CLUTCHES 101: THE BASICS

Have you ever looked at the time sheet from a round of qualifying at a national level event or major money race? Did you notice anything that stood out? Did you notice that the sheer amount of karts in any one class has risen to huge numbers? This is most definitely true, but even more important than the length of the entry list is the fact that the lap times we now see are so close that competitors are separated by just thousandths of a second, and in some cases even less. Armed with the knowledge of how close we are all running these days, one can now start thinking about what would happen if you lost a few tenths or more from the guy in front of you as soon as the green flag flew to start a 20-lap feature race. If you were only a couple of thousandths quicker than this competitor in qualifying, will you be able to catch the kart and pass him before you run out of time?

I recently wrote an article for this magazine about chassis adjustments that some of you may remember. In that article, I mentioned something about covering all of your bases to be competitive. I want to remind you that this concept extends far beyond your chassis and set-up. In my opinion, a typical kart is made up of three sections or "bases": the chassis, the drive train, and possibly the most important one of all, your tires. In this particular article, we will take an in-depth look at the clutch, which I believe is one of the key components of your kart's drive train. We will attempt to dole out a few tips while presenting a general explanation of the components that make up the clutch, as well as how all of these components work together inside the unit.

I know that many of our readers completely understand each and every part of the clutch and how to make them work to their optimum, but for those of you who are not experts or are new to the sport, maybe I can offer some useful information. Many of the people who have been around this sport for a while, started in karting when clutches were fairly simple. In fact, I don't think I can remember giving them a great deal of attention until the competition level of karting started to grow, as it has in recent years. Technology has developed at an equal rate.

These days, clutches are still fairly simple and even though they have many more parts and seem much more complicated, they still work off of the same basic principle. Before we dive too far into this concept, I will go ahead and mention that regular maintenance is very important to the life and performance of your clutch. You must keep your clutch clean. Dirt is one of its primary enemies and I know that must sound great to all of the dirt racers out there, but dirt and heat top the clutch's enemy chart. Clutches have a lot of internal and external parts that must be able to move freely without any obstruction in order for your clutch to operate properly, so always keep your clutch as clean as possible.

Let's move into the clutch's basic operation. To put it bluntly, the clutch is responsible for transferring all of the power that your engine produces to the rear wheels. With this stated, does this mean that it's possible that your clutch could be more important than you engine? Maybe. If your clutch can't transfer the power that you've paid for, it doesn't really matter how much HP you have, does it?

Now let's move to the operation of the clutch. The clutch can be set-up to achieve various "stall speeds" (or what many of us refer to as "clutch slip") depending on a few contributing factors. We can break these factors up into three parts: **spring tension, lever weight and air gap.**

When you set-up a clutch, it is important to dyno your engine or contact your engine builder and find out at exactly what RPM your engine produces its maximum torque. This is the RPM at which you want your clutch to engage. This will produce the quickest acceleration and will get you running at your best.

I am sure that your next question is... *"I know where my torque peak is, but how do I set my clutch to engage at that RPM?"* This is where those three factors I mentioned earlier come into play, so let's look into them in a little more detail.

SPRINGS

Most manufacturers offer a few different rates or heights of springs to choose from. For example, the 'taller' or 'stiffer' springs would be used to achieve higher stall speeds (more clutch slippage), where the 'shorter' or 'weaker' springs would be used to achieve lower stall speeds such as on a junior kart with a restricted motor that produces less torque. A clutch achieves lock-up when the RPM's of the motor overcome the pre-set rate of the springs and allow the levers to 'sling out' and press the discs together inside the clutch. On most clutches, the springs are held in place by a bolt and a retaining washer. You can change the spring height by turning the bolt clockwise, which will increase the tension on the spring which will, in turn, raise the stall speed. The opposite would also be true for turning the bolt counter-clockwise to decrease the tension, which would lower the stall speed. This seems simple enough right?

Simply put, this means that when the engine produces enough force (torque), the levers are allowed to swing out and press the pressure plate down and squeeze the discs together, thereby engaging the clutch. This engagement point can be changed by adjusting the springs as stated above.

LEVERS

The levers are very simple to understand and are simple parts. The more weight that is placed on a lever, the faster it will sling out and force the pressure plate into the discs and engage the clutch. The levers, however, are still controlled by the springs - the stiffer the spring or the higher the rate of the spring, then the more force it will take to allow the lever to sling out. The more weight you put on the lever, the faster the lever can overcome the rate of the spring and achieve lockup. When the levers sling out, they are actually pressing down on the pressure plate and when the pressure plate is pressed down like this, it squeezes the discs together and engages the clutch. This incorporates the springs because they keep constant force on the pressure plate by pulling up against the levers. The key here is that you must find a medium where the springs and the levers can work together to achieve the stall speed or amount of clutch slippage desired. This is where the manufacturer of the clutch can provide you with some guidelines and starting points for the particular engine and class you are running.

Once you have a starting point, you can fine tune your clutch by adjusting your springs or your lever weights. This now brings us to the air gap of your discs which also affects your stall speed.

AIR GAP

Air gap is another very simple term to understand. Air gap is measured with a feeler gauge and is the distance between the clutch discs. This measurement affects stall speed because the greater the air gap, the further the pressure plate must travel to compress the discs and engage the clutch. Each clutch manufacturer has a suggestion as to how much air gap is recommended. I have found from my years of building clutches that air gap has the least affect on the stall speed of the clutch out of the three factors we have discussed so far. I have found that when the air gap becomes too great, the clutch cannot fully "lock-up" and can cause problems such as chatter. For example, if it seems as though .040" to .050" is ideal, the minimum air gap would be .030 and a maximum of about .060. As the air gap grows, you can use floater discs which are available in various thicknesses to keep your desired air gap at a constant amount.

MAINTENANCE

Now that we know and understand what affects a clutch's stall speed and adjustment, let's move on to some maintenance and re-building tips. As far as the friction discs go, there is not much maintenance. I prefer to replace them once the tabs start to become deformed or once the friction material starts to chip off on the corners. If your clutch is performing properly, then the friction discs will need to be replaced once they wear down. The floaters and the friction discs should also be replaced if they become warped. When these discs build heat, they may become glazed over and this is why they need to be re-ground. I do this with a medium grit emery cloth and a sanding block.

Your levers should be cleaned and inspected for wear (flat spots) on the nose of the lever, where it rides on the pressure plate. It is also important to make sure the dowel pin that holds the lever in place is clean and allows the lever to move freely. The thrust bearing should be run dry, by this I mean without any lubrication. I like to run the thrust washer without lubrication because you don't want any grease or oil getting onto the friction discs. You can replace a lot of thrust washers for a lot less than the cost of ruined friction discs.

A few more things to keep an eye on are the drum and the drive sprocket. The drum should be cleaned and checked for any distortion, especially where the friction discs impact the drum. If grooves become worn into this area, the drum should be replaced. The drive sprocket should be inspected for wear on the teeth of the sprocket. You should use a very small amount of grease in the sprocket bearings, but be careful not to use too much grease because it can also make its way to the friction discs. Another problem that the sprocket bearing faces is a misalignment, which can be caused by either a misaligned rear sprocket or serious axle lead. These two problems can apply pressure on the sprocket and can cause the bearing to be pulled out of the sprocket partially, so keep and eye out for this.

Hopefully I have given some of you a little insight as to how the clutch works, as well as how to maintain and adjust the unit for optimum performance and reliability.

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