



Modifications For GY6 150cc Based Engines

Quick and easy mods that get you more performance out of your GY6 150cc based motors found in most Chinese 150cc Scooters & Go Karts. This write up will look at ways to modify and increase the performance of gas scooter engines which are now also being used in go karts. There are different specific engine designs used on these go karts and scooters, but the principles on this page will also apply to many different engines. A lot of scooters and go karts are powered by a 150cc engine based on the Honda GY6 scooter engine design. The GY6 engine with CVT (continuously variable transmission) has decent performance for its small 150cc engine displacement. It surprising how well of a job a small 150 engine can do at moving an adult around on a scooter or even a heavy go kart. Of course, more power would always be nice, but considering the small displacement of this GY6 based 150cc engine, it really is impressive. Even so, mod kits for gas scooters and go karts are available, and other modifications can be made to increase performance further.

The GY6 based engine found in these scooters and go karts is like most any other internal combustion engine - in that it can benefit from some well directed modifications. This is true of just about any mass produced engine which have compromises that are driven because of manufacturing restraints like time and cost. These compromises usually limit efficiency and performance potential of an engine. **Increasing air flow through an engine is the goal. More air flow along with the appropriate amount of fuel will result in more power producing potential.** With that idea in mind, let's look at some ways that the performance of scooter engines can be increased.

1) Install a high flow air filter system. The stock air box can be eliminated and a high flow air filter like a K&N style or Uni foam filter can be used. For very dusty and dirty off road conditions on go kart applications, an oiled Uni foam filter is probably the best way to go. An intake tube can be made out of aluminum tubing, steel exhaust tubing, probably even PVC or other material that is the right size tube to match the air filter and carburetor intake diameters. A piece of radiator hose from an auto parts store can be used as a rubber connector between the carburetor and tubing. Just be sure to clamp everything together securely and make sure that there are no air leaks where dirt can enter your engine. The picture below shows a Uni filter installed along with a homemade intake tube on a go kart GY6 scooter engine.



GY6 Engine with Uni Filter

When using a foam air filter like a Uni or a fabric gauze filter like a K&N style, be sure to apply plenty of the proper air filter oil. Without the oil, the foam or fabric filter media will NOT be effective in filtering out damaging dust and dirt particles and you could (probably WILL) wreck critical parts like piston rings and probably scuff and score the piston and cylinder bore. What good is it to increase power by modifying your engine or installing mod kits for gas scooters and go kart engines, and then quickly wreck your engine because of sucking in dirty air?!? You won't have much power with a worn out cylinder or rings. Worse yet, a worn engine will burn oil and if you don't keep an eye on your oil level, you can seize and fry the whole engine because of lack of lubrication. The moral of the story is simply: don't neglect your air filter - check and clean it frequently!

2) Another way to increase the performance of a scooter engine is to increase exhaust flow. Stock mufflers can be cut open and gutted out, but beware that this can be loud. In addition, check to see if there is an aftermarket exhaust systems available for your particular go kart or scooter. There are mod kits for gas scooters that come with a high performance exhaust. Some stock scooter engine mufflers can be very restrictive and choke the ability of the engine to rid itself of exhaust gases and as a result prohibit the inflow of fresh air/fuel mixture into the cylinder. As a result, a restrictive exhaust can severely limit the airflow through and engine. An exhaust system upgrade can yield a big improvement in performance as long as the additional flow is combined with properly tuned carburetor... see #3 below!

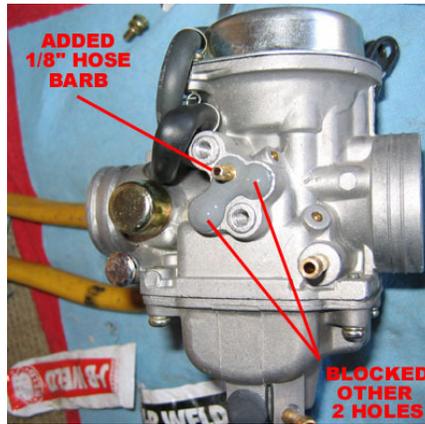
3) Re-jet your carburetor! Modifying your scooter engine for additional airflow will NOT increase performance, UNLESS you have the appropriate amount of fuel to go along with it to produce more power. Depending on the modifications you make to your engine, you should probably look to re-jet your carburetor with a main jet in the 120 -130 size range (for GY6 150 engines). Many of the GY6 scooter engines seem to use a Keihin style CV carburetor (24mm), so check with a motorcycle shop or motorcycle supply source that sells carb jets. It would probably be best for you to bring in your stock jet so it can be visually matched with a new one that is the right style. Best to error on the rich side (larger jet), because too small of a jet and you could run too lean and damage your engine. If someone were to put on a high flow intake filter and also a high flow exhaust, then you'd probably want to look closer to the 130 main jet size if you have the stock 24mm CV carb on a 150cc gy6 engine. Depending on elevation, a 125, 128, or 130 might work well with a high flow air filter and exhaust near sea level. You might want to buy a few different jet sizes and then experiment with what gives you the best performance. Read your spark plugs to see if you are running lean or rich under wide open throttle conditions. Just remember, that too lean of an air/fuel mixture can increase engine temperatures and cause engine damage. If in doubt, err on the rich side with extra fuel to help avoid engine damage.



Keihin Carburetor Main Jet

4) Eliminate automatic choke. Most of the GY6 scooter engines seem to come equipped with the Keihin style CV carburetor with automatic choke. In theory, this is a nice feature - the choke turns on by itself when needed and then shuts itself off - assuming it all works properly. Unfortunately, the automatic choke on these carbs seems to have a tendency to stick ON at times. As a result, the air/fuel mixture will be way too rich. This KILLS performance. There are a few ways to deal with this... one is to just remove and block off all passages in the carb for the automatic choke. An epoxy such as JB Weld can be used or one of the epoxy putties commonly found in automotive stores. If you primarily drive in warm weather, then the choke may not be needed anyway. However, if you drive in cooler climates, then you may need a way to richen the mixture so that you can get your engine started easier. Getting a whole new carburetor with a manual choke is one idea. Some of the newer Dazon buggies (go karts) are supposed to come with a manual choke carb on their GY6 engine. Also, a Mikuni TM24 carburetor can be used as a substitute, but since it's a slide carb then the throttle cable will need to be modified or replaced. The TM24 carburetor (or other manual choke carbs) also may require a spacer on the intake manifold to help the float bowl clear the engine shroud underneath. Another way to get fuel enrichment on a stock carb with choke removed is to add one of the plunger primers that are made for use on snowmobile or ultralight engines. This primer plunger can be pumped and squirt fuel into the intake and help with cold weather starting. A small 1/8" fitting needs to be added where the fuel is squirted into the carburetor or intake manifold. Also, a 1/8" hose needs to be added to supply fuel to the plunger primer. This supply

line can be T'ed off the main fuel line or fuel can be tapped off the float bowl or however it works best on your application. Adding this plunger primer is not the easiest method but it does work, and allows the stock carb to be used in cold climates with auto choke eliminated. A more direct bolt in carb like found on some of the Dazon buggy GY6 engine may be the easier choice for these 150cc engines. Just check to make sure that it will fit your particular application. Not all carbs fit all engines! In any case, whatever you end up doing, eliminating the stock automatic electric choke can result in much more consistent performance. If your engines runs consistently well all of the time, then don't worry about changing the auto choke. However, if your scooter engine runs strong one moment and then feel sluggish the next, then it MIGHT be the auto choke sticking on. Just be aware of this as a factor in performance.



Hose Barb added for Plunger Primer System



Plunger Primer installed on Off Road Go Kart

5) Advance ignition timing. Another way that people try to increase performance of a scooter engine is to increase ignition advance. Ignition timing is when the spark plug fires relative to the position of the piston (and crankshaft/flywheel). The gy6 engine has a magnet imbedded in the outside surface which passes by a pickup sensor that acts as the trigger for initiating the ignition spark. By changing the timing of the spark, it is sometimes possible to increase power and torque of an engine. There are a number of ways that this can be done. One way is to reposition the ignition pickup that is located next to the flywheel. However, to make any significant changes in timing this way, trying to move the ignition pickup may require welding and drilling/tapping of new holes for the ignition pickup mount. This is probably not the best way for most people. Another way is to take a stock flywheel key (that indexes the flywheel on the crankshaft and keeps position secure) and grind an offset so that the flywheel is repositioned relative to the ignition pickup. This is probably also not the most straight forward way of doing this. A different way that is more convenient is to install a performance CDI (capacitive discharge ignition) module that has additional ignition advance programmed into the ignition calibration. These may be included in some mod kits for gas scooters and go karts, or you can often buy one by itself. The CDI is sort of the brain of the whole ignition system and changing modules is as simple as unplugging the old and plugging in the new. Truly just Plug and Play! Just be sure you get a CDI that actually has a remapped ignition curve with additional ignition timing advance. Some modules might simply have a higher RPM rev limit. If you want to advance your ignition timing, then make sure the unit you get actually has the advance programmed into it!



Performance CDI Module

6) Another way to increasing air flow is to port the cylinder head. This article will not attempt to give specific instructions on all the "how to" details of porting. Just note that careless or improper porting can HURT engine performance. Even worse, porting done improperly can not only hurt performance, but result in damage to the engine. If you are not familiar with porting, then the best way to learn is to research, read up on the subject, watch someone who knows what they are doing, and then get some hands on experience yourself. Just don't experiment with a cylinder head that you can't afford to scrap. When porting any cylinder head, you have to be very careful not to damage the valve seat sealing surface. If you make a nick there, then it will at least require regrinding of the seat and if the gash is deep enough, grinding may not do it. In that case, a new valve seat may need to be installed or a whole new cylinder head purchased. In either case, it can be an expensive mistake.

The picture below shows a ported intake port of a GY6 engine head. The photo is not focused well, but you can still see that the intake port has been enlarged and the valve guide "knot" (the hump in the port where the valve guide protrudes) has been shaped more to a dull knife edge shape to help enhance airflow around the valve guide knot. **One of the most powerful tools to use during porting is the finger!** The finger can feel the shape of the port and help find spots that need to be worked on. A smooth air flow path is the goal. No abrupt changes in the flow path - especially where a passage restricts down to a smaller size. That is bad. If there is a mismatch in ports necessary, then it should be done in such a way that air flow goes into a larger diameter. In other words, mismatches should "step up" in size in the direction of flow. You don't want the airflow along the surface of a passage to slam into an abrupt "wall" (or edge) as it transitions to another passage.



Ported GY6 Engine Intake Port

On the exhaust port, the port can be enlarged to match a larger header exhaust if you plan to use one. If you plan to stick with a stock sized exhaust header, then just use a die grinder and sanding roll to clean up the casting surface in the exhaust port. You can shape the valve guide knot as well. On some race engine, builders will completely remove the valve guide knot in the ports to increase flow, but for most engines this is probably not a good idea because much of the valve guide bearing surface is lost, and in the long term the valve stems may then wear the smaller valve guide bearing surfaces too quickly. The valve may also not be properly supported with such a short valve guide.

7) Recalibrate your CVT (Continuously Variable Transmission). This can be a big one! Recalibrating your CVT will not increase the actual power output, but it can be one of the best bang for the buck modifications that you can buy. Most mod kits for gas scooters will also come with new parts for the CVT. A properly calibrated CVT can significantly increase the overall performance. The front pulley (driver) can be recalibrated with different roller weights to vary to overall RPM of the engine under driving conditions. Lighter roller weights will increase overall engine RPM. Heavier roller weights decrease engine RPM. Roller weights can be found for the 150cc GY6 in the range of probably 8 - 15 grams or so. Somewhere around 10 -12 grams would probably be a good place to start to experiment for heavier go karts. Lighter scooters may want to have a little heavier roller weights. Weigh your stock weights using a precision scale and select new rollers weights either lighter or heavier - depending how you want to change your engine RPM range. In addition to the front driver pulley, the rear driver pulley can also be

recalibrated with different clutch shoe springs to vary clutch engagement RPM, and also the main driven compression spring can be changed to a stiffer spring which also effectively boosts engine RPM under driving conditions. There is a lot to be said about CVT tuning, but to simplify many people can probably benefit from slightly lighter roller weights in the front driver pulley and also a stiffer torque (compression spring) in the rear driven pulley. These changes will effectively slow down the upshift of the CVT and allow the engine to rev up higher and have better torque under driving conditions. Don't go too far though. Too high of an RPM and you might be way out of your power band. Also, too high of an RPM can be annoying while cruising with low engine loads. It can feel like driving your 5 speed car in 3rd gear on the freeway. The buzzing of the RPM at all times can be annoying to some people.



GY6 Continuously Variable Transmission (CVT)



8) Other ways to increase performance of your GY6 engine. There are other ways that you can also boost the performance of your GY6 scooter engine. Boosting compression ratio can increase engine torque and power production of an engine. One way to boost compression on a gy6 engine (or other) is to have the head milled at a competent machine shop. A small slice of the cylinder head surface can be milled away which results in a small combustion chamber volume and which increases the compression ratio. Don't have too much milled off or you may boost compression too much (and need high octane race fuel), or you may have interference between the piston and valves (not good)!

CONCLUSION: Because of the popularity of the GY6 engine in the scooter world, there are many mod kits for gas scooters and go karts to boost gy6 engine performance. There are even big bore kits that boost engine displacement up to 180cc. Stroker cranks. Larger carbs. Different intake manifolds. Even aftermarket 4 valve heads. So, if you have a go kart then check out the mod kits for gas scooters because many of the parts may work on your go kart application. In addition, if you own a scooter, then check into some of the go kart engine mods because they may also work on your scooter. Regardless of what machine you own, performance upgrades can help increase the power output (and fun factor) of your go kart or scooter!