solarbike

battery charging instructions and information

The battery that comes with your electric bicycle conversion kit uses very advanced lithium ion chemistry.

The most suited lithium ion battery chemistry for electric bicycles is widely considered to be lithium iron phosphate ($LiFePO_4$ or LFP).

This is due to their safety and a greatly enhanced lifetime (conservatively estimated to be approximately 1000 cycles vs 500 cycles for the next best – $LiMnPO_4$). However, to get these benefits you must treat your battery appropriately.

LFP batteries have a down side in that they do **not like to be drained of all power**, doing this will greatly diminish the lifetime of your battery.

Aim to never deplete your battery completely and aim to keep it as charged as possible at all times.

Do:

- **Fully charge** your battery after **every ride.**

  Your battery should be fully charged within a few hours and will turn the charger off to prevent overcharge and damage of the battery.

- **Always turn off the switch** on the battery when the bicycle is not being used or is recharging.

  Not turning the switch off will mean that there is still a small amount of current running through the controller and this will drain your battery.

Don't:

- **Leave** the switch **on for days** without use as it may drain the battery completely.

  If you are not using your electric bicycle for a while then the battery will still hold good charge as long as the **switch is turned off**.

NOTE: You should still aim to recharge your battery **every two months** if you are not using your bicycle.

While charging:

- When charging the battery you need to make sure that the **orange light** on the charger **comes on and stays on**.

  When the battery is charging you will also hear a small fan running.

The charger gets "confused" if you connect the battery and charger **whilst power is on**.

Connecting the charger:

- Connect battery and charger
- Plug charger into power-point
- Turn on the power-point switch and the charger switch.

When battery is fully charged the orange light will turn green.

NOTE: The maximum recharge time should be approximately 5 hours from dead flat but it will very rarely take this long.

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Lights:

The green light can mean one of **two things**;

- the battery is **fully charged**
- or, the battery is **not being charged**

  so it is important to check that the orange light comes on initially during the charging period (or your batter has not been charged.

  If the orange light did not come on then turn **all switches off**, reconnect everything and turn on.

- If you cannot get the orange light to come on then check the fuse (5 amp) in the charger, and any loose wires.

Battery management system (BMS):

Your electric bicycle battery has a small piece of circuitry inside it called a battery management system (BMS). This serves to balance the charge between the cells (12 cells all up in a 36V battery) and prevent the battery from excessive discharge.

If you push your bicycle to its range limit then the battery will suddenly cut out. You will not likely feel any change in power throughout your ride. If you do not use the throttle for about a minute then the charge will have balanced somewhat between your cells and you will be able to push the bicycle for about another couple of kilometers, you may even be able to do this a few times.

However, please don't. The first time your battery cuts out you should get off your bike, turn off the switch and ride home using all of those muscles you've developed from lots of electrical bicycle riding.

By completely draining the battery you will damage it and your range will suffer in future.

The following is a table of the theoretical estimated range of a 36V 10 ah lithium ion battery with the different motor choices. These estimates are under constant full power and do not take human power into consideration. Estimated distance could nearly be doubled with moderate rider input. Differences in bicycle type, rider size and power will also cause these values to vary somewhat but this should provide a useful guide as to what the electrical system can provide.

Theoretical estimated range of a 36V 10 ah lithium ion battery

Motor SIZE(36V)	**Current** DRAW	**Battery (36V 10ah)** TIME TILL FLAT	**Average** SPEED	**Estimated** DISTANCE
200 watt	5.5 amps	1.8 hour	25km/h	45 km
350 watt	9.7 amps	62 min	30km/h	32 km
500 watt	13.9 amps	43 min	35km/h	25 km

We don't have battery gauges (yet) because of trying to maintain system simplicity. Also, we haven't found good ones and they don't really tell you anything you don't know.

Adding a gauge usually comes with lights and dials and draws power from the battery so will reduce your range. They also require an additional connection to the controller and a cable extending from the gauge to the controller (inside the battery bag).

The gauges we've tried have only really given a rough estimate of full, half-charged or empty. You should really know this anyway, if it's been fully charged then it's full, if you've ridden it for a little over 20-30 minutes then it's about half-full and if it's stopped working then it's empty. If you really want to know how far you can ride it then the best way is to get a speedometer/odometer from a bike shop for around $40 and then ride it till flat and measure the distance.

All lights, gauges and accessories are not beneficial additions to an electric conversion kit in our opinion and should be independent systems if used.

The main battery chemistries for electric bicycles are lead acid, nickel metal hydride, and the lithium ion series. Lead acid batteries are very heavy, have a limited life cycle (approximately 200 – 300) and are environmentally toxic.

Nickel metal hydride batteries are a step up in terms of life cycles but are still quite heavy and toxic.

The best are lithium ion batteries but there are a confusing amount of lithium ion batteries based on the metal bonded to lithium in the cells. Chemistry for lithium ion batteries that has been used extensively for electrical bicycles include lithium iron phosphate (LFP), lithium cobalt oxide (LCO), lithium manganese oxide (LMO) and lithium nickel oxide (LNO).

The bonds in LFP batteries are stronger than in the other lithium ion batteries so they are more stable at high temperatures. LCO and LNO batteries breaks down at high temperatures so decay is quicker and they are potentially dangerous. LMO batteries are very widely used and tested and are also a good option as they are safer than LNO and LCO batteries and not as bad for the environment but they too suffer at high running temperatures. In terms of weight, then LFP is slightly the heaviest, LMO, LCO and then LNO the lightest. The weight is quite similar in all of them though. LMO are usually a good cost effective solution because they are produced on mass at lower cost. They suffer from heat though so must be kept and operated at below about 50°C.

In conclusion, the far superior life-cycle makes LFP the choice battery of use. They are the safest environmentally speaking and can be operated at higher temperatures than all of the other batteries - up to 70°C. In the long run LFP also works out to be the most economically sensible option of all battery types.