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Setup Guide

Tuned pipes, how they work and why

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There is a good reason for using a tuned pipe on your rc engine, it provides more power, a lot more power. If you want, or need more power, read on.

A tuned pipe is simple in the way it works, but first a word about why. For that, we need to understand a little bit about how the engine works. The basic two-stroke glow or nitro engine has two chambers: - crankcase and cylinder. The crankcase has an intake that opens to the atmosphere via the carburetor. The cylinder has an exhaust opening, and a transfer port inside connects the crankcase chamber to the cylinder. Other than bearings it has only 3 moving parts: - piston, connecting rod, and crankshaft. The crankshaft is hollow with an opening that passes over the intake port and opens or closes it to the atmosphere. The piston opens and closes the exhaust and transfer ports the same way as it moves up and down in the cylinder.

Tracing the passages fuel takes through the engine, we find that the crankshaft rotates pushing the piston up and creating a low pressure in the crankcase while the opening in the crankshaft has cut off the carburetor opening. The opening in the crank passes over the intake opening it to the atmosphere. The pressure difference between the inside and outside of the crankcase causes air to rush into the crankcase picking up fuel as it passes through the carburetor. The intake port closes before the piston starts its downward motion, sealing the crankcase. The piston comes down into the crankcase pressurizing the air inside by reducing the internal volume. At this time the expanding gasses in the cylinder escape through the exhaust port eventually causing lower air pressure in the cylinder compared to the crankcase. As the piston moves down, it uncovers the fuel transfer port, and again, the pressure difference between the crankcase and cylinder causes the air fuel mix to flow up into the cylinder. The air fuel mixture is then compressed when the piston moves up and closes both the transfer port and exhaust port. As the piston reaches the top the fuel is ignited. As it burns it produces heat and expands building pressure in the cylinder pushing the piston back down until the exhaust port is opened. It then escapes to the atmosphere. The process is repeated each time the crankshaft makes one turn.

This happens when we are dealing with a normally aspirated engine. That means only atmospheric pressure is used to move the air through the motor. Now if we can get some way to get more fuel into the cylinder at a slightly higher pressure, it will produce more power. That's what a tuned pipe does and here is how.

Air has mass, just like paper or water, only not as much, and mass has inertia that resists any change in motion. The hot gasses in the cylinder move down the pipe at a high rate of speed when the exhaust port opens, and this gives it a lot of energy, energy we put to use as follows. When the exhaust port is opened, the escaping gas is being driven down the pipe and constantly being replaced from the cylinder but when the exhaust port is closed we have a sealed cylinder open on one end (the tuned pipe) with gas rushing out. This creates a low pressure inside the pipe at the exhaust port, just before it opens. Think of it as a vacuum cleaner hose attached to the exhaust port to suck out the burned gases. That is basically what we are doing with a tuned pipe. By sucking out the burned gas from the cylinder we make more room for a fresh fuel charge. That means we get more fuel in the motor, and that makes more power. There is also a pressure wave that travels back down the pipe due to the narrowing tail end of the pipe, due to design this pressure wave hits the exhaust port just before it closes. This wave stops the fresh fuel charge from being sucked out of the exhaust before it closes and helps build even more pressure in the cylinder giving even more power and that is how they work.

Now here is how to tune a pipe to work with your engine. All pipes are in two parts, the header and the pipe itself, they are normally connected with a silicon tube and clamps. Before you even start you need to decide what prop you are going to use and put it on the engine and run it without the pipe, just the standard muffler. Use a tachometer and record the best RPM speed you can get out of the motor / prop combination. (Don’t ruin the engine running too lean, just tune it for best high end RPM.) Now install the pipe just as it comes out of the box, joining the two parts, using the full length of silicon tubing if possible. Now run the engine and record the new RPM figure. It may be less than with a muffler, or maybe not, that doesn't matter at this point we just need a figure to start with. Now cut ¼-inch off the end of the header pipe put it all back together and do it again. If you find the RPM has increased, record the new value and do it all again cutting off another ¼-inch. As long as you are increasing the RPM, keep shortening the pipe. When you reach the point where it makes no change or causes the RPM to drop off, you have it almost right, slide it out of the silicon coupler about 1/8-inch and try again. This should bring it back up to the best speed. You may have to move it out the full ¼-inch, but that is what tuning the pipe is all about. Just keep working with it until you get it where the engine attains the highest RPM. If shortening the pipe the first time causes the RPM to drop off, you need to make the pipe longer in ¼-inch steps until you hit the right length, hence using the full length of silicon tubing. That's all there is to tuning a pipe.

It takes some time to get it right but it can make as much as 10% more power when you do. Now here is the bad news. If you change your fuel or propeller you have to do it all over

again. Sorry but that is just the way it is. A tuned pipe is the easiest way to gain more power, but it isn't free. You have to keep retuning for every change you make until you get the best combination of prop, fuel and pipe length. Another thing that will affect the tuning is the atmospheric pressure. If the pressure changes, everything else can change as well. This may seem a lot of trouble? Yes, it is but if you need more power this is the best way to get it. Hope this helps reduce some of the mystery of the tuned pipe. It really is simple, it just takes a lot of repetitive tuning to make it work for you. Is it worth it? You bet it is, besides it looks cool on your airplane.