Engine Troubleshooting

Fuel.

Glow fuel is made up of methanol alcohol ideally 98% pure, castor and or synthetic oil and usually nitromethane. The exact mixture is up to the manufacturer of the fuel and is almost never on the bottle. Usually you will be told the percent nitro to alcohol and the percent of oil and if the oil is synthetic or not. What is actually in the bottle is anyone's guess. Some fuel also contains corrosion inhibitors, this is desirable in four cycle engines where the exhaust is more acidic.

If your engine changes its operation when you change fuel….. well dah….. However even if you use the same fuel, the manufacturer may change it do to mixing errors or maybe to rip you off or it just might be old..

Methanol is poisonous, keep all fuel out of reach of children, even older children who may not understand the difference between drinking alcohol and flying alcohol. Take this seriously, when I was in the Navy some sailors who were old enough to know better, drank some methanol and a couple of them died...

Problems with fuel.

1. The amount of nitromethane

Low amounts will cause low power and hard starting.

Too much will cause the engine to over heat and over rev.

2. Light

Nitromethane is light sensitive, light destroys nitromethane with a photochemical reaction.

Keep fuel in a light proof bottle. Plastic bottles like this are sold for use in photo labs or use a tin can (for safety reasons don't use glass). Keep just the amount you are likely to use in your flight box bottle and keep the rest in the cool dark.

3. Age

Alcohol evaporates, the warmer the fuel is the faster it evaporates.

The older the fuel is the more likely it is that you have lost alcohol. When you remove alcohol you change the percent of oil and nitro which will affect the way your engine runs.

Again keep only the minimum amount of fuel in your flight box bottle.

Keep in mind when you buy your fuel in the spring you are probably buying fuel that has been sitting on the shelf from last year! So the idea of buying "fresh" fuel for the new flying season, although a good idea may not do you any good….

It would be nice to have "born on dates" like some other alcohol products!

4. Temperature

The warmer the fuel the easier it will change into vapor inside your engine. Only vapor will burn, liquid fuel will not burn. (When you see liquid burn you are really seeing the vapor burn on the surface.) Your engine will work differently (not necessarily better) when the fuel has been sitting in the hot sun all day. A warm or hot engine can cause the same effect. That is why you warm up the engine before you fly. Fuel should be stored between 32 and 80 degrees F.

5. Contamination

The ports in your carburetor are very small even the smallest particle of dirt can clog the ports. If your glow plug is dry when you take it out this may be what has happened. The port size is critical, even a tiny change will make the carburetor unusable. For this reason do not try to clean dirt out with a wire or other tool.

Make sure you have a filter on your fuel bottle outlet not just on the clunk in the bottom of the bottle. Some people put filters on board the airplane in the hose going to the input of the carburetor. This is probably a good idea, but only if it is mounted in such a way that when you fill the tank you put fuel in through the output of the filter so that it is "back flushed" and cleaned. Remember that if the filter is clogged you have the same problem: No fuel reaching the engine.

Oil is in the alcohol for one reason to lubricate the engine. If you have contaminates in the fuel oil mixture you are grinding down the engine parts not lubricating them.

One of the main contaminants in fuel is water. Alcohol mixes easily with water. Exposing it to air allows alcohol to absorb water from the air. Water in your fuel is not a good thing of course, keep bottle tightly capped.

Glow Plugs

Short, Long, Cool, Hot

Plugs are sometimes rated as cool to hot. The size of the filament is mostly what determines this rating however the length of the plug has some effect.

A cool plug means that it will not as readily ignite your fuel. This sounds like a bad thing, but not necessarily, timing is very important. If the fuel ignites too soon the piston will be at top dead center or maybe not even all the way up, this is called pre-ignition. (It causes spark knock or backfiring in automobile engines.) If you ignite the fuel too soon while the piston is at top dead center or before, you can damage your main bearings or the engine will stop on you. In this case a cooler plug may help delay the ignition.

The hotter plugs are hotter because they have a larger filament and reach farther down into the ignition chamber. (Warning: some engines may not be able to use a long plug, because it can hit the piston when it comes up. (This is rare) Always turn your engine over by hand after you change a plug.)

If ignition occurs after the correct point, compression is less so the fuel air mixture is wrong, you loose power or the engine quits. Four cycles have this problem because of the length of time between ignitions. I.e. ignition / power stroke - exhaust stroke - intake stroke - compression stroke - ignition /power…..Do to the length of time the plug cools off and is slower to ignite the fuel.

Some plugs have idle bars, a small bar of metal mounted over the filament. This protects the filament from being cooled by the fuel thus the plug is hotter when starting. This sometimes allows a better idle.

I wish I could give you a rule to go by as to which plug to use, but there are none. There are too many veritable that effect what plug to use. It is another thing like fuel, start with what the manufacturer recommends then try everything else until something works…..

Problems with Glow Plugs;

Other then having the wrong kind of plug you can have other problems with glow plugs.

If the plug burns out it is usually a voltage/current problem with your glow starter. Only use the kind glow starter that has a single battery built into the unit. Never use the glow starter built into power panels mounted on flight boxes. They are never right and will blow your plug in an instant, you can easily knock the knob out of adjustment and fry the plug too. Not to mention that they are unsafe, it is easy to get the wire in the prop

If you are using a glow starter and still have bad plugs all the time your problem may be vibration, try balancing the prop or using (or not using) a soft engine mount. Some very high compression engines or engines that experience rapid throttle changes like on fun fly planes will blow plugs.

Another problem glow plugs have is the filament will be come clogged with oil or dirt, cleaning them works sometimes, but not often. Check the center connector on top of the plug, the insulator will sometimes crack or leak, bubbles around the plug insulator may be an indicator of this. Always check that the small washer is in place when you change the plug. This washer helps to seal the plug and lifts the plug up higher out of the combustion chamber.

Cracked filaments will not cause your engine to stop once the engine is running the filament will work even if there is no electrical connection as long as it is still in the plug. Of course it will not start your engine again.

Glow plugs also have problems with the screw threads striping on the engine. The threads on glow plugs are not always correct even though there is only one thread size. If the plug is loose or will not tighten you could be loosing compression. Unfortunately it is never the plug that strips, it is usually the engine. They do sell dies to re-thread glow plugs and it is a good idea to run the plug through the die to make sure it will not damage your engine.

If you are having problems with idle or low speed running and nothing seems to work you might try an on board glow plug starter that turns on whenever the throttle is set low. Note: This can be dangerous, your engine could start when you don't want it to. Be careful not to turn your prop with the power on, unless starting.

Needle valve settings.

Setting needle valves is somewhat of a "Black art" most engines have two needle valves a "High Speed" and a "Low Speed". The names are descriptive i.e. The low speed is adjusted when the engine is running at low speed. Setting one valve will affect the other, but it is minimal in most cases.

Always leave the low speed valve alone until you get the high-speed valve set. If your engine has run correctly before don't touch the low speed valve until you try everything else first, it is probably correct.

Before you start unscrew the high speed valve all the way out and take a good look at the end of the needle it should be smooth and slightly rounded, in addition the entire thing should be straight with no

bend. I have seen needles break off just the last 1/32 of an inch. This makes it almost impossible to adjust the valve if you have an engine that just will not get lean enough this may be the problem especially if it runs with the valve all the way closed or you may have damaged the valve seat..

1. Open the high speed valve about 3 turns from full closed. Note: Do not over tighten the needle valve when finding full closed you can and will damage the valve seat.

2. Start the engine if it dies immediately after starting try opening the valve about a half turn. You can't hurt anything opening the valve you can by closing it.

3. Once started open the valve until the engine starts to sputter, cough and smoke.

4. Close the valve until the engine is running fast and there is no smoke immediately start opening the valve again until the smoke just comes back. No smoke is a indication that the engine is too lean this is very bad. What you want is the engine running the way you think it should and still putting out light visible smoke.

5. Fine-tune the engine for the best sound with it still putting out smoke.

6. Now with the engine running fast, pinch the fuel hose so the fuel is cut off for a second.

a. If the engine speeds up then slows down after you pinch the hose, close the valve some.

b. If the engine speeds up and continues at the same speed after the pinch you are close the valve should be closed just a little more.

c. If the engine does not speed up and continues running at the same speed after the pinch you have the correct setting.

The low speed valves is very touchy make only tiny adjustments and write them down if you can. Trying to remember if you turned the valve clockwise and how much after a ten-minute flight ending in a dead stick is hard to do. Make sure your engine is broken in and warm before you try to adjust the low speed needle valve. If your engine is still new and tight it will not likely idle correctly at any adjustment. Make sure you have adjusted the high-speed valve before you start on the low speed valve.

Never try to adjust the low speed valve with the engine throttle open by more then a third. Ideally it should be at the idle setting..

If the valve has not been adjusted since it left the factory work from there skip the rough adjustment. If you are sure it is wrong use one and one half turns from closed as a starting point. When you are finished you want the engine to idle smoothly with just a little smoke coming out of the muffler.

First you have to rough adjust the valve. Open the valve first until you start getting raw fuel coming out of the muffler and the engine dies as soon as it goes to idle. Now start closing it down until you have little or no smoke. Now fine adjust it no more then 1/8 of a turn at a time until you see some smoke and the engine will run at the speed you want it to run at. New fliers need someone to help them determine what this magic speed is. Do not rush this, remember the engine is using very little fuel so adjustments are slow to take affect, count to 30 before you make another adjustment. Try the idle with different amounts of fuel in the tank it will be most important when the fuel in the tank is low because that will be when you are trying to land and need a good idle. Once you have the low speed adjusted try not to mess with it again, it should not change unless you change fuels, altitude or air temperature.

If you can not get a good idle, try a smaller or less pitch propeller. If the engine is under too high a load it will not idle at a slow speed. Another thing that will keep an engine from idling properly is if the engine has bad bearings or has a bind. Take the glow plug out and turn the engine over slowly it should be smooth and not bind at any point. ABC engines will have tight points, but they should not bind. Now check for play from side to side at the point that the crankshaft comes out of the engine. There should be a small amount, more if it is a bushing engine then with ball bearing engines. Any excessive slop will allow air to leak into the engine around the shaft and indicates that the bearings are worn.

Fuel tanks

Most fuel systems work by having pressure from the muffler pressurize the tank in the airplane, pushing the fuel out of the tank into the engine. Some engines have pumps or even use gravity feed.

If you look inside the air intake of the engine you will see a small brass tube that runs across it, this is the port that the fuel is sprayed from into the carburetor. The center of your fuel tank should be at the same level as this port no matter how the engine is mounted. If the tank is too high it will have what is called a positive head and too much fuel will flow into the engine. Sometimes the fuel will even siphon into the engine and leak out of the carburetor when the engine is off. If the center of the tank is too low the engine will run lean and have trouble getting enough fuel when the fuel is low in the tank.

If you can not get the tank high enough you might look into buying a small fuel pump, they mount onto the back of the engine and vibration pumps the fuel, they do not need electric power..

Most problems with fuel tanks are caused by leaks in the tank or hose. Even a pinhole will keep an engine from running. Leaks in the bottom of the tank or output hose are obvious as the fuel will leak out, although some small leaks may not leak fuel until the tank is under pressure. Unless the leak is huge it will not effect the running of the engine, however some holes leak air into the fuel line, not fuel out, this is what will cause your engine to run badly. Watch your fuel line with the engine running if you see bubbles in the line you may have a leak or the fuel is foaming. Leaks in the pressure side are harder to find, but effect the pressurization of the tank. Pressure problems can also come from the muffler if the pressure port is clogged or the muffler is loose you can loose pressure.

The best way to check out a tank is to disconnect the hose from the engine and blow through the tank. You should feel very little backpressure. If you do check for pinched hoses or the pickup hose in the bottom of the tank kinked. Now pinch closed the pressure hose on the muffler and pressurize the tank like you were blowing up a balloon. Now hold the pressure you should not feel any pressure loss. If you do you have a leak. IMPORTANT let go of the pressure hose FIRST, before you release pressure with your mouth or the pressure in the tank will pump a mouth full of the worst tasting cocktail you have ever had into your mouth!!! (Of course if you have ever done this before you already know that.)

Another problem is fuel foaming. If you have too much vibration the fuel will mix with air in the tank and foam. If this foam gets into the fuel line the fuel mixture will be screwed up. This often happens during a high speed run when the fuel is getting low. It is almost impossible to see this problem on the ground, but if you see bubbles in the fuel line and there are no leaks this may be the problem. A soft engine mount or padding the fuel tank and balancing the prop may help a lot. An engine that is setup correctly and suddenly stops in the air especially right after increasing altitude probably has this problem.

On your first flight of the year pump some fuel into the tank then shake the airplane. Then pump the fuel out again and discard. You do this to clean the tank up, the fuel and oil left in the tank all winter can turn to goo.

One other problem I had using a small 2oz tank, the fuel hose inside the tank between the clunk and the fuel fitting was so stiff that the clunk would not reach the bottom of the tank it just stuck straight out. I had to add weight to the clunk to get it to the bottom.

Engine Running \ Starting Symptoms;

Engine Refuses to Fire

Weak or dead battery; bad connector, wires, or burned out glow plug. Check the circuit, the glow plug should glow bright red/orange. If all the above checks out, is the engine getting any fuel?

Engine Starts, Slows Down, Stops

Engine is too rich. Close the needle valve and flip prop until engine fires. It should run for a few seconds then die. Repeat a few more times until it won't fire, then reopen the needle valve to restart the engine.

Engine Starts With Lots of Power, Runs for a Few Seconds, Then Dies

Engine is not getting enough fuel; mixture is too lean. Open needle valve slightly and try again. If this problem persists, more may be wrong. Check the carburetor for dirt. If necessary, disassemble and clean it. You could also have pinholes in the fuel line, so check it carefully, and replace if necessary. Finally, make sure the fuel line is not pinched inside the fuel tank compartment.

Engine Turns Hard and Does Not Start

It's flooded! Close the needle valve and remove the glow plug. Turn the engine upside down to drain the cylinder, rotate the prop also to help remove excess. Next, replace the plug and try again with the mixture screw leaned out more. An electric starter can help out here, but do not apply the starter and crank, and crank, and crank until the engine starts. Use short "blips" of the starter as this will turn the engine over several times, and help preserve battery life, spinner life, and engine parts. reinstall a new glow plug, reopen the needle valve, and proceed with the manufacturers starting instructions. Make sure you don't prime the engine or choke it to much!

Overheating, Over revving

If your engine over heats it will randomly stop for apparently no reason or freeze up.

Using too small or too low of a pitch in a propeller will cause the engine to over rev. this not only wears out the engine quickly it also overheats it. Most engines have a recommended propeller in the instructions. You may have to use one a little bigger or smaller then the one recommended according to the aircraft it is on, but you should not go too wrong if you stay in that area. If you have a tachometer you can easily see if the engine is in the manufactures suggested RPM range.

Using too high a nitromethane content can also cause overheating do to over revving and because the fuel burns at a higher temperature.

If something is plugging up your muffler the engine will run a lot hotter then it should do to back pressure. The use of rubber extender tubes restricts the exhaust flow and will cause overheating, low power output and poor idle on two cycle engines. Four cycles will tolerate extenders usually without problems.

On aircraft with cowlings around the engine you must have air holes to allow air to cool the engine. Just because you have a hole for air to get in does not mean anything if you do not have a hole for air to get out.

The leaner the fuel setting the faster the engine runs, but it also makes the engine hotter. Make sure you have some smoke coming out of the muffler at all times.

On four cycle engines if the valve timing is out so that the valves are open a tiny bit all the time the engine will overheat. When setting the timing, error on the too wide side there must be some clearance however small. On two cycles too hot a plug can cause the engine to work against itself making it run hotter.

Engine Preventive Maintenance.

The best thing you can do to prevent engine problems is to keep your engine clean. Dirt causes a lot of problems that are not always obvious as to cause. Most dirt enters through the carburetor, but can also enter through contaminated fuel or loose muffler connections. One of the most risky times is after a crash or landing in high weeds, dirt and plant material may enter the engine at this time. Never turn over an engine after a crash until you make sure all dirt has been removed from the carburetor. If dirt may have entered the carburetor you should remove the carburetor from the engine and wash in clean fuel. Check the input hole under the carburetor for dirt before replacing the carburetor.

When fuel burns it chemically changes, the exhaust gases and waste oil become acidic and can quickly corrode ball bearings and other parts in your engine. The best way to prevent this is to use after run oil. You can buy bottles of after run oil at most hobby outlets, but a lower cost alternative is to buy air tool oil. Most large hardware stores have several brands. The reason you have to use air tool oil instead of motor oil is that it is not petroleum based. Petroleum based oils can attack the silicone o-rings in a glow engine. If you have a gasoline engine use any good 2 cycle motor oil, do not use air tool oil, as it will attack your neoprene rubber fittings. Make sure you check the manufacturer's instructions before using any after run oil, some glow engines with pumps can be damaged with after run oil.

With 2 cycles engines simply drip some after run oil into the carburetor while turning over the engine by hand until you have put about one half ounce into the engine.

With four cycle engines you will have to connect a fuel hose to the crankcase breather port and inject a half ounce of oil with a syringe while turning over the engine by hand. This is best done with the airplane held tail up so the oil is more likely to run into the bearings. Next inject another half ounce into the fuel input port with the throttle open this time make sure the barrel of the carburetor is pointing up or the oil will just run out.. This is messy and oil will be dripping out of your engine until you go flying again, but it is better then having your engine freeze up.

Next time you go flying make sure that you turn the engine over a few times by hand before starting to make sure the engine is not full of oil and liquid locked.

Four cycles require that you check the valve timing and clearance every so many hours. Your instructions should tell you how to do this. Basically you turn the prop until it is at TDC on the compression stroke at that time the valves should be closed and there should be a small amount of clearance between the valve arm and the valve stem. The hard part is determining when the engine is in the correct position. It is critically important that the arm not touch the valve stem. Remember that when the engine is hot the clearance may be smaller do to expansion. If the valves are left open even the smallest amount they can be burned, you also lose compression and power.