An Owl cannot fly without ...

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Flight Feathers

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MEETINGS

FIRST SATURDAY OF THE MONTH AT 11AM

NO MEETINGS JULY/AUGUST

NEXT MEETING:

JANUARY 7th

EMERGENCY CALLS FROM OUR FIELD

352-485-5111

2022
WISE OWLS

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BRET MARTIN
FERNANDO MESA
AMA INTRO PILOT INSTRUCTORS

From the Newsletter Guy:

I was unable to attend the December meeting and did not receive any photo contribution from the membership. Bert has kindly provided a very complete and well-written Guide to Lithium Polymer batteries for the newsletter. It is re-printed below.

Happy Holidays!

Document sent by Bert

A Guide to Lithium Polymer Batteries

LiPo batteries (short for Lithium Polymer) are a type of rechargeable battery that has taken the electric RC world by storm, especially for planes, helicopters, and multi-rotor. They are the main reason electric flight is now a very viable option over fuel powered models.

RC LiPo batteries have four main things going for them that make them the perfect battery choice for RC planes and even more so for RC helicopters over conventional rechargeable battery types such as NiCad, or NiMH.

- **RC LiPo batteries are light weight and can be made in almost any shape and size.**
- **RC LiPo batteries have large capacities, meaning they hold lots of energy in a small package.**
- **RC LiPo batteries have high discharge rates to power the most demanding electric motors.**
- **Unlike NiCad or NiMh; LiPo's have no "memory-effect".**

In short, LiPo's provide high energy storage to weight ratios, are capable of fast discharges, and come in an endless variety of shapes and sizes.

INTRODUCTION

Lithium Polymer batteries (henceforth referred to as "LiPo" batteries), are a newer type of battery now used in many consumer electronics devices. They have been gaining in popularity in the radio control industry over the last few years, and are now the most popular choice for anyone looking for long run times and high power.

LiPo batteries offer a wide array of benefits. But each user must decide if the benefits outweigh the drawbacks. For more and more people, they do. There is nothing to fear from LiPo batteries, so long as you follow the rules and treat the batteries with the respect they deserve.

Lithium-Polymer batteries contain, quite obviously, **lithium**. Lithium is an **alkali metal**, meaning it reacts with water and combusts. Lithium also combusts when reacting with oxygen, but only when heated. The process of using the battery, in the sometimes extreme ways that we do in the R/C world, causes there to be excess atoms of Oxygen and excess atoms of Lithium on either end (be it the **cathode** or **anode**) of the battery. This can and does cause Lithium Oxide (Li2O) to build up on the anode or cathode. Lithium Oxide is basically corrosion, albeit of the lithium kind; not iron oxide, which is otherwise known as "rust". The Li2O causes the internal resistance of the battery to increase. Internal resistance is best described as the measure of opposition that a circuit presents to the passage of current. The practical result of higher internal resistance is that the battery will heat up more during use.

How to best maintain your battery in order to have maximum performance and life span. Some of you might know this already, but it is never bad to review your knowledge, yet some will regard it as new, and will learn something useful, which could potentially save them money and frustration in the long run.

First of all please understand that, the life and performance of a Lipo battery is critically affected by the way the battery is broken in, and the way it is maintained. The sooner you realize that and start treating your batteries properly, the sooner you will notice the benefits of this little effort.

Voltage / Cell Count

A LiPo cell has a nominal voltage of 3.7V. For the 7.4V battery above, that means that there are two cells in series (which means the voltage gets added together). This is sometimes why you will hear people talk about a "2S" battery pack - it means that there are 2 cells in Series. So a two-cell (2S) pack is 7.4V, a three-cell (3S) pack is 11.1V, and so on.

If you are wondering what the 1-12S in parenthesis means; it's the way battery manufacturers indicate how the cells are hooked in series(S).

- **3.7 volt battery = 1 cell x 3.7 volts (1S)**
- **7.4 volt battery = 2 cells x 3.7 volts (2S)**
- **11.1 volt battery = 3 cells x 3.7 volts (3S)**
- **14.8 volt battery = 4 cells x 3.7 volts (4S)**
- **18.5 volt battery = 5 cells x 3.7 volts (5S)**
- **22.2 volt battery = 6 cells x 3.7 volts (6S)**
- **29.6 volt battery = 8 cells x 3.7 volts (8S)**
- **37.0 volt battery = 10 cells x 3.7 volts (10S)**
- **44.4 volt battery = 12 cells x 3.7 volts (12S)**

What is Nominal Voltage?

Nominal voltage is the default, resting voltage of a battery pack. This is how the battery industry has decided to discuss and compare batteries. It is not, however, the full charge voltage of the cell. **LiPo batteries** are fully charged when they reach 4.2v/cell, and their minimum safe charge, as we will discuss in detail later, is 3.0v/cell. 3.7v is pretty much in the middle, and that is the nominal charge of the cell.

In the early days of LiPo batteries, you might have seen a battery pack described as "2S2P". This meant that there were actually four cells in the battery; two cells wired in series, and two more wired into the first two batteries in parallel (parallel meaning the capacities get added together). This terminology is not used much nowadays; modern technology allows us to have the individual cells hold much more energy than they could only a few years ago. Even so, it can be handy to know the older terms, just in case you run into something with a few years on it.

The voltage of a battery pack is essentially going to determine how fast your vehicle is going to go. Voltage directly influences the RPM of the electric motor (brushless motors are rated by kV, which means 'RPM per Volt'). So if you have a brushless motor with a rating of 3,500kV, that motor will spin 3,500 RPM for every volt you apply to it. On a 2S LiPo battery, that motor will spin around 25,900 RPM. On a 3S, it will spin a whopping 38,850 RPM. So the more voltage you have, the faster you're going to go.

Capacity (mAh)

The capacity of a battery is basically a measure of how much power the battery can hold. Think of it as the size of your fuel tank. The unit of measure here is milliamp hours (mAh). This is saying how much drain can be put on the battery to discharge it in one hour. Since we usually discuss the drain of a motor system in amps (A), here is the conversion:

1000mAh = 1 Amp Hour (1Ah)

It is said that the capacity of the battery is like the fuel tank - which means the capacity determines how long you can run before you have to recharge. The higher the number, the longer the run time. Airplanes and helicopters don't really have a standard capacity, because they come in many different sizes, but for R/C cars and trucks, the average is 5000mAh - that is our most popular battery here in the store. Some manufactures also produce over 5,000mAh cells for industrial purposes. At the moment, Hyperion does not offer any solutions for these high mAh applications, but if you ever need to increase your millamp capacity, we suggest wiring batteries into parallel. Wiring you batteries in parallel will increase your mAh capacity.

The main thing to get out of this is **if you want more flight time; increase the capacity of your battery pack**. Unlike voltage, capacity can be changed around to give you more or less flight time. Naturally because of size & weight restrictions, you have to stay within a certain battery capacity range seeing that the more capacity a battery pack has, the larger and heavier it will be.

Nitro lovers can think of increasing the RC Lipo battery capacity as similar to putting a larger fuel tank in the RC vehicle.

Understanding “C” Rating

Let start off by understanding **what the battery's "C" rating means**. C rate is the battery's maximum **SAFE** continuous discharge rate. If the label says "20C" that means that the battery can be discharged at a rate of up to 20 times the capacity of the battery, until it is depleted. Capacity refers to the milliamp-hour rating of the battery, which will be listed as a number followed by "mAh" - 2200mAh. Some brands also use Amp ratings, which is pretty much the same, just a different scale, so 2200mAh will be displayed as 2.2. Keep in mind that 1000mAh equal 1Amp. So here is an example with a 2200mAh 20C pack (pack voltage does not play a part in determining C rating):

2200mAh = 2.2Amps
2.2Amps x 20C = 44Amps continuous discharge

This means that you can safely draw up to 44Amps from that pack, without damaging it. That is only the theory however, in reality, some of the cheaper battery brands tend to over-rate their batteries, which causes a lot of people a lot of frustration, and dramatically reduces the battery's life span.

Breaking in batteries

So let’s start from the beginning. Irrespective of the battery's voltage (cell count), C rating, or capacity, **ALL NEW BATTERIES MUST BE BROKEN IN** before they are used on a model, or for whatever application they were in- tended for. And this is how it works - all batteries have a "C" charge rate, in addition to the "C" discharge rate. Usually, the charge rate is much smaller than the discharge rate. Some brands claim that you can safely charge their batteries with up to 8C charge rate, but this would be foolish, and experience has proven that doing this, shortens a battery's life dramatically. Especially for the break in cycles (1 cycle refers to one charge and one discharge of a battery), the battery MUST be charged and discharged at 1C. So, for example, if you have the above mentioned 2200mAh 20C Lipo, you must set your charger to charge it at 2.2Amps, and then discharge it again at 2.2Amps. It is recommended to put new batteries through 6-7 break in cycles at 1C, before putting them in a model. Most modern chargers have automatic programs for battery cycling, so you just have to input the number of cycles, and the charge and discharge rates, start the program and wait for it to finish. With older chargers you will have to manually start every charge and discharge program, until you complete 6-7 cycles.

Charge C ratings are usually indicated on the label on the back of the battery.
However, not all brands indicate that, so make sure you ask for your specific battery's charge C rating when you buy it.

This is the highest charge current rating the manufacturer states the battery can be charged at safely. Please note however, charging at maximum rates will shorten battery life as is discussed further down this page in the LiPo charging calculation section. This is a safe maximum number, not a best for maximum life number in other words.

Another important thing to know, is to set the low voltage cut-off of the discharge part of the break in cycles. Setting the cut-off voltage to 3.5v per cell during the discharge part of the break in cycles is a good way to give the battery a nice work out, and also for you to determine its true capacity. Standard tests have repeatedly shown that when you discharge a battery down to 3.5v per cell, at 1C discharge rate, when the low voltage cut-off engages and stops the discharge procedure, the battery has been pretty much completely discharged. During the first 2-3 cycles, the battery will not charge or discharge to its full capacity, but on the following cycles you will see that the amount of charged and discharged

mAh will get closer and closer to the mAh capacity written on the label. You might also notice that some brands have a real mAh capacity slightly larger than the stated one, while others have real mAh capacity slightly smaller. A smaller real mAh capacity does not mean the battery is bad, it usually means it might be lighter than a comparable stated mAh capacity / C rate / voltage Lipo from another brand. On average, new and good batteries should discharge close to their stated mAh capacity, when discharged to 3.5v per cell at 1C discharge rate.

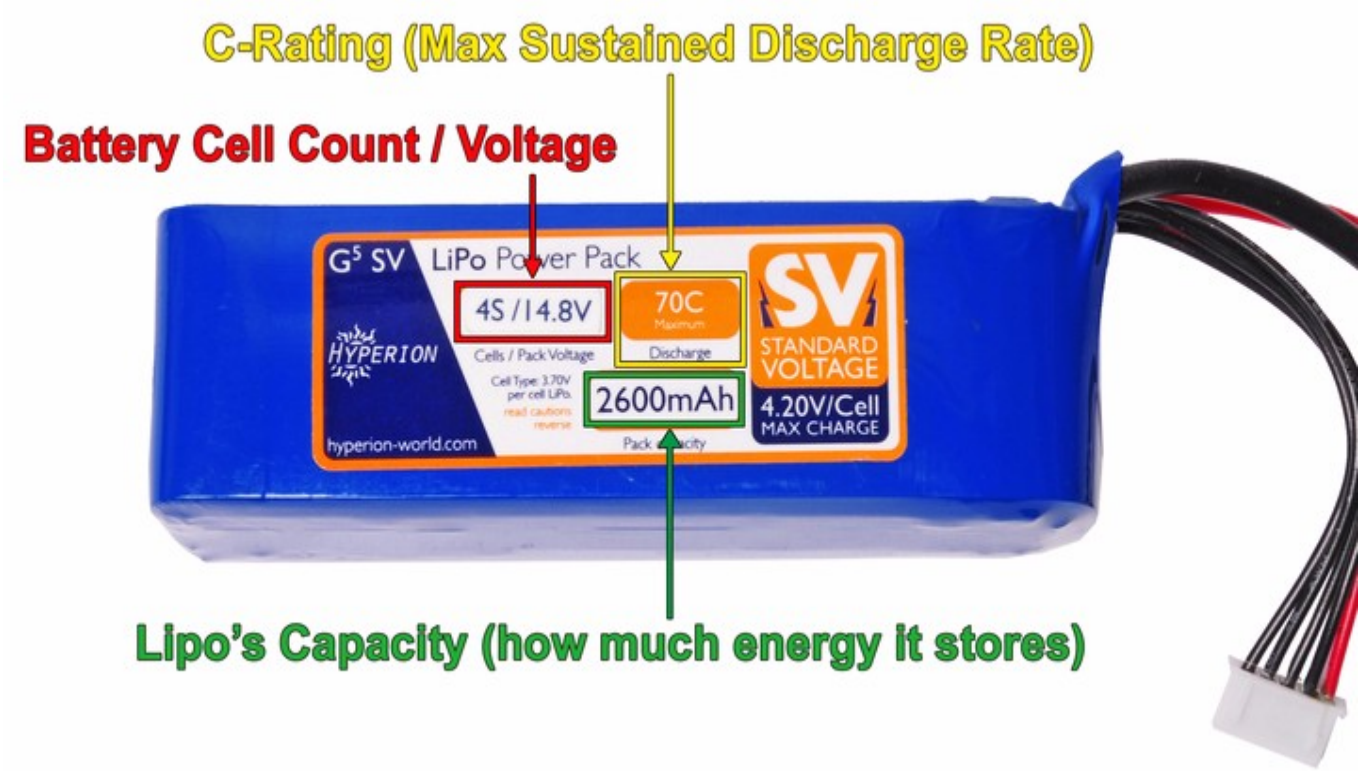
Battery charging

Now, we come to charging the batteries during the course of their life span. Battery charge C rates vary between 1C, for Tx and Rx packs, to 8-10C for high performance packs. Most batteries have a charge C rate between 2C and 5C. NEVER charge batteries at more than 1.5C, and that is only at the field, Always charge them at 1C. Experience has proven that really expensive, high-end Lipos do have a long life span (over 300 cycles), even when constantly charged at 4-5C, however, these batteries cost quite a lot, and either way. Cheaper, and more popular Lipo brands do suffer from high charge C rates, and in some cases like helicopters, people are replacing them every 50 cycles, because they can feel the oncoming lack of performance. Helicopters, however, are just one part of the hobby, and is a special case. Helicopters are generally very demanding of the batteries, so 50 cycles are actually pretty OK for packs used in extreme 3D heli’s.

In any case, opinions will differ - some people do not bother to wait for 30-40 minutes for a pack to charge, so they charge at high C rates, and replace their packs more often. But it is better to have more battery packs per model, so often you don't even need to charge at the field, so all of the charging is either at 1C or 1.5C at the most. At the end the decision is up to you - whether you want your batteries to last longer, or have fewer charges. There is one thing that people should be careful about - when you receive your battery, if you want to charge it at rates over 2C, make sure you KNOW for a fact that the battery CAN handle more than 2C charge rates, otherwise you run the risk of ruining it very quickly, or even making it to explode.

(The safest charge rate for most LiPo batteries is *1C*, or 1 x capacity of battery in Amps.)

Battery discharging



Now it's time to discuss discharge rates. It's a common misconception that people think the batteries "capacity" or "discharge rate" should be used to limit the motors power, or some people might think that using a higher mAh capacity battery will overload the motor. Make note! A battery should never be strained at 80~100% discharge rate for extended periods of time. 100% use of power, or "Burst power" should only be reserved for a maximum of around 15 seconds, for best practice. Overloading the battery with high amperage will severely affect the longevity of your power system, and will potentially lead to in-flight failure i.e., Low-voltage cutoff (LVC) turning on prematurely, or your lipo packs puffing or catching on fire.

When we choose a model, unless it comes with the power system already installed, we should choose the power system in the following order: first is the motor, and preferably one that could provide sufficient power for the model, then, and only THEN do we go about choosing an appropriate ESC and battery.

So here is an example - if the selected motor has a max amp rating (that is the maximum amount of amps that the motor can SAFELY draw continuously) of 20Amps, a 20Amp ESC would work, but preferably it should be at least 25, or even 30Amps. The battery used for this motor should be capable of providing around twice the maximum amp draw of the motor: for a 20Amp motor, a suitable battery would be 2200mAh 20C, because it can provide max of 44Amps, which is twice what the motor could ever draw.

While adhering to these principles, two things will always be a fact: under full motor load, the battery will be strained at only 50%, which means less voltage drop, which means more power goes to the motor, which translates into more thrust, and the battery will not be over-stressed, will not overheat, will not puff up, and generally will last MUCH longer. Trying to do the opposite - to limit motor power by using a lower discharge rate battery - will end up over-stressing your battery, it will puff up, and it will last only a few cycles. Not to mention, that the motor will drop considerably, because the battery voltage will drop very low, and will not provide enough power to the motor. As a general thumb rule, try to use a battery that can provide twice as much current as the motor can draw. This will ensure your battery's longevity and will definitely improve the flight performance of your model.

A LiPo cell should NEVER be discharged below 3.5V

Another **VERY** important factor to increasing the life of your batteries, is the use of a PROGRAMMABLE Low voltage Lipo alarm in your models. Those are the Lipo alarms that display battery pack and cell voltage on a screen, and have a button for adjusting the alarm voltage. For optimum flight times, and depending on the battery's state, the alarm should be set to 3.7v per cell. When the alarm sounds be quick to land, otherwise you run the risk of completely depleting the battery, which is not good for the battery, but it could also potentially crash your model.

Remember, states of charge in any battery are based on capacity, not voltage for the simple reason voltage drop in a battery is non-linear.
The below table shows a voltage vs capacity comparision for 1S to 4S Lipos.

Capacity	1 cell	2 cell	3 cell	4 cell	
110%	4.35	8.70	13.05	17.4	
100%	4.20	8.40	12.6	16.8	
90%	4.11	8.22	12.33	16.44	
80%	4.02	8.04	12.06	16.08	
70%	3.95	7.90	11.85	15.8	
60%	3.87	7.74	11.61	15.48	
50%	3.8	7.60	11.4	15.2	
40%	3.7	7.4	11.1	14.8	
20%	3.6	7.2	10.8	14.4	
<10%	3.5	7	10.5	14	
				THE ABOVE FIGURES ARE OFFLOAD AND T	
				AND SUBJECT TO VARY WITH CELL TYPE, AGE AN	

Storage Mode

And last, but not least, we come to battery storage. For long term storage, the batteries should be discharged or charged, depending on their current state, to around 3.8v per cell. That voltage will ensure that the battery will not be damaged over long periods out of use, and will also prevent the voltage from dropping too low due to self-discharge. Most modern chargers should have programs for charging/discharging batteries to storage level voltage. As a general rule **NEVER** leave your batteries charged for more than one day. Some people might argue that even one day is a long time for a Lipo battery to stay charged. It is recommended to always charge the battery the same day you plan to go to the flying field.

As long as the voltage is 3.8v per cell, the Lipos should be OK to sit for a long period. Well, that about concludes it for now, so if you've understood at least half of the information above, your batteries should last much longer.

LiPo batteries offer plenty of power and runtime for us radio control enthusiasts. But that power and runtime comes at a price. LiPo batteries are capable of catching fire if not used properly - they are much more delicate than the older NiMH/NiCd batteries. The problem comes from the chemistry of the battery itself.

Proper LiPo Storage Voltage = 3.8V per cell

Internal Resistance

As we touched on earlier, some modern chargers can read the internal resistance of the battery in milliohms (mΩ). If you have one of these chargers, you can get a sense of how your LiPos are performing, and how their internal resistance increases as they age. Simply keep track of the internal resistance reading each time you charge your battery, and chart the increase over time. You will see how just the process of using the LiPo battery begins to wear it out.

Higher Internal Resistance = Higher Operating Temperature

Heat causes the excess oxygen to build up more and more. Eventually the LiPo pack begins to swell (due to the oxygen gas build up). This is a good time to stop using the battery – it’s trying to tell you that it has come (prematurely or not) to the end of its life. Further use can, and probably will, be dangerous. After the pack has swollen, continued use can cause even more heat to be generated. At this point, a process called Thermal Runaway occurs.

A Swelled, or Puffed, LiPo

Thermal Runaway is a self-sustaining reaction that is accelerated by increased temperature, in turn releasing energy that further increases temperature. Basically, when this reaction starts, it creates heat. This heat leads to a product that increases resistance (more Li2O), which causes more heat, and the process continues until the battery bursts open from the pressure. At this point, the combination of heat, oxygen, and the humidity in the air all react with the lithium, resulting in a very hot and dangerous fire.

However, even if you stop using the battery when it swells, you still have to render it safe. If you puncture a LiPo that has swollen and still has a charge, it can still catch fire. This is because the unstable bonds that exist in a charged battery are in search of a more stable state of existence. That's how a battery works; you destroy a stable chemical bond to create an unstable chemical bond. Unstable bonds are more apt to release their energy in the pursuit of a more stable bond.

When a LiPo is punctured, the lithium reacts with the humidity in the atmosphere and heats up the battery. This heat excites the unstable bonds, which break, releasing energy in the form of heat. The Thermal Runaway starts, and you again get a very hot and dangerous fire.

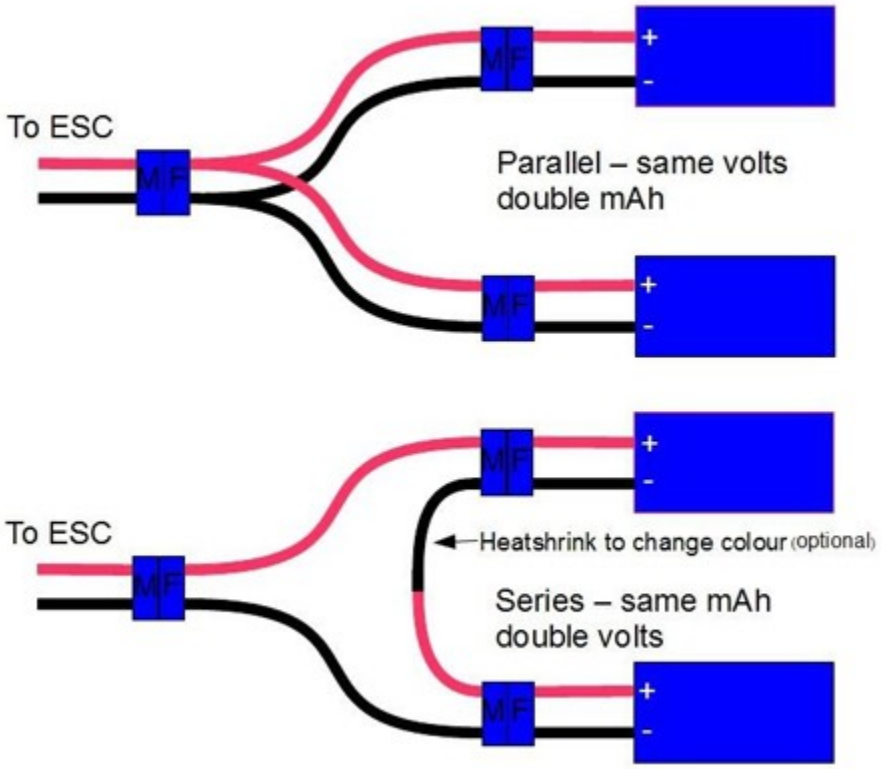
The entire process of building up that lithium oxide usually takes around 300-400 charge/discharge cycles to reach a tipping point. That's a typical lifetime of a LiPo battery. But when we heat the batteries up during a run, or discharge them lower than 3.0 volts per cell, or physically damage them in any way, or allow water to enter the batteries (inside the foil wrapping), it reduces the life of the battery, and hastens the buildup of Li2O.

LiPo Battery Disposal

So you have a bad LiPo battery? No one really wants to keep them around (fire hazards that they are). So what is the process to get rid of a bad LiPo battery safely? Let's go through it.

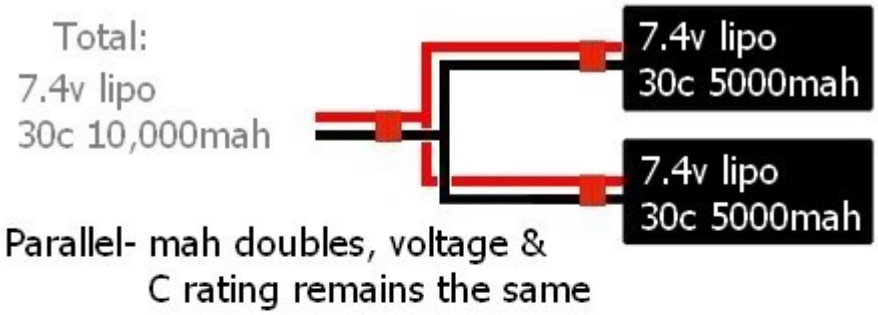
1. **Discharge the LiPo battery as far down as you safely can**. You can do this a number of ways. Most computerized LiPo chargers have a discharge feature in them. If you don't have a charger with a discharge feature, you can run down the battery in your vehicle - keep in mind that you risk a fire and potentially damaging your vehicle doing this, so take care to have the necessary safety equipment around. Alternatively, you can build your own discharge rig with a taillight bulb and some wire. Simply solder a male connector of your choosing to the tabs on a taillight bulb, and plug the battery in. Make sure to have the battery in a fireproof container while doing this.
2. **Place the LiPo in a salt water bath**. Mix table salt into some warm (not hot) water. Keep adding salt until it will no longer dissolve in the water. Ensure that the wires are all entirely submerged. The salt water is very conductive, and it will essentially short out the battery, further discharging it. Leave the battery in the salt water bath for at least 24 hours.
3. **Check the voltage of the LiPo**. If the voltage of the battery is 0.0V, great! Move onto the next step. Otherwise, put it back in the salt water bath for another 24 hours. Continue doing this until the battery reaches 0.0V.
4. **Dispose of the battery in the trash**. That's right - unlike NiMH and NiCd batteries, LiPos are not hazardous to the environment. They can be thrown in the garbage with no problem.

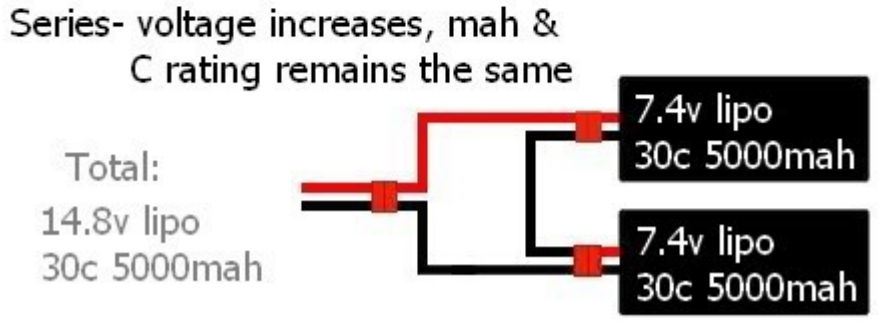
Series and Parallel Connections



Above diagram shows the use of lipo batteries with 2 types of connections, depending on the setup LiPos can be wired in series or parallel using wire harness to either increase capacity or voltage.

Below diagram is self-explanatory and shows result of parallel and series connection.





General Tips

1. Never charge, discharge, use, or store a damaged or puffy LiPo battery. Immediately follow proper disposal protocols.
2. Avoid purchasing used LiPo batteries. You never know what the previous owner did with them and they could already be badly damaged. “LiPo Battery like New, Used Once” is usually a scam and should be avoided.
3. Always use a proper LiPo battery balance charger/discharger when charging and discharging your LiPos. It is crucial that all cells in a LiPo battery maintain the same voltage across all cells at all times. If the voltages across the cells deviate too much from each other (5mV ~ 10Mv), the battery can become unstable and dangerous. (Unless it’s a single cell LiPo, in which case you do not need to worry about cell balance).
4. Always use a fire proof **LiPo safety bag**, metal ammo box, or other fire proof container when you are charging, discharging, or storing your LiPo batteries. While LiPo fires are rare, they can happen incredibly quickly and can do a lot of damage. All it takes is an internal short circuit to set the battery off. There is no way to predict when it will happen. It does tend to happen more often when batteries are fully charged, being overcharged, or while being discharged, but it can happen to any LiPo at any time. Never fill the container to capacity with your batteries, always follow manufacturer recommendations on LiPo bags for how many mAh’s it can safely contain. It’s ALWAYS worth investing in an (under $10) explosion-proof LiPo bag

5. Do not use your flight case/travel case for long term LiPo storage. The foam and plastic in these cases can help spread a LiPo fire or always recommend using fire proof container such as damage free LiPo bags for storage.
6. Never leave your LiPo batteries charging while unattended. If a battery starts to become puffy, smoke, or catches fire you need to be able to immediately handle the situation. Walking away for even just 5 minutes can spell disaster.
7. A LiPo fire is a chemical fire. Always keep a Class D fire extinguisher nearby your battery charging/discharging and storage area. The battery charging/discharging and storage area should be free from any materials which can catch fire such as wood tables, carpet, or gasoline containers. The ideal surface for charging and storing LiPo batteries is concrete or ceramic.
8. Never overcharge a LiPo battery. Typically a full charge is 4.2v per cell. Never “trickle” charge a LiPo battery.
9. Never discharge a LiPo battery below 3.0v per cell. Ideally you never want to go below 3.2v per cell to maintain a healthy battery. 2.9v per cell and lower is causing permanent damage.
10. Never leave your LiPo batteries sitting around on a full charge for more than one day. If by 24 hours later you realize you are not going to use your battery today, you need to discharge your battery down to 3.7v-3.8v per cell for safe storage until you are ready to use the battery again.
11. Always store your LiPo batteries at room temperature. Do not store them in a hot garage, or in a cold refrigerator. Even though a cold battery has less chemical reaction taking place which can prolong its lifespan, taking a battery out from a cold fridge can cause condensation to occur on the inside of the battery, which can be very dangerous.
12. Always remember that heat is the number one enemy of LiPo batteries. The hotter your batteries get, the shorter their lifespan will be. Never charge a battery that is still warm from usage, and never use a battery that is still warm from charging.
13. Depending on how they are used, most LiPo batteries typically do not last longer than 300 charge cycles. Leaving them around on a full or depleted charge all the time, running them completely dead, or exposing them to high temperatures will shorten this lifespan dramatically.
14. LiPo batteries do not work well in cold weather. The colder it is, the shorter your run times will be due to the slowing down of the chemical activity within the battery. If it is below 14F (-10C), LiPo usage is not recommended at all. Your battery could cause your R/C vehicle to suddenly fail without warning in these temperatures.
15. Always pack your LiPo batteries in your carry-on bag and never in your checked baggage when traveling on an airplane. It’s the law.

Extra Care

Protect your lipo's from accidental short circuits and dust, with the XT 60 battery indicator caps. These three bright colored silicone caps battery charge indicators which are designed for easy indication of your battery status, from FULL, STORE and EMPTY. So you will never be confused again about which batteries are charged or discharged, before flying. XT60 battery indicators easily provide Lipo batteries with full protection against accidental short circuit and dust.

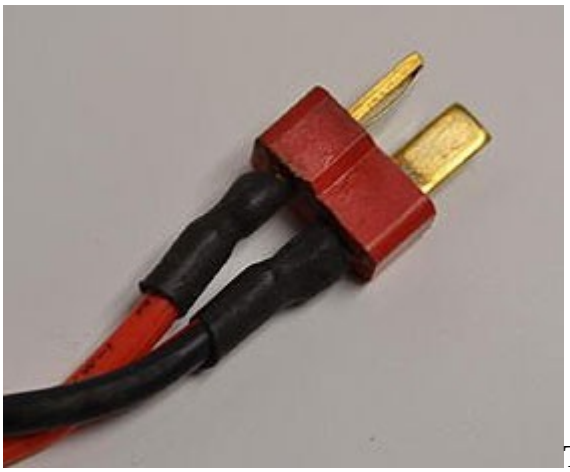
Connectors

It may seem funny to think about it but what is the actual purpose of an electrical connector? Well in basic terms it is a device used to connect two or more electrical elements in order to allow current to flow between the elements. In this context a connector is a device to connect different power system components together in order to allow an electric Rc model to function properly. But there is more to it than just connecting components together because that can be done without connectors. We need connectors that meet several needs including how well it allows current to flow, how easy the connector is to solder and use, and of course there are safety concerns as well. So the purpose of a connector for RC use is not simply that it can connect to components, it needs to be properly designed as well.

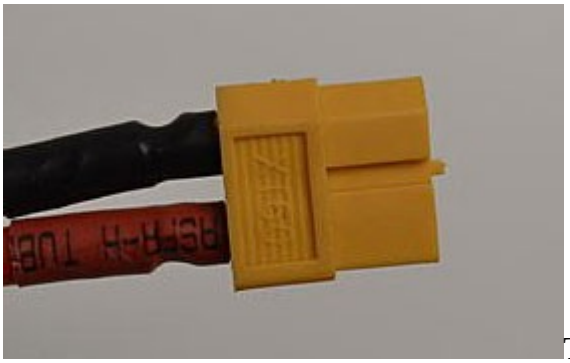
The **XT30, XT60 and XT90** connectors are designed to be used as per the wire gauge associated with your battery. As the name suggests, the XT30 suits smaller lipos and handle current up to 30A. XT60 can take 60A and perfect for midsize models. The XT90 is designed for use with bigger capacity lipos and handle current up to 90A.

Which battery connector is the best for your application?

If you are using a lithium polymer battery then you need a connector, the question is which one is the right one? There are various styles of connectors, some better than others. There are multiple reasons why many of us pick one battery connector style and stick with it. A standard connector gives advantage of charging and having the ability to swap batteries between different vehicles. To be able to move a single battery around like that you either need to make adapters for the connector or simply use the same battery connector on everything.



This is the original T-plug (Deans) connector. This was the first heavy duty plug that was being comfortably used on everything. These were purposely made for the RC industry. There are clones of this design and many of the clones plastic will melt if you get your soldering iron too hot when attaching your wires. The main issue with this plug is that they are a little tricky to attach wires to since they are simply flat. If your wires are very thick (larger than 12awg) then they are really tricky. They will also spark when you connect them if you are using a big LiPo.



These **XT60 connectors** are rated for 60 amps. This is the other alternative to T-plugs. These consist of 3.5 mm bullets that are shrouded with plastic. There is a male and female side. The great part about this plug is that the side you solder to is cupped. It will hold your solder and your wire a lot easier than a Dean's plug. The other advantage is that a lot of batteries ship with this connector. That means all you have to do is create some corresponding connectors for your charger/RC vehicle and you are in business. Disconnecting them can also be a little tricky.

The battery connector type you use is a personal choice. You may use a lipo that comes with the same connector type on every pack. In this case, using what the manufacturer ships with is the easiest way to go - no cutting and soldering.

 The use of adaptors like the one shown on the left gives you the ability to either use them on different setups or also for charge/discharge purpose.

Caution:
Also, when soldering do not expose your wire leads to high temperatures for too long, the wires conducts heat into the battery which could leave the battery damaged for too long, we recommend never to directly touch a soldering iron to your battery wires for more than 15 seconds, if so, you must allow for the wire to cool-down before soldering again.

And, Never ever try to cut both battery wires with pliers or a cutter at the same-time, the metal tool will conduct electricity and cause the battery to short-circuit. We also recommend to solder one wire lead at a time, while keeping the other wire lead under tape or heat-shrink. A short-circuit for even a second could cause a decrease in capacity retention and output.

Conclusion

Lithium Ion and Lithium Ion Polymer batteries are a great power source for projects but they require care during use and charging. They can be easy to damage or misuse and can hurt you or your property! All the batteries Hyperion sell pass testing and certification but you should still be careful with them. Read the Guide properly and follow our suggestions, as well as most important use your common sense!

Hyperion does not take responsibility for improper use of Lithium polymer batteries and the sole responsibility lies with the users themselves.