

LiPo Battery Basics 2

CHARGING:

Most multi-cell LiPo batteries feature two power connectors. The primary connector provides the full series voltage of the battery to whatever device it is intended to run. You will also find a balance plug which enables you to tap into individual cells within the battery. The voltages of the cells in a battery pack may not stay in synch as they are cycled. The balance plug allows the charger to ensure that each cell within the pack is charged to the 4.2 volt maximum and no more. Most other battery chemistries don't require this level of precision when charging. It matters with LiPos, so don't overlook it. To manage charging risk, I have a smoke detector just above my charging area.

The C unit is used for maximum charge rate as well as maximum discharge rate - for instance, a 500mAh battery rated for 20C discharge and 1C charge, can be charged at a maximum of 10A; trying to charge it at a higher rate might damage the battery.

Several chargers offer a charge cutoff labeled "Long Life" or something similar and they stop the charge at 4.1 volts per cell. Using the 4.1 volts keeps you off the top end and setting an ESC low-voltage cutoff above the traditional 3 volts per cell will keep you off the bottom end. Unless you're a competitor trying to squeeze every last bit out of your flight, this will serve you well and save you money.

Chargers

It should come as no surprise that if you are going to use LiPo batteries to power your electric aircraft, then a charger designed to charge LiPo batteries is required.

When it comes time to purchase your first charger, or possibly a replacement charger, there are many things to consider such as input power, output power (in watts), capability to charge single or multiple battery packs at the same time, number of cells supported, balancing, and computer connectivity (for tracking and updates).

Selecting a charger with an LCD screen is also a good idea so that you can easily and accurately change charging parameters and monitor the charge cycle and the voltage of individual cells.

Chargers are typically rated in watts. Watts are calculated by multiplying the voltage and the amps. A fully charged 2,200 mAh 3S LiPo battery would have a voltage of 12.6. Charging at 1C, it would draw roughly 28 watts of power (12.6 volts x 2.2 amps = 27.72 watts). As you might expect, charging at a higher C rating will increase the required wattage needed from the charger.

Balancing

Balance charging LiPo batteries is essential to getting the most from your batteries by ensuring that the voltage of each individual cell in a pack is equal. Balancing helps prevent single cells from being overcharged or discharged, which can damage the cell and has the potential to cause a fire.

The balancing process will typically discharge the higher-voltage cells to match the lower-voltage cells during the charging process. LiPo batteries composed of two cells or more use balancing connectors. Some chargers include one or more balancing boards and some have all four on one board. If your charger doesn't have the balancing connector to match your batteries, you can probably purchase one.

Connectors

Beyond the balancing connector, most batteries have a primary connection used to connect the battery to your aircraft and to the charger. This consists of a positive and negative wire with a connector that is usually preinstalled on the battery when purchased.

Some batteries come without a connector, allowing the end user to choose the connector.

Bullet connectors with one positive and one negative lead are used to connect the charge lead to the charger. On the other end could be a pair of bare wires (requiring that a connector be installed), a preinstalled connector, or multiple connectors.

Here is a suggested procedure for charging your battery for the first time:

1. Make a visual inspection of the pack. Check for any damaged leads, connectors, broken or cracked shrink covering, puffiness, or other irregularities.
2. Before installing or changing the connector, check the pack's voltage using a digital voltmeter (not your charger). All new packs ship at approximately 3.8 volts to 3.9 volts per cell. For example: A 2S pack should read approximately 7.60 volts to 7.8 volts; a 3S pack should read approximately 11.40 volts to 11.7 volts.
3. If you find any damage to the pack or leads, or the voltage is significantly less for your pack than specified, do not attempt to charge or use the battery.

Storage Charge

If storing a LiPo battery longer than one week, batteries should be stored at 3.8 to 3.9 volts per cell (approximately 50% charged). Storing a LiPo battery fully charged can affect its capacity loss over time. A LiPo battery charged to 4.2 volts per cell and then left on the shelf at room temperature will lose roughly 20% of its capacity in two or three years. Store the same battery at the optimum storage voltage and put it in the refrigerator and it will take approximately 10 years to lose 20% of its capacity.

Charge Rate

To get the most from your batteries, manufacturers recommend charging at 1C, even if the battery states it can be charged at 3C or even 5C. Charging at a higher rate throughout the life of a battery will affect the number of cycles you are able to get from the battery.

Think of your charge rate as similar to shipping a package. To get your package faster than standard shipping has a cost associated with it - namely money. The same goes for your batteries. Charging them at higher than 1C will allow the charge process to complete faster; however, it is at the cost of reducing the number of cycles that the battery will provide throughout its serviceable life.

Safely Charging Batteries

The two most common instances of having a LiPo battery vent or catch fire is arguably during the charging process or resulting from a crash. In the case of charging the battery, you can further protect yourself by never charging batteries unattended, charging batteries in an isolated area away from flammable materials, and using some type of device or container that will encompass the flames if a battery were to vent.

Commercially available products include the LiPo Sack, LiPo Bunker, an ammunition can, or concrete blocks. Any device that you use should contain the flames while allowing the gases to vent. In the case of the ammunition can, you can drill small holes in the top to allow venting. If the LiPo is unable to vent, it could cause an explosion.

It is important to have a nearby smoke detector, sand, and fire extinguisher. The detector will alert you if a pack begins to vent. The sand should be used to extinguish a LiPo fire and the extinguisher is to put out any other material that might ignite because of the fire. Household fire extinguishers are not rated for use on a LiPo fire. Class D fire extinguishers can be used for a LiPo battery fire, but they are costly.