



How To Prolong The Life of Your LiPo Batteries

I'm very enthusiastic about electric flight and I don't want people put off by their expensive LiPo cells only lasting a short number of cycles. I would like people to enjoy electric flight and continue to enjoy electric flight and here are my recommendations on how to get the most from your LiPo (Lithium Polymer) batteries.

Lithium Polymer cells are often referred to as LiPo's or Li-Poly's and are a great advancement to increasing the performance and duration of electric flight. If used incorrectly LiPo cells will only give a short number of cycles and in the worst cases can result in a fire.

Good quality cells like ours, although cost more initially will easily out perform (hold a higher voltage under load) and outlast the cheaper cells and therefore cost you less in the long term. Good quality cells are also safer in operation than the cheaper far east cells. As with all things in life, you get what you pay for.

Recommendations to get the most out of your LiPo cells.

- Purchase good quality battery packs. Cheap far east cells are a bad investment with regards to life, performance and safety.
- Purchase a good quality charger designed specifically for charging Lithium Polymer cells. Make sure the charger has a display that will show the amount of energy that is put back into your packs in terms of "mAh" and one that shows the voltage of the individual cells being charged. This is essential to monitoring and therefore adapting your use and charging of your batteries.
- Purchase a digital voltmeter. These can be bought from eBay for as little as £6.99 and is an essential tool for checking your battery packs.
- Purchase a watt meter. Again this is an essential tool to measure currents, voltages and watts.
- Where ever possible always use a cell balancer when charging. A cell balancer will keep the cells within a pack at the same voltage. This greatly helps the pack maintain its peak performance and prolong its life. A cell balancer will also give you the 1st indication that a single cell within a pack is failing. If one of the LED's on the balancer remains constantly on during the charge cycle this is an indication that one of the cells is failing. A failing cell can cause the other cells in the pack to become over charged, which can result in a fire.
- Aim to draw less than 60% of the maximum continuous rated current of your LiPo's. If you draw less than 60%, your cells will last even longer.
- Avoid discharging more than 80% of the cells capacity. If you consistently put less than 80% back you will increase the life of your cells. Start with short flights and time them. Make a note of how many "mAh" you put back and divide the number of "mAh" by the minutes to get an approximate "mAh" per minute figure. Use this mAh/minute figure to calculate the number of minutes you can fly without going over the 80% figure.
- Do not fly until the ESC cuts power to your motor as this will seriously shorten the life of your LiPo's.
- Charge at 80% of the capacity of the LiPo. e.g. a 1000mAh pack should be charged at 800mAh (0.8Ah) or less. (1000mAh x 0.8 = 800mAh)
- Do not fully charge your packs. Charge them to 4.15V per cell instead of 4.20V per cell. Some new chargers have a "quick" setting. This setting will also reduce the time it takes to re-charge your batteries
- Do not charge your packs below 10°C/50°F and definitely not below 0°C/32°F.
- Do not charge hot cells. Warm cells are OK, cool cells are best. Let hot cells cool before charging.
- Lithium Polymer cells do not have a "memory" unlike Ni-Cad's and therefore they **SHOULD NOT** be cycled. Cycling will bring the voltage down to 3.00V per cell which will shorten the life of your battery.
- **DO NOT "top up"** your cells before flight. Measure the voltage. If it is above 4.1V per cell then just fly as you would normally and then charge. LiPo's lose less than 1% of their capacity per month in storage. Apart from being unnecessary there is a chance of overcharging your cells which will damage them & possibly cause a fire.
- If you plan to store your LiPo cells for an extended period (over 1 month), discharge them as you would normally. Then charge them to only 3.80V/3.85V per cell.
- If you discharge your LiPo's down to 3.30V per cell or less (no Load) you will damage them and shorten their life.
- If you deeply discharge LiPo's below 2.50V per cell you will severely damage them and therefore severely shorten their life and may even destroy them



First Use

Some manufactures recommend that you 'break in' your LiPo cells by using them 'gently' for short periods and allowing them to cool for 15 minutes between uses.

For example, if you expect to get 15 minutes flight as your standard flight time, (not exceeding your 80% of total capacity of course) then have 3 short flights of 5 minutes with 15 minutes between flights. Have gentle flights and avoid full throttle. It is recommended to do this for 5 or 6 charge cycles.

Example 1

3S 2,200mAh. Max continuous rating = 20C and a peak of 30C.

Charge as a 3S pack (11.1V nominal) and at 1,760mA (1.75A) or less. ($2,200\text{mAh} \times 0.8 = 1,760\text{mA}$).
Stop charging when the voltage reaches 12.45V ($3 \times 4.15\text{V}$)

Maximum discharge current is 20C. C is the cells capacity therefore
 $20\text{C} = 20 \times 2,200 = 44,000\text{mA}$ which is also equal to 44 Amps

In this example you should try to achieve the following:-

Keep your current draw below 26.4 Amps.

$20 \times 2,200\text{mA} = 44,000\text{mA}$ $44,000\text{mA} \times 0.60 = 26,400\text{mA} = 26.4\text{A}$

Adjust your flight time to put no more then 1,760mAh back into your pack ($2,200\text{mAh} \times 0.8 = 1,760\text{mAh}$).

Example 2

3S 3,600mAh. Max continuous rating = 30C and a peak of 60C.

Charge as a 3S pack (11.1V nominal) and at 2,880mA (2.88A) or less ($3,600\text{mAh} \times 0.8 = 2,880\text{mA}$).
Stop charging when the voltage reaches 12.45V ($3 \times 4.15\text{V}$)

Maximum discharge current is 30C. C is the cells capacity therefore
 $30\text{C} = 30 \times 3,600 = 108,000\text{mA}$ which is also equal to 108.00 Amps

In this example you should try to achieve the following:-

Keep your current draw below 64.8 Amps.

$30 \times 3,600\text{mA} = 108,000\text{mA}$ $108,000\text{mA} \times 0.60 = 64,800\text{mA} = 64.8\text{A}$

Adjust your flight time to put no more then 2,880mAh back into your pack ($3,600\text{mAh} \times 0.8 = 2,880\text{mAh}$).

In conclusion

If you draw the absolute maximum current from your cells and fly until your ESC cuts power to your motor and you charge your cells to 4.20V per cell at 1C then you may get as few as 20-50 cycles from your cells.

If on the other hand you do not stress your cells, i.e. break them in gently, take 60% or less of the maximum continuous rated current, always use less then 80% of the pack's capacity, charge at 0.8C and only charge your cells to 4.15V per cell, then you should get up to and maybe more then 200 cycles from your expensive, high power/performance, low weight LiPo packs.

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