



RSM Distribution
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Batteries

The following section on batteries was provided by Mr. Norm Whittle and is used with his permission. Please read it and then re read it!

7 Important Battery Questions Answered: Information By Igor Burger and Norm Whittle. 15 March 2011

1. Define the common Lipo terms. 2S, 3S, 4S etc. 20C, 30C etc.

“S” stands for “series” connection and “P” stands for “parallel” connection. 2S, 3S refers to how many cells are wired in series. So a 2S means 2 cells are wired in series 3S means 3 cells in series. The result is the voltage is an “S” multiple of cell voltage (nominal 3.7 vDC Lipo batteries cell voltage times “S” or 7.4 volts for 2S and 11.1 volts for 3S). “C” stands for “capacity”. So 20C, 30C is a rating that the manufactures place on their batteries to reflect the discharge capability of their batteries. If an 1800 mah capacity battery is rated 20C the battery could discharge at 36 amperes. On a 30C rated 1800 mah battery, the maximum discharge rate would be 54 amperes. There are normally two “C” ratings on a battery. Example 20C/40C the first or “20C” refers to the continuous discharge and the second “40C” defines the burst discharge rate. Another “C” rating is the charge rate normally rated at 1C, 2C... so the charge rate is defined as a function of the storage capacity of the battery. Note: On some low end batteries “C” rating could be unreliable and caution should be used in discharging at the full rates. Consider high “C” rated batteries bring in more money.

2. Fully charged what is the voltage of a Lipo cell?

Standard Lipo batteries are charged to 4.2 vDC per cell. So if you run a 5S pack, meaning 5 cells in series, the fully charged pack is 21 vDC, although the nominal rating is 18.5 vDC. 5×3.7 equaling 18.5 vDC and a fully charged pack is 5×4.2 equaling 21 vDC. If you are using A123 or LiFe cells then the fully charged voltage is 3.6 vDC and the nominal rating is 3.3 vDC per cell. This is one reason an extra cell is often used on a LiFe battery pack. Igor Burger uses a 6S 2300, A123 battery pack. These LiFe cells have some real advantages that outweigh the extra weight of the additional cell.

3. Can Lipo cells be run in series and parallel?

Yes, they are run in series most of the time but the Pattern Fliers run parallel pack mostly to gain capacity. Note: the configurations must be compatible, not an 1800mah rated pack and a 5000mah rated pack in parallel. If you have two 4S packs with 1800 mah capacity each and you want to maintain the 14.8 vDC nominal voltage, but increase duration, you could construct a connector that allowed the two packs to be plugged into the ESC in parallel. The capacity would then be 3600 mah. Safety hint DO NOT try to charge these in parallel, you will screw up the balance of the cells. Charge each pack individual.

4. As a rule of thumb what is the fastest charge rate for a Lipo pack?

The short answer is 1C which means 1 times the rated mah rate of the battery pack. Example if you have a 5S 1800 battery pack then you can charge it at 1800 ma or 1.8 amperes (a) be sure to set the charger to the correct number of cells (5 in this case) and then set charge current to 1.8 amps. Some high performance battery cells allow higher charge rates; ThunderPower just came out with Generation 6 (G6) cells that are rated at 12C charge and discharge rates at 65C/130C. Meaning that an 1800 mah battery can be charged at 21.6 Amperes and the battery can be discharged at 117 amps and burst at 234 amps. Wow! Don't try this at home your wiring won't like it. Recommend you stick with 1C charge rate to make your batteries last as long as possible.

5. What is the lowest safe discharge voltage of a Lipo cell?

Standard Lipo batteries should only be discharged to 3.0 vDC per cell, measured under load. Example - discharge a 5S 1800 battery to 15 vDC; 3.0×5 or 15 vDC. Many folks set the low voltage cutoff on their ESC to 3.2 vDC per cell - this is conservative but I think prudent. In our example this would discharge to 16 vDC under load. The place to control this is in your ESC setting.

6. What is the proper way to store Lipo cells - long term, short term?

Short term storage means from flying session to flying session (less than a week, normally a few days). I store mine charged and ready to go from session to session. Long term storage mean over the winter storage or just not using the battery on regular basis. Store these batteries at 3.8 to 3.9 vDC per cell (no load). Check voltage with a digital voltmeter and maintain the charge at 3.8-3.9 vDC for the duration of storage time. It is best to keep temperature of batteries at around 70 deg F. Igor suggests keeping long-term storage batteries in the vegetable bin of the refrigerator. If you can get away with that - go for it. Sound like Igor has his priorities right.

7. **How real are the fire/explosion dangers of Lipo cells? What is a safe setup to charge Lipo packs unattended?**

Last question first – If you have access to a WWII bunker complete with blast doors go ahead and charge unattended. In case you don't have access to such a bunker - **don't leave your batteries to charge unattended.** Many batteries have gone up in flames, 99% of the time it is operator error. The most often cause is the wrong kind of charger or wrong settings programmed by the operator. Here are some common sense things to think about, maybe they will save your car or house from going up with your batteries. Always think safety.

- *Get a reliable charger that is purpose built for the job of charging Lipo batteries. Learn how to use the charger properly. I know 99% of the folks reading this are male and “we don't need no stinkin' instructions” but for once read the instructions.*
- *Get a Lipo charge bag or fireproof container to place your batteries into during charging.*
- *To transport your batteries, follow Paul Walker's lead and get a fireproof “Safety Box” from Lowes or Home Depot. They are about \$25 from Lowes.*
- *Check for bad connections on all parts of your electrical system - often.*

In case of a crash and the batteries is damage use extreme caution when handling it. The symptoms of damaged, battery puffing or physical damage can be delayed by hours or even days. First step is to isolate the crashed battery from people and equipment. Use caution and a sealed container to transport the battery. If damage is detected: Submerge the battery into bucket or tub of salt water. This container should have a lid, but it need to be air-tight. Prepare a plastic container (do not use metal) of cold water and mix in 1/2 cup of salt per gallon of water. Place the battery into the salt water. Allow the battery to remain in the tub of salt water for at least 2 weeks. Remove the LiPo battery from the salt water, wrap it in newspaper or paper towels and place it in the normal trash. They are landfill safe.

Hint: If this is a Thunder Power battery, checks for warranty coverage before disposing in the trash.