

Tuning 2 and 4 Cycle Glow Engines **May 15, 2008**

Tuning any glow engine for peak performance is a relatively simple process, but is made more difficult for the typical novice RC flyer because of a lack of knowledge of carburetor basics and engine instructions that leave a lot to be desired. What follows is a straightforward discussion of engine preparation, carburetor basics, and a five step process for tuning that could significantly improve the performance of any two or four cycle glow engine, especially one that hasn't been properly tuned before. The process applies equally to old engines that haven't been used for a while as well as new engines right out of the box.

Two-cycle engines are easier to adjust for peak performance than four-cycle engines, only because mixture changes are easier to hear; techniques for both, however are the same.

Steps for tuning provided below apply equally to new or old engines. However, old engines may require some work to eliminate leaks before tuning can be accomplished.

New engines need to be well broken in per manufacturers' recommendations before best high end and idle performance can be obtained.

The steps for tuning provided below are for typical two-needle carburetors without fuel pumps. Air bleed carburetors are different as far as low-end adjustment is concerned. These differences will be pointed out where appropriate.

Preparation:

1. If engine is new, make sure it's well broken in before fine-tuning. A new engine will not run or idle well out of the box.
2. Make sure head bolts, muffler bolts and muffler pressure tap are tight and there is no visible leakage of oil at the joint surfaces.
3. Check for cracks in fuel lines and replace if questionable. Make sure fuel tank stopper screw is tight.
4. If engine is old, check carburetor-to-engine "O" ring for integrity (cracks, brittleness, etc which can provide an air leakage path to crankcase). Is the bolt holding the carburetor to the engine tight?
5. Check tightness of engine back plate bolts and the integrity of the back plate gasket (if one is supplied). Silicone glue is a good cure for leakage here.

6. Make sure glow plug is tight. If you can't remember the last time you changed it, replace it with a new one prior to tuning.

Things you need to know:

1. Tuning is a trial and error process requiring patience where you make small mixture adjustments while listening to the effects of the changes on engine rpm.
2. An internal combustion engine is nothing more than an air pump. The more air you can put into the engine, the more fuel can be added and the more power can be produced. The amount of air entering an engine is controlled by the throttle. In general, the main function of a carburetor is to provide an optimum quantity of fuel into the engine to match the quantity of air entering the engine for any throttle setting. Most engines used in RC accomplish this task with two needles: a high-speed needle for full throttle conditions and a low-speed needle for idle/transition conditions. Air bleed carburetors are an exception to this. In these carburetors, air flow not fuel flow is changed to get an optimum air/fuel mix at idle/transition conditions.
3. Air bleed carburetors are cheaper to manufacture because they do not have a needle for controlling fuel flow at idle conditions. These carburetors are distinguishable by a small hole drilled into the front of the carburetor and a screw located to the side of the hole which is used to control the amount of air entering the carburetor at idle.
4. In general, if you are regulating fuel flow, turn the needle or adjusting screw out to richen, and in to lean out. If you have an air bleed carburetor, the opposite is true for adjusting idle mix.
5. Proper carburetor adjustment requires setting both high end and idle mixes.
6. High-end adjustments can affect low-end performance and vice versa. Low-end adjustments affect idle and mid-range acceleration/throttle response from idle.
7. Low-end adjustments are more sensitive to performance changes than high end. This is especially true for air bleed idle carburetors. Make small changes here.
8. New engines come out of the box with high and low-end needle settings notoriously rich. Some new engines come with a low end a full turn too rich.

Tuning is a Five Step Process:

1. Start engine and run for a minute or 2 with glow driver battery connected to get engine to operating temperature. Briefly go to full throttle to flush out excess fuel out of crankcase.

2. Adjust high-end mixture. Remove glow battery, if connected. Start rich and lean out until you get to peak rpm (you can use a tach, but your ears are good enough). Richen mixture until you get a 200-300 rpm drop in speed. Pick plane up and raise engine to vertical. Listen for rpm changes. If rpm increases significantly, the mixture is too rich. If engine seems to bog down, mixture is too lean. Adjust to optimum (slight increase in rpm) with "clicks" of needle (nothing major).
3. Adjust idle. If the glow battery is not connected, connect it now. Find a throttle position that gives a low reliable idle. Disconnect glow battery and listen to rpm. If engine gradually slows, idle mix is too rich. If engine is hard to start, idle mix may be too lean. Make mixture adjustments in small increments and test for RPM changes after each adjustment.
4. Adjust low end for smooth quick transition from idle to full throttle. Remove battery, if attached, and quickly advance the throttle from idle to full throttle. Any hesitation or smoky exhaust means low-end mix is too rich. If engine quickly dies, the mix is too lean. Make adjustments in small increments and test for smooth transition after each adjustment.
5. Readjust high-end mix. Go to full throttle and raise engine to vertical for 10-15 seconds. Listen for small speed changes and readjust high-end mixture as needed. Adjustments, if needed, should only require 1 or 2 "clicks" of the needle valve.

If you think you're done and your engine is running better than it ever has, don't stop here. Do steps 2 and 4 again. In a lot of cases, additional minor changes will find that "sweet spot" for maximum engine performance.

Good luck and good tuning!

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