HOME

LIPO PACKS

HELICOPTER & UAVS

BATTERY PACKS

CONNECTORS

CUSTOM PACKS

SHRINK

LOOSE CELLS

WIRE

ACCESSORIES

SAFETY INFORMATION AND HANDLING PRECAUTIONS

Introduction

Modern Lithium Polymer batteries (LiPo, Li-Poly) are a preferred source of power for flying models because of their ability to store and deliver large amounts of energy from lightweight packs. Performance wise, these new batteries have much more in common with model aircraft fuel than with any previous battery technology and they deserve similar respect. **For safe handling, it is useful to Think of Lithium Polymer Batteries as Fuel**.

Treated with respect in knowledgeable hands, Lithium batteries have been proven worldwide to be a controllable, practical and enjoyable power source for model aviation.

What Can Go Wrong

Fire can be caused by: 'Overcharging' (wrong charger or charger setting, unbalanced battery load, charger fouled by poor power supply), charging a damaged cell, or pack and short circuit (including crash damage).

Cells or packs can be damaged by: 'Over-discharging' (running 'too flat' and/or too hot, discharging an unbalanced battery load), short circuit, and crash damage.

The definitions of 'overcharging' and 'too flat' are detailed in the dos and don'ts section.

With the exception of a very small number of fires that have resulted directly from crash damage at the flying field, fires have almost always occurred during charging. These fires have been almost exclusively permitted by avoidable human error. Therefore the main purpose of this information is:

- To provide information that can help you actively avoid a dangerous charging situation.
- To provide some standard precautions to limit loss or injury in case a fire results anyway.

Lithium Polymer Jargon

- 3s1p – means a battery pack containing 3 cells in series, 1 cell in parallel. 5s2p means a battery pack containing 5 cells in series, 2 cells in parallel, and so on.
- Cells in series "s" add to the Voltage (V). For every "s" add 3.7 Volts (nominal). Parallel cells "p" add to the capacity of the battery in mAh. A "2p" pack made from 2500 mAh cells will become a 5000mAh pack, "3p" 7500mAh, and so on. The choice of single or multiple "p" packs is a feature of LiPo (for NiCd and NiMH packs the term "p" is redundant as these packs are invariably "1p").
- For LiPo packs made with identical kinds of cells, a 3s2p pack can deliver twice the current for roughly the same duration as a 3s1p pack, or the same current for roughly twice the length of time.
- In our 3s1p/3s2p example, note that the 3s2p will be about twice the weight and size. For maximum power-t-weight performance in a model, we would generally choose the 3s2p only when the required current approaches or exceeds the

discharge "C" rating of the 3s1p.

- "C" is a 1000:1 ratio of the capacity of a cell or pack in mAh to a given current in Amps. It is normally used to define maximum current-handling capabilities for charging (e.g., 1C or 2C) and discharging. A large "C rating" for discharge permits high currents from smaller packs. For instance, a 20C continuous rated 5000mAh pack is able to deliver 100 Amps continuously. In this instance, 20C constant should be seen as the maximum "full Throttle" That can be applied ongoing before damage to the pack will be inevitable. Like running a sports car at full throttle all the time, habitually running a Lipo pack at its maximum C rating is not good practice.
- 3.7v is the nominal voltage for LiPo Chemistry. The actual voltage per series cell will increase when fully charged to about 4.2V and decrease to 3.1V at full permitted discharge.
- 4.25v is a maximum - charging at higher voltage is dangerous. 3.1V is a minimum - continuing to draw operating current (Amps) when the cell has reached 3.1V will cause rapid overheating and damage.
- For charging set-up, we are principally concerned with the number of cells in SERIES. A 3s2p pack MUST be charged as a "3-cell" Lithium Polymer (LiPo) pack, sometimes shown as a 11.1V pack (=3 x 3.7V). We should normally limit the current during charging to a maximum of 1C. For instance, 5 Amps for a 5000mAh pack. An appropriate LiPo charger will normally prevent overcharging if this data is entered correctly.
- The new 20C chemistry can be charged at 2C and above for the first 90% of its capacity, given proper supervision and/or appropriate LiPo fast charger. For most LiPo chargers on the market, setting the charger to a 1C charge rate should be regarded as good practice.

To Actively Prevent a Fire:

Lithium Polymer Dos

DO -

- Always use a correctly specified Lithium Polymer charger (mandatory).
- Always double-check that your multi-function charger is set in LiPo mode (extremely important).
- Ensure that your charger has a clean power supply such as a car battery that is not itself on charge.
- Always set the charger to the total series cell count "s" of your pack (or packs if charging in series).
- Read the battery label to confirm the cell count for charging shown e.g., "charge as 3 cell".
- Handle and transport carefully to avoid piercing, deformation, or short circuit with other objects.
- Disconnect batteries fully from ESCs with BEC to prevent slow over-discharge.
- Ensure connectors are insulated correctly to prevent short circuit in handling or storage.
- Always check that batteries are physically and electrically undamaged before charge or discharge.

Lithium Polymer Don'ts

DO NOT -

- Ever allow charging to continue above 4.25V per "s" series cell (definition of overcharging).
- Confuse the total number of actual cells in a pack (e.g., 6 for 3s2p) with the series cell count (3 for 3s2p).
- Set the charge current limit above 1C unless you have special equipment available and supervise the process fully. 1C = 3.2 Amps for a 3200Ah pack, 0.83Amps for an 830mAh pack, and so on. Chose an available charger setting at or below the 1C value for your pack.
- Charge dissimilar or un-matched packs in series or with any difference in cell type,

cell capacity, pack capacity, or charge state (+ / - 0.03V per cell). If in any doubt, charge separately.
- Permit your pack to be discharged below 3.1V per cell (hint, use monitoring and timing or a Lithium safe ESC, land immediately in case of noticeable power drop, over-discharge=overheating/damage).
- Expose batteries to intense heat or prolonged exposure to elevated temperature.
- Charge any pack containing one or more damaged or swollen cell.
- Continue charging if any part of the pack is getting warm (Lipo packs should charge cool).
- Charge any pack that is undervoltage after recovery (under 3.1V per series cell).
- Charge batteries unattended, always remain alert and monitor the charging process.

Limit the Consequences of a Potential Fire Hazard

Charge in an isolated area away from flammables and valuables and avoid charging batteries in the model. If you decide to charge in the vicinity of other property, equip your charging location with a dry extinguisher or fire blanket. Never charge in a moving vehicle where the dangers of fire and smoke can be compounded by the risk of a road accident. If the battery is crashed in a model, or gets warm during charging, place the battery in an open space for observation. Never place the battery directly into a vehicle, clubhouse, garage, or home. If at any time you observe a cell or pack that has started to balloon or swell up, place in a safe area for observation. If swelling occurs while charging, disconnect immediately and place in a safe place for observation. If the wire leads accidentally short out, place battery in a safe place and observe for 15 minutes. If you determine that the battery should be disposed of, discharge it slowly to dead flat before throwing away or recycling so it does not present a short-circuit danger to the waste disposal system. Use a light bulb or immerse in salt water to discharge slowly.

Please Note: Terms of Use

The purpose of this document is to warn you of the safety considerations surrounding batteries of this type so that you are better informed when making decisions and taking precautions concerning their use. These batteries are intended for RC flight only, no other use is approved. Because RC modeling invariably requires decisions about preparation and deployment to pass beyond our control (and that of our retailers or agents) your decision to use LEPTRON/FlightPower products incorporates your agreement that you have read and understood that safety precautions printed here and on each battery pack, and that you agree to accept full responsibility for any injury, loss or damage resulting from all circumstances surrounding your use or misuse of this product. You are also responsible for inspecting and detecting any signs of damage or defect before and after flight, and prior to charging, and to discontinue use immediately if any such issue arises. If you do not agree to these terms of use, you are under no obligation to proceed; instead you may contact LEPTRON.com to arrange for the return of this product to us in its original condition for a full refund.

- FlightPower *Lithium Polymer*, Autography Flight Technology, Ltd., United Kingdom.