rider and the external conditions, such as total weight, tires, air pressure, surface, weather, etc. The R200 measurement method compares the performance of eBikes by measuring at a uniform support factor of 200% (hence: R200).

This means that the tested drive system provides support of 140 watts with an average rider performance of 70 watts. This corresponds to a medium-to-high support factor.



R200 provides practical comparability

For an objective comparison, R200 also sets values for speeds up to 20 mph. (32 km/h) and cadence (60 revolutions per minute). For other factors such as weight, terrain, surface, starting frequency and wind conditions, typical example values were set. The defined parameters represent the mean values for real riding conditions. At the end of the test we have a concrete indication of how many miles (km) an eBike will travel under these standard conditions. Due to different frame and bike specifications, manufacturers need to test each model individually using the R200 method.

R200 is carried out in qualified laboratories – the operator simply needs to enter the values of the catalog requirements. The first manufacturers have already commissioned 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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