‘Do’s’ and ‘Don’ts’ when using Lithium Polymer Cells

Modern Lithium Polymer batteries (LiPo, Li-Poly) are able to store and deliver large amounts of energy from light-weight packs. Think of and treat LiPo batteries as fuel. Lithium Polymer cells, as with any high energy source (petrol, electricity, gunpowder etc) must be handled with appropriate precautions and care. Lithium Polymer batteries have been proven world-wide to be a practical and enjoyable power source for model aircraft.
With the exception of a very small number of fires that have resulted directly from a crash, fires have nearly always occurred during charging. These fires have been almost exclusively caused by human error. Therefore the main purpose of this information is:
A. To provide information that can help you actively avoid a dangerous charging situation.
B. To provide some standard precautions to limit loss or injury in case a fire occurs.
As long as you adhere to a few do’s and don’ts when handling, using, charging and storing your cells you should enjoy many hours of trouble free use from your LiPo’s.

Do’s

- **Only ever use a charger specifically designed to charge Lithium Polymer cells. Failure to do so may a cause fire, which may result in personal injury and/or property damage.**
- **Check and double check that you have set the correct voltage/number of cells and the maximum current does not exceed the stated charge rate (normally 1C). If using an automatic charger, check that it has detected the correct number of cells. Check it again through every stage of charging. Do these checks for EVERY charge.**
- Keep all batteries out of the reach of children.
- Check the voltage of your LiPo pack before charging with a digital multimeter. Only charge if it is 3.30V or greater per cell (e.g. 9.90V for a 3S pack).
- Only charge in an isolated area away from other flammable materials and on a non conductive and non flammable surface. Use a LiPo Guard bag or use a non-conductive container like a casserole dish with a lid as it will help contain any fire. LiPo battery fires can not be extinguished with water. If a fire occurs, either cover it with sand or better still salt. **On no account use water to extinguish a fire.** Water acts like petrol on a LiPo battery fire.
- If at any time you see a cell ‘puff up’ disconnect it immediately and either cover it in sand, or put it in a non-conductive container and place it outside away from all flammable objects for at least 30 minutes.
- If charging indoors, only charge with a smoke detector above where you are charging.
- Manually check the temperature of your LiPo battery pack constantly during charging. Unlike other types of cells, LiPo cells should never get warm and should stay at the ambient temperature when being charged. If any of the individual cells become warm/hot compared to the other cells, disconnect it immediately and either cover it in sand, or put it in a non-conductive container and place it outside away from all flammable objects for at least 30 minutes.
- Where ever possible always use a cell balancer when charging. A cell balancer will give you the 1st indication that a single cell within a pack is failing. If one of the LED’s remains on during the charge cycle this is indicating that one of the cells is failing, possible causing other cells in the pack to become over charged, which can result in a fire.
- Store LiPo batteries at room temperature between 5ºC and 27ºC (40ºF and 80ºF) for best results. The lower the temperature the better.
- When connecting 2 packs in series always make sure they are from the same manufacturer, the same capacity, the same age and type and that there is a voltage difference of 0.03V or less.
- When connecting 2 packs in parallel always make sure they are from the same manufacturer, the same capacity, the same age and type and that there is a voltage difference of 0.03V or less, otherwise the higher voltage pack will discharge into the lower voltage pack, which may cause a fire.
- If you plan to store your LiPo cells for an extended period (over 1 month) then discharge them as you would normally. Then charge them to only 3.80-3.85V per cell.
- Physically disconnect batteries from ESC’s with BEC’s to prevent slow over-discharge. The on/off switch does not stop the slow discharge.
- Do ensure connectors are insulated correctly to prevent short circuit in handling or storage.
- Do always check that batteries are physically and electrically undamaged before charge or discharge.

Don'ts

- **Do not use a charger that is not specifically designed to charge Lithium Polymer cells.**
- Do not leave cells un-attended when charging. You should always remain close to the charging cells to monitor the charging process and react to potential problems should they occur.
- Do not charge LiPo batteries in the model.
- Do not charge LiPo batteries in a vehicle or in the engine compartment of a vehicle.
- Do not carry LiPo batteries in your pocket. They have been known to short against coins and keys and cause fires.
- Do not puncture the cells.
- Do not place LiPo batteries in a fire.
- Do not short the wires of your LiPo cells/battery. This is very dangerous and can cause a fire or even an explosion. If you accidentally short the wires of your LiPo cells/battery, either cover it in sand, or put it in a non-conductive container and place it outside away from all flammable objects for at least 30 minutes.
- In the event of a crash, remove battery(s) and place it/them in a safe open area away from any combustible material for approximately 30 minutes. On no account should you place it in a vehicle for at least 30 minutes as a delayed chemical re-action can occur causing a fire.
- Do not 'Top up' your cells. Even if you charged them up to 1 year ago. LiPo cells loose less then 1% of their capacity per month. Just use them and then re-charge them as normal.
  Over-charging LiPo batteries will damage them and possibly cause a fire.
- Do not charge cells that have been stored in cold conditions (below 10ºC/50ºF), let them warm up (above (10ºC/50ºF), for a minimum of 30 minutes.
- You risk an explosion if you attempt to use cells that have been stored at or below 0ºC (32ºF), Warm them first for at least 60 minutes above 10ºC (50ºF) before charging or discharging.
- Do not store your cells for extended periods of time (more then 1 hour) in a hot place (i.e. in your car on a hot day) as this may cause them to catch fire of even explode.
- Do not ingest contents of LiPo cells. If you do accidentally swallow the contents of LiPo cells seek medical attention immediately.
- Do not charge hot cells. Warm cells are OK, let hot cells cool before charging.
- Do not allow charging to continue above 4.25V per cell. This is **VERY** important as a fire could result.
- Do not discharge you LiPo cells below 3.00V per cell (e.g. 9.00V for a 3S pack) as this will damage the cells and dramatically reduce the life of your cells. If you do accidentally discharge them below 3.00V per cell, leave them for 30 minutes and if the voltage recovers to over 3.30V per cell then they should be OK to use them again. If they do not recover to at least 3.00V per cell then I'm afraid you have damaged them and they should be disposed of (Please see below as the correct method of disposal).
- Do not charge dissimilar or un-matched packs in series or parallel with any difference in cell type, cell capacity, manufacturer, age, pack capacity or charge state (+/- 0.03V per cell). If in any doubt, charge them separately.
- Do not charge any pack containing one or more damaged or swollen/puffed cell as there is a high risk of a fire.

Disposing of Lithium Polymer Cells

Discharge the battery as normal but this time to 3.00V/Cell. Then place a high resistive load (e.g. car sidelight) across it until the voltage has dropped to zero. Make sure the output wires are insulated, then wrap battery in a bag and place in normal rubbish bin.

Life of Lithium Polymer Batteries

This is a '64 million Dollar' question….
A Lithium Polymer battery needs to be replaced when it holds 80% or less of its capacity.
If used at the maximum continuous discharge rate on every cycle and every charge is at 1C or greater and it's used down to 3.00V per cell under load (when your LiPo compatible ESC cuts power to the motor) then don't expect to get more then 40 or 50 cycles from your LiPo Pack. Please see my guide to prolonging the life of your LiPo's.