The Matching Process

Every time you do something like this, you want to start by looking at your motor. Is it the kind that the manufacturer recommends for your vehicle? Or, if you're putting your car together from scratch, is it the kind generally recommended for the type and size of vehicle you want to make? This information is usually available on vehicle packaging or in instruction manuals, listed as the kV rating (for example, 3300kV) and the size (length x diameter). You might not always be able to find a perfect match, but if your motor is as close to these requirements as possible, then you're off to an excellent start.

The next thing you need to do is figure out your motor's amperage; we'll explain why in a minute. This information might also be supplied by the manufacturer, which could make things simpler, but be cautious: their amperage might only be for the motor running at 90% or even 85% efficiency. Reaching 100% might be rare, but for maximum performance you want to make sure that your setup can support it, so it's best to work out the maximum amperage your motor will draw.

To do this, take the number of Watts your motor is rated at and divide it by the voltage of your battery pack (this will generally be 11.1V for a three cell Li-Po battery or 14.8V for a four cell version – if you're not sure which you'll be using just do both sums, there is 3.7v per cell). Motor watts/battery voltage = Maximum motor amperage. So if, for example, you're using a four cell Li-Po battery and your motor is rated at 550 Watts, then 550/14.8 will give you a maximum amperage of roughly 37.2.

Getting this figure will help you out in two ways. Firstly, it lets you know the figure you want your electronic speed control (ESC) to beat. A less powerful ESC might do the trick, but one that has a higher Amps rating than the motor/battery combination will never hold your vehicle back. Taking our 550 Watt motor/four cell Li-Po combination as an example, this setup means that you ideally want an ESC rated 37.2A or higher. A less powerful one might get you by, but this will definitely be enough (ie 40A and above for example).

This works the same way for the battery pack, which is this number's second use; ideally the amperage of the battery pack should exceed that of the motor, ensuring that even when the motor is running at 100%, the battery will not hold it back. If your ESC and battery pack are both able to handle more amperage than the motor will ever draw, then that motor will always be able to pull all the energy it needs and your vehicle will be able to realise its full potential.

Now let us address one of the misconceptions about getting the maximum power from your vehicle. You'll find plenty of people on the internet saying that if you switch up to using a bigger battery then you're going to get more power. This is true up to a point; if your previous battery was too weak, then switching up to one better suited to your motor will help. But this certainly won't happen indefinitely. Above a certain size, as we've just explained, the size simply won't matter any more because the motor is only ever going to draw the energy it needs. Whether there's more energy available or not won't make any difference if the motor has what it needs. Furthermore, you need to check your ESC will handle the current/amperage, otherwise it will hold you back or fry your ESC.

Check the above steps carefully, because you can save yourself a lot of time and money doing this the smart way. Figure out the amperage your motor will pull, and there'll be no costly trial-and-error involved in finding the right battery pack. You'll also do yourself a favour by not making your vehicle carry the weight of an unnecessarily chunky battery pack, which, unless you need the weight to balance your vehicle, could hold you back in terms of speed and performance. Pick a battery just above the motor's amperage pull rating, and you'll have the optimum power/weight combination.

But what if you don't know the amperage of your battery pack? It's not always listed, and if you can't find it out from anywhere, that could be a real headache. Fortunately, there's a quick calculation you can use to work that out as well. If you have the battery's milliamp (mAh) rating and C rating (if it is given for both charging and discharging use the discharge version), then you can calculate the amperage a battery can safely have pulled from it. You simply multiply the mAh rating by the C rating, then divide the lot by 1000: mAh x C = A.

Let's use an example; a battery rated 3100 mAh and 25C will have an amperage of 77.5 (3100 x 25 = 77500, 77500/1000 = 77.5). Assuming we were still looking for a match for the 550 Watt motor we were talking about earlier, which rated at 37.2A when using a four cell battery, then this 3100 mAh battery would be more than big enough, with 40.3 excess Amps. Talk about overkill… We'd definitely be looking for a lighter battery to improve that vehicle's speed.

But if you've done all of those sums, you now know everything you need to match your motor, ESC and Li-Po battery pack perfectly in your brushless RC vehicle. For a quick recap: 1) Make sure your motor is well suited to your vehicle using manufacturer recommendations, 2) Calculate the maximum amperage it will draw when running at 100% efficiency, 3) Find an ESC that will be able to handle said amperage, 4) Find a battery pack that can also handle that amperage, using our equations if need be. Do all of that, and your setup will be as close to perfect as can be. Result!