

Rocky Mountain Modelers Safety Officer Tips: February 2020

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The Ten Worst Things You Can Do To Your Li-Po Flight Batteries

1. **Over Discharging Batteries:** Contrary to a lot of published information, I have had found that discharging Li-Po's below even their nominal charge of 3.7 volts per cell can permanently damage batteries. I have had very good results by flying my batteries down to about the LiPo storage level of 3.8 volts per cell, which is 11.4 and 15.2 volts for 3 and 4 cell batteries, respectively. Note: ESC's can allow you to discharge batteries all the way down to 3.0 volts per cell, or even lower, before curtailing power, which is well below the storage and nominal charge of 3.7 and 3.8 volts per cell, respectively.
2. **Discharging Batteries Too Fast:** Multiplying the "C-Rating" by the storage capacity yields the safe maximum discharge current for the battery. (Example: A 20C 3200mAh battery has a safe maximum discharge current of $20/h \times 3.2Ah = 64 \text{ amps(A)}$.) Hence, it is important to properly select a battery for an aircraft's power system (i.e., motor and ESC).
3. **Recharging Batteries Too Fast:** Most Li-Po's are designed to be charged at a maximum rate of 1C. (Example: the safe charge rate for a 3200mAh battery is: $1/h \times 3.2Ah = 3.2 \text{ amps(A)}$.) Hence, it is very important to properly program your charger for each battery. Some batteries with C-Ratings greater than 20C can possibly be charged at 2 to 5C; however, it is important to verify with the battery's manufacturer for this specification before charging at a rate greater than 1C. CAUTION should be taken to ensure the battery does not overheat; hence, it is recommended that batteries should not even get warm to the touch during charging.
4. **Recharging Hot Batteries:** It is important to let batteries cool down before recharging them, since excess heat can damage batteries and possibly result in a battery failure/fire.
5. **Not Balance Charging:** Individual cells typically degrade and develop internal resistance unevenly, which can result in the cells charging unevenly. Hence, it is important to ALWAYS "balance" charge, otherwise it is possible to over-charge individual cells.
6. **Charging Batteries Unattended and with Unreliable Chargers:** Batteries should not be charged unattended and should always be charged with a reliable charger.
7. **Charging Batteries in an Unsafe Location and Without Fire-Fighting Materials:** Batteries should always be charged in a safe location away from flammable material; however, it may also be advisable, in addition to a smoke/fire detector, to:
 - keep a bucket of sand nearby to help prevent the spreading of a Li-Po battery fire; and/or
 - keep a fire extinguisher nearby to put out any fire that might spread from a battery fire to surrounding materials (workbench, drapery, walls, other batteries, ... etc.).
8. **Storing Batteries Fully Charged:** Storing batteries fully charged for long periods of time can permanently damage the battery. A general guideline is that fully charged batteries should not be stored for over 2 weeks.
9. **Not Storing Batteries in a Safe Manner:** Batteries should be stored in a cool dry place. Freezing or exposing batteries to excessive heat can result in permanent damage. Batteries can lose charge/voltage over time; hence, it is also appropriate to verify on a regular basis that stored batteries are at the proper storage level (i.e., 3.8 volts per cell).
10. **Not Providing Sufficient Air-Flow Over the Battery:** It is important that there is sufficient airflow over the battery in the aircraft to prevent the battery from overheating and being damaged.

As a final note, there are a few things you should never do with flight batteries:

- Never short-circuit batteries; hence, be very careful when soldering on new adapters.
- Never dispose of charged batteries.
- Never fly batteries purchased used, before thorough testing.