

Q: There are a lot of concerns about Lipo packs floating about on the internet. What is the real truth regarding the safety of this technology?

A: Many people have reservations about using lipos or allowing them at their track because of the outdated and often third hand stories floating around about packs "spontaneously combusting" without warning and for no apparent reason. The real truth is that a lipo pack is just like any other electron storage device: They don't do anything "spontaneously all by themselves". For a pack to fail destructively, the user has to do something to it first. It must have been damaged previously, or currently in the process of being seriously abused to fail destructively. If you follow the lipo rules below and never abuse the pack, it will provide you with many hundreds of worry free and consistent cycles. Like any other battery technology, lipos have been constantly evolving and improving in all areas. Safety, performance, and resistance to damage have all made very large advances over the last five years. Modern packs made specifically for the car industry represent the latest and most stable technology. It is actually extremely difficult to induce a failure involving flames even when these packs are intentionally and repeatedly abused.

Q: So what are these "rules for lipo" to make sure I safely get the most from my Core lipo packs?

A: The Lipo Rules:

A Lipo pack is damaged when any of the following rules are broken. The damage is cumulative and cannot be reversed, so you want to make sure none of these are ever broken to get the longest life and best performance from your Core packs.

Followed rules = hundreds of consistent cycles and a happy pack.
Unfollowed rules = less and less cycles before the pack does not perform anymore, and may result in a destructive failure depending on how many times and how deeply the rules are violated.

Rule #1) Proper cutoff voltage.

With modern car packs, it's best to have a cutoff set on your ESC (or separate cutoff device) at 6.0 to 6.4v for a 2 cell (7.4v) pack. Most common speed controls won't give you the option to set a cutoff voltage, but some products from Novak, LRP, Quark, and Castle Creations have the proper option built into them.

Damage always occurs to 7.4v packs when they are at any lower voltage than 6.0 volts, regardless of whether the pack is under a discharge load or not. If the resting voltage is below 6 volts the pack has been seriously damaged because the voltage when it was under a discharge load was actually much lower. The lower the voltage and the longer it stays low, the more damage is occurring. Sometimes just one time well below 6 volts is enough to permanently damage a 7.4v pack to the point where it will no longer charge or perform. It just depends how far below, and how many times previously it's been below 6 volts.

If your ESC doesn't have a setting for cutoff voltage, DO NOT use any lipo pack unless you have a secondary device to cut off the motor at the correct voltage. By the time the pack "feels soft" or you notice any decrease in power, the pack has already been damaged.

Rule #2) Maximum Temperature.

Any temperature measured on any part of the pack exceeding 60degC/140degF will cause damage. Generally the pack temp will INCREASE for about 5-10mins after the run is over, so temp the pack immediately after the run and then again about 10mins later if you think it's close to the maximum

In an electric system, amps = heat. The more amps you're drawing in the system, the hotter the batteries, ESC and motor will get. In cars, amps come from top speed. The faster the car is at full throttle (actual full throttle, not just full throttle with the radios endpoints turned down) the more amps the motor is drawing, the battery is delivering, and the ESC is flowing. I mention "actual full throttle" because of the way ESC's work. It doesn't matter very

much heat (amp) wise, if you turn down the throttle endpoint on your radio to slow down the car if it's too fast, or use all of the throttle (speed). It will heat up (use amps) just like its being run mostly wide open. It's very highly recommended to simply gear for the top speed you need for your track or running area, and not "dial out" throttle throw to slow the car down.

For most tracks with your Core lipo packs, heat (speed) will RARELY even come close to being an issue. The less capable the pack, the more it will heat up with the same load (think IB4200's vs. NiCad 2400's on a mod motor) and your Core pack actually has much more output capability than most any 10th scale ESCs and motors can handle!

Rule #3) Charging

Always charge your Core lipo pack at a 1C rate. "1C" means use the same charge rate as the Mah capacity of the pack. So for your Core 5000mah (5.0 amp hours) pack, the 1C charge rate would be 5 amps. Charging at more than 1C will reduce the cycle life and overall performance of your Core pack. This type of damage is poorly understood at this time, mostly because as the output "C" rate goes up with better generations of lipos, they are becoming more resistant to damage from "quick charging" at 2C, 3C, and above. However, all real world data at this time still suggests that even the most modern cells will still suffer from decreased cycle life when more than a 1C charge rate is used.

Rule #4) Storage

If you have Core lipo packs that will not be run for more than a month or two, you must store them at about 1/2 charge. Do NOT store them fully charged and DO NOT store them near fully discharged (down to 6.0v).

The best way to know the charge state of a lipo is to use a mah reporting device either when charging from fully discharged (read the Mah into the pack from your charger if capable. For a Core a 5000mah pack driven all the way to cutoff, charge it until you have 2500mah back into the pack and disconnect it from the charger for storage) or as you discharge it from fully charged. Using a wattmeter, or the discharge function on your charger, discharge a fully charged pack to 1/2 of its capacity. So for a fully charged 5000mah pack, discharge 2500mah from it before storage.

The Core packs require no special storage or transport containers. You can use your normal battery cases or drawers in a hauler bag. DO however try to keep your Core packs near room temperature (not out in the freezing cold or burning hot garage) for best performance at the drop of a hat. (More about temp and performance below)

Q: So how is a Core Lipo pack different than my old 6 cell NiMH packs?

A: Construction

A single lipo cell has a higher voltage than a single NiMH cell. Two lipo cells in series have a fully charged and nominal voltage that are similar to a 6 cell NiMH pack. So your Core 7.4v pack is actually made up of only two battery cells.

Voltage

Just like NiMH, the number of cells in the pack determines the pack voltage. Each lipo cell is 4.2v fully charged. Most folks are comfortable with the fact that each cell in an average NiMH/NiCad pack is around 1.5v fully charged. A six cell NiMH pack is around 9.0v fully peaked, and it is named a 7.2v pack (1.2v/cell) for its "nominal" voltage. A two cell lipo pack is 8.4v fully charged, and is named a 7.4v pack (3.7v/cell) for its "nominal" voltage.

As you can see, "nominal" voltage is fairly arbitrary in both cases, as it's neither the fully charged voltage, nor the fully discharged voltage, but somewhere in between.

Performance:

Your Core lipo packs are subject to the same rules of performance as any other battery. They are still an electron storage device, but in a different looking package and configuration than you're used to seeing. The main parameter controlling any battery's performance is its internal resistance. The lower the internal resistance, the more amps (speed/punch) it can deliver, the higher the voltage (speed/punch) it will maintain during that delivery and the cooler it will be at the end of the delivery.

In general, your Core lipo pack will maintain a very similar or higher average voltage under load than even the best hand zapped, pushed, tweaked, and matched NiMH pack. This corresponds to both

more power and speed on tap, and longer runtimes.

The most profound difference between a Core lipo and NiMH packs is that the output performance of the pack is exactly consistent from the first pull of the trigger to the last during a run. There is no "peak" to get over in the first few laps, and no "sag" in the later stages of the run as the NiMH pack starts to get soft. Your Core pack will also give you consistent performance run after run for its entire lifespan. No more relegating expensive packs to "practice only" after just a few runs!

Mah Capacity

One of the most interesting things about lipos is that as the Mah of the pack goes up - so does the output performance as well as the runtime. Your Core lipo pack is 5000mah in capacity, which gives you very long runtimes as well as more power capability than most ESCs and motors can handle.

Discharging

There is no need to discharge your Core Lipo pack before charging if you haven't used its full capacity. You may charge it from any state between fully discharged (6.0v or higher) and nearly fully charged (8.4v or lower) without worry of "memory" or reduced performance.

Memory

Your Core Lipo has no memory effect at all. This is beneficial because you can use the same pack for bashing, track practice and racing.

Resting Time

Your Core lipo pack needs no 24 hour "rest period" between cycles to maintain peak performance like a NiMH pack does. If you have enough time to recharge between rounds (about an hour or less), you can even use one single pack for an entire day of practice, heats and mains!

Q: "Can I use my Core lipo pack with a regular brushed motor and brushed ESC?"

A: Most standard brushed ESCs are not capable of providing the correct cutoff voltage to keep the packs from being damaged or destroyed from being drawn down too far. An overdrawn pack will be damaged and must be watched closely for the rest of its cycle life or be disposed of properly. Any over discharged pack can be a hazard when it's put back on a charger.

The good news is that there are devices you can have inline to either provide the correct cutoff directly, or sound an audible and/or LED warning indirectly to let you know when it's time to stop running. You MUST use one of these devices if you use a lipo pack with an ESC that does not have a proper lipo cutoff setting. By the time you notice the power falling off, it is FAR TOO LATE and the voltage is already too low and the pack has been damaged.

Due to the fully charged peak voltage of a good 6cell NiMH pack actually being higher than a 2cell lipo pack, your ESC and motor are in no danger. You may want to temp your motor the first few runs with a new lipo pack and re-gear for the track as needed, but just going from a high quality 6cell NiMH to a 2cell lipo pack shouldn't make a huge difference to the ESC and motor. The pack will be maintaining a higher voltage under load, so you will notice quicker acceleration and possibly higher top speed as well.

Q: why does my Core lipo pack have a plastic case around it?

A: Exposed Lipo cells can be very vulnerable to physical damage. If the thin silver cell envelope gets the slightest scrape, puncture or tear, the pack must then be immediately disposed of properly. Your Core lipo pack has an impact resistant plastic case to protect the pack from damage and ensure it has a long useful life for you. Bashing and racing with a non-encased lipo pack can be a serious safety risk, not to mention the potential to be an expensive replacement cost with any crash or loose battery strap!

Q: Every battery type has it's "tweaks" to improve performance.

Can I:

Zap the cells/pack?

Absolutely not. Zapping lowers internal resistance of NiMH cells by destroying the inner insulating layers of the cell, but at the cost of reducing performance life. Any such procedure attempted on a lipo pack would surely end in an immediate and dangerous catastrophic pack failure.

Charge to more than 8.4 volts?

CORE RC Lipo Information.txt

Absolutely not. Lipo packs are especially sensitive and intolerant of overcharging. Any charging over 8.4v will immediately and permanently damage your pack, and may lead to the destructive failure of the pack at any time.

“Re-Peak” the pack just before the race?

There are zero benefits to “re-peaking” a lipo because they are either fully charged, or not. The charging process puts capacity into the pack until the pack shows 8.4v at rest. There is no “peak” to lipo charging - only full or not full! In most cases the charger will see the voltage of the charged pack is already at 8.4v and not even begin the charge cycle.

Q: So what CAN I do to tweak the performance?

A: Starting Temperature

Like most batteries, lipos all have an "ideal output temperature". When run with a starting temperature of around 100degF, the internal resistance is at its lowest. So you get best voltage under load AND least amount of heat built up during the run if you start your Core lipo pack out at 100degF. Starting the run at room temperature may show a slight decrease in power output, but only with very high performance setups. A very cold pack (<50degF) can show poor performance in most setups until it warms up with use.

In the wintertime or in cold climates, it's best to store your Core lipo packs in a heated indoor living space rather than in a cold garage so they're ready for use at a moments notice.

For outdoor racing in cold climates, you can get an edge on the competition by pre-warming your Core lipo packs to 90-100degF before the race.

Quality Connectors

Your Core battery can only flow as much juice as the connector allows. You can actually see a large performance difference between the supplied beefy low resistance connectors, and the stock white connectors that come on most RC electronics. Quality connectors made for high amperage use will allow your pack to deliver its full power potential.

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