Lithium Polymer Battery Storage Tips

Lithium polymer batteries (lipos) power our electric model airplanes. With sizable inventories of packs that represent a fair investment, getting the longest life out of our lipos is in our best interest. Two words: proper storage.

The bulk of a packs lifetime is spent in “non-use”. The conditions packs see during the cumulative days, weeks, months and even years of storage takes its toll. A unique characteristic of lipos is their life span is dependent upon aging from time of manufacture and not just on the number of charge/discharge cycles. An older battery will not perform as well as a new one, due solely to its age. This drawback is not widely publicized or known by the typical user.

As lipo batteries age, their internal resistance rises. This causes the voltage to drop under load, reducing the maximum current that can be drawn. Additionally as lipos age, usable capacity is lost. Typically once a battery has lost 20% of its rated capacity it considered at the end of its useful life. It’s a fact, lipos age and degrade even during non-use. What can we do to minimize these effects? Manage two factors that are totally in our control: cell storage voltage and storage temperature.

Storage Voltage:
A fully charged lipo cell is approximately 4.2 volts. Lipos are different from other battery chemistries as they should never be stored fully charged. Lipos should be stored approximately “half full”. Many of the newer lipo balance chargers have a “Storage Mode” which charges the pack to the proper reduced voltage state for storage purposes. The popular FMA CellPro charger charges cells to 3.85Vdc in Storage Mode. Check your charger manual, some chargers can both discharge the pack and then charge up to the storage level, while others can only charge up to the storage level. The later type charger requires you to discharge the pack below the storage level to take advantage of the storage feature. Storing your packs at the proper voltage level is the simplest thing you can do to lengthen their usable life span (assuming proper application and use). Storage is not just “over the winter”. If you only fly on the weekends, your packs are technically in storage all week, week after week during the entire flying season. Those cumulative hours can add up slowly degrading your packs.

Temperature:
Lipo batteries function via a chemical reaction that occurs inside their sealed foil envelopes. Providing power is a chemical reaction, while the aging/degrading process is another chemical reaction. If you remember back to high school chemistry, a chemical reaction doubles its speed for every ten degrees increase of ambient temperature. This is why lipos don’t perform as well in cold weather. The cold “slows down” the chemical reaction process. But this fact can work in our favor when it comes to lipo storage. Reducing the storage temperature slows the chemical reaction of the aging/degrading process. There is a limit as to how cold is OK. Lipos don’t want to be frozen solid, but keeping them cool during storage is most certainly in our favor. It turns out the typically household refrigerator (37 to 40 degrees) is the perfect storage place.

Put lipos in plastic zip top storage bags and place them in the fridge when not in use. When you take them out leave them in the bags, to prevent any atmospheric moisture from condensing on them as they warm. After they’re at room temperature, use them as you normally would. To see it all in black and white look at the table below…it tells the whole story.

My typical routine for a Saturday morning flying session: Friday night when I get home from work I take the storage Bags of lipos out of the fridge to warm. After dinner I charge the packs as I’m prepping my planes and loading the car. Saturday morning I go out and fly. Saturday afternoon when I return from the field I discharge all my packs (used or unused) to slightly below the storage voltage of my charger. I then put each pack on a CellPro charger set to Storage Mode. The packs then go back in their storage bags and are returned to the fridge. I don’t leave a pack fully charged or at room temperature for more than 24 hours if at all possible.

Permanent Capacity Loss versus Storage Conditions

Storage Temperature	40% Charge	100% Charge
0 °C (32 °F)	**2%** loss after 1 year	**6%** loss after 1 year
25 °C (77 °F)	**4%** loss after 1 year	**20%** loss after 1 year
40 °C (104 °F)	**15%** loss after 1 year	**35%** loss after 1 year
60 °C (140 °F)	**25%** loss after 1 year	**40%** loss after 3 months

Source: BatteryUniversity.com

Is this all necessary? I’ve reviewed CBA battery analyzer discharge graphs of packs that were base lined brand new and put in “proper storage” for over 3 years. When CBA tested again years later the packs were virtually identical to the “brand new” discharge graphs. Capacity and current sourcing ability were unchanged. So how long a pack last is in a large way up to you. It’s your decision on what you want to do to care for your batteries. It doesn’t take much effort to get the most out of your lipo investment. Like others, I bought a small “dorm refrigerator” for my shop for storing lipos (after my wife threw me out of our kitchen refrigerator vegetable crisper drawer). Refrigerators are a good place to store CA and alkaline batteries too.