Extend engine life

Helpful tips to keep your powerplant happy!

by the staff of Model Airplane News

Today's 2-stroke glow engines are technological marvels; they're powerful, lightweight, easy to use and, with proper use and care, will last for many years. Next to the radio system, the engine is one of the most expensive investments we make in RC. Over the years, we've learned a lot about the care and feeding of engines, and we know there aren't any secrets to operating a model airplane engine correctly. From adjusting the fuel mixture and choosing the best glow plug to proper maintenance and using common sense to improve reliability, this article is full of helpful hints and information to help you have a happy relationship with your 2-stroke glow engine.

EASY STARTING
Nothing is more frustrating than owning an engine that's difficult to start. Our frustration often leads to a flight that ends with a dead-stick landing or a crash. When you start any engine, there are three things to remember. For combustion to occur, your engine needs air, fuel and fire (heat). If your engine won't start, check the carb to make sure that air and fuel are available, and check your glow plug to ensure that it provides enough heat to ignite the air/fuel mixture. Remove the glow plug and attach the glow driver; its element should glow brightly. If it doesn't, replace it; if it does, reinstall it. Close the needle valve and then open it three full turns. Place your thumb over the carb, and flip the prop several times until fuel is drawn through the fuel line and into the carb. If you remove any one of these three elements from the equation, your engine will not start.

SECURE FUEL LINES
Proper fuel-line installation is very important. If your fuel line is too big, it may leak air or even slip off in flight. Fuel lines come in several sizes, so use the size that best fits the carburetor's fuel fittings. Air bubbles in the fuel line may cause the engine to run lean, and if the line slips off, the engine will die. Be sure that there is adequate slack in the line, and secure it to the fuel fitting with a wire clip or a small length of tubing slipped over the end of the main line.

TIGHT SEALS
If your engine begins to run erratically, and the mixture leans out even after you've adjusted the needle valve, you may have an air leak in the carb. Make sure that the carb is firmly and properly attached to the crankcase. If the intake is sealed with an O-ring, check it for cracks or breaks and make sure that it's seated properly, lies flat and isn't distorted when the carb-attachment screw is tightened. Make sure that all the adjustment screws and the needle-valve assembly are properly sealed and work correctly.

Last, check that the fuel-intake fitting is tightly screwed into place and that it isn't damaged or cracked. The fuel tank and fuel lines must be properly and securely installed. If you have previously nosed the model over or made a hard landing, the fuel pick-up clunk may have shifted forward in the tank; this can pinch off the fuel supply. The clunk and pick-up line should move freely, and you should be able to hear the clunk rattle in the tank.

FUEL FLOW
If your engine always runs rich or floods easily, check the position of the fuel tank. The tank should be installed in the fuselage so its centerline is at or slightly below the carburetor's spray bar. Use scraps of foam to position it securely so it can't
To improve fuel draw, attach a line from the pressure fitting on your muffler to the tank's vent line. If you use a third filler line with your tank close it off to allow the muffler pressure to enhance fuel draw.

**ENGINE CARE MADE EASY**

A reliable idle is very important, especially during landings. A carburetor can have either a low-end needle-valve adjustment (left) or an air-bleed hole in the front of the carb housing (right). Adjust the high-end needle valve before you adjust the idle.

**MOVE AROUND IN THE TANK COMPARTMENT**

If the tank is too high in the fuselage, fuel will tend to be siphoned out and run freely into the carb. Conversely, if the tank is too low or too far away from the carb, the engine may have difficulty drawing fuel into the carb, and it will run lean.

**A RELIABLE IDLE IS VERY IMPORTANT**

An engine that idles poorly can be frustrating. The last thing you want is for your engine to quit during a landing. Proper fuel mixture, too much fuel line between the tank and the engine and the type of fuel and glow plug you use move around in the tank compartment.

**IDLE RELIABILITY**

A tachometer is a very important accessory to ensure proper engine operation. Use one whenever you adjust the engine's air/fuel mixture to check the change in rpm.

**WHY USE A TACHOMETER?**

A tachometer is a flightline accessory that I can't do without! I started using one to adjust my engine's needle valve a few years ago, and now I find that using one ensures that my engines run consistently. A tach shows minute changes in engine rpm that you cannot detect by ear. Having the engine set a couple of hundred revs below maximum rpm is ideal. Using a tach to count the prop revs is also much safer than pinching the fuel line to check the mixture setting. Note that the engine should be well broken in; a tight, new engine will rarely hold a good needle-valve setting.

Here are some tips to help you properly adjust your engine.

- Set the high-speed (main) needle valve to the recommended factory setting, and start the engine. The engine should run somewhat rich.
- While using the tach, gradually lean the mixture (turn the needle-valve adjustment screw in, or clockwise) until there is no longer an increase in rpm. Adjust the mixture slowly, and allow the engine speed to stabilize.
- Once you've achieved peak rpm, richen the mixture slightly (again, using the tach) to reduce the rpm by 200 to 300.

Once you've set the high end, check the idle setting. After you have properly adjusted the engine, avoid the temptation to tweak the needle valve whenever you restart your engine. If atmospheric conditions (humidity, air temperature, etc.) change, however, then a click or two of the needle valve may be necessary. Again, use the tach to check rpm while making these adjustments. —Rick Bell
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A GOOD MIX
When you hear someone talking about adjusting an engine, you’ll often hear them refer to “the mixture.” This is the mixture of air and fuel that is combined in the carburetor. Fuel and air enter the venturi, become atomized and enter the engine through the intake port. The atomized mixture then enters the crankcase and is transferred to the combustion chamber through the bypass ports. The needle-valve assembly brings the air and fuel together and controls the ratio between the two. If there is more air in the mixture than the engine needs, the mixture is “lean.” If the mixture has more fuel than is required, it is “rich.”

Of the two, a too-rich mixture is preferred, as little (if any) damage will result from running your engine on the rich side. Running your engine too lean, however, will overheat it and, if you do it too frequently, you’ll damage the engine.

TWO-STROKE ENGINE OPERATION
A 2-stroke engine is relatively simple in operation. The crankshaft makes one complete revolution for every power cycle. During the piston’s upstroke, the fuel/air mixture above the piston is compressed for combustion. At the same time, a fresh mixture is drawn into the crankcase below the piston. After combustion, the piston is forced downward, and the spent fuel charge is expelled through the exhaust port. At the same time, a fresh fuel/air mixture is drawn through the carb and into the crankcase. The intake valve is sealed, and the mixture is forced through the transfer ports and into the cylinder above the piston to start a new power cycle.

1. As the piston reaches top dead center (TDC), a fresh air/fuel mixture charge is drawn into the crankcase because of the low pressure created as the piston travels upward.
2. The piston then compresses the mixture in the combustion chamber, and it is heated and ignited by the glow plug; this forces the piston down.
3. As the piston comes down, it opens the exhaust port, and the spent fuel begins to exit the combustion chamber. At the same time, the piston compresses the new fuel/air mixture in the crankcase.
4. At bottom dead center (BDC), the piston opens the bypass port, and the new air/fuel mixture charge flows from the crankcase into the combustion chamber as the last of the spent charge leaves.
5. The piston comes back up and seals the exhaust and bypass ports, and the entire process begins again.

HAPPY GLOW PLUGS
The glow plug is a critical part of the engine’s overall performance; you can choose from several types, but always refer to your engine’s instructions for the recommended plug. Glow plugs come with long and short thread parts, with or without an idle bar and are rated for hot or cold operating temperatures, but they don’t last forever. The first sign that a plug is on its way out is a drop in rpm when you remove the glow-plug driver; also, when an engine that normally idles well suddenly doesn’t run well at low rpm, you have a problem. If you use a plug that is too hot for your engine, the engine may suffer from detonation and pre-ignition and might overheat and run lean. Using a plug that is too cold will result in lower top-end rpm and poor idling. Small engines (.15 and smaller) should use short-reach plugs; a plug that’s too long may hit the top of the piston and damage the engine.

STAYING COOL
A cool engine is a happy engine. One of the worst things you can do to an engine is to run it lean. This increases its temperature and can drastically shorten its life. Always use a tachometer to adjust peak rpm and then richen the mixture slightly for a 200 to 300rpm drop from the peak
ENGINE CARE MADE EASY

reading. If your engine is inside a cowl (such as in a scale model), make sure you provide adequate ventilation. Ideally, the air-exit area should be at least twice the size of the air-entry area. Don't block the air outlet with the engine's muffler, or you'll greatly increase the engine's operating temperature.

PROPER COMPRESSION
Compression is important to a glow engine. As well as affecting the density of the fuel mixture, compression is also necessary for the glow plug to fire. If your engine becomes difficult (or impossible) to start, compression may be low. To fix this, check the glow-plug and engine-head bolts to make sure they are tightly fastened. You should also check the backplate attachment bolts. If the cylinder-head bolts are loose, air can leak into the combustion chamber, and this will affect performance. If you have been running your engine too lean, the piston and sleeve fit can be worn out, and this will prevent your having a tight seal. If this is the case, you'll have to replace the worn components.

FUEL FILTERS
There has always been debate about whether or not to use a fuel filter between the model's tank and the engine's needle valve. For years, I've run my engines without an in-line filter, and I have never had a problem with fuel blockage. This is because I filter the fuel three times before it gets to the tank.

First, I use a sintered-bronze filter as the pick-up clunk in my main fuel jug. It prevents any large particles from leaving the jug.

After the fuel exits the fuel pump, it passes through a Sullivan Crap Trap, which removes any fine particles the first filter may have missed. The Sullivan filter has a transparent body and a fine mesh screen at both ends; you can see whether there is anything in the fuel.

The last filter I use is a Du-Bro Final Filter. It has two micromesh screens to remove the tiniest particles from the fuel. I use this filter between the fuel-pump line to the model's filter line. The filters are progressively finer, and this keeps out any contaminants that might be in the fuel.

To minimize the chances of your fuel becoming contaminated, change the pick-up lines in your jug twice a year. The nitromethane in the fuel can degrade the lines, and they are inexpensive to replace.

—Rick Bell

ENGINE CORROSION
Corrosion is the main enemy of our engines. It forms on the bearings and other ferrous components. The alcohol contained in glow fuel is hygroscopic (it attracts moisture). To prevent corrosion, at the end of the flying day, always run your engine until it is dry of fuel and use after-run oil. When you've finished flying for the day, empty the fuel tank, start the engine and let it run until it quits. This will ensure that there isn't any fuel residue left in the engine. Squirt after-run oil into the carburetor and the glow-plug opening, and turn the prop manually several times to fully coat the inside of the engine with the protective oil. Before storing an engine for an extended period, remove it from your model, oil it well, wrap it in a cloth and place it in a sealable plastic bag for safekeeping.

How much fun we have when we fly our models is directly proportional to how well our engines behave. Taking proper care of them is the best way to keep them happy. It's time well spent and an investment that keeps paying us back. •

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