ENGINE RUNNING - IN FOR TWO-STROKE MOTORS

From Model Airplane News 1975 – edited by the Windsock

The aim of running in an engine is to get the engine to the point where all the rubbing surfaces are nicely mated to each other at all temperatures likely to be attained while causing as little wear as possible in the process.

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The method used to achieve the above is simple. Run the engine very rich and lightly loaded at first; gradually increase the amount of work the engine is allowed to do, at the same time gradually increasing the temperature that the engine is allowed to attain, by careful use of the needle valve. This gradual process is spread over approximately the first hour of the engine's life and at the end of this period it should be ready to operate at maximum speed.

All running-in is done with the throttle fully open. Start by using one of the larger diameter, with less pitch props recommended by the manufacturer and a minimum of 20% oil.

Run the first full tank really rich, keeping the glow-plug driver attached if necessary to keep the engine running. Limit all engine runs to a short duration with a few minutes cooling down time between each run.

For the next few runs set the needle valve to give a fast four-stroke with the hint of two-stroking. Allow the engine to run for 30 seconds and then close the throttle or richen up the needle to slow the engine for 20 or 30 seconds cooling period – open the throttle again for 30 seconds then allow to cool again. Gradually increase the length of the full throttle period over two full tanks of fuel. At the end of these, lean the engine out to the point where the engine is two-stroking and four-stroking (ratio about 60/40) and repeat the procedure of short runs, gradually being increased in length for the next two full tanks.

The engine should now be ready for full speed running, but still needs the first couple of tanks to be short runs, gradually increasing in length. (If the engine is to be used with a tuned pipe then it will need a longer running-in period.)

The reason this procedure must be completed in small and gradual increments is that the facing surfaces have to be mated at gradually increasing pressures and to further complicate this the shape of the parts change as temperatures are increased.

Now that the engine is run-in check all screws and bolts for security and if you have to tighten any cylinder head bolts, remember to tighten a little at a time and in diagonal rotation. You might also find the glow-plug has been affected by small metal particles fired at it during the running-in period. If you have any doubts replace it.

SETTING THE MAIN NEEDLE

This is a most important setting as not only does it set maximum power, but it also controls the running temperature of the engine and from there the length of the engine's life, the life of the glow-plug and the overall reliability of the engine.

Engines don't often cut out in flight because they are set slightly too rich, but they most certainly do when set too lean! The result of which can be all too familiar!

SETTING THE HIGH SPEED

- Start the engine on low throttle, for safety and easier starting.

- Once started, open the throttle fully and set engine to max speed.
- Leave the engine to warm up thoroughly at top speed for a minute or so, then adjust the needle to see whether an improvement in RPM can be achieved.
- From this point richen up slowly until a small but definite drop in RPM is noticed with the engine two-stroking
- Lift the nose of the model up vertically and if the small loss of RPM is regained then you should have a good engine setting for flying.
- If the engine has a tendency to go rich or go lean in flight then an extra allowance will have to be made for this on the final setting.
- The aim of this is to get maximum power from the engine when it is needed most, either when the model is climbing or when turning sharply
- If the engine will respond whilst the nose is continually held vertically, then this is the perfect setting for reliability, durability and efficiency

SETTING THE LOW SPEED

The need for a low speed adjustment on the carby is because as the throttle is closed it lets less air through into the engine and to keep the fuel/air mixture within combustible limits the fuel flow has to be altered.

To adjust the low speed mixture:-

- Start the engine, warm it up and make sure the needle valve setting is correct.
- Connect the glow-plug lead to energize the plug then slow the engine down by gradually closing the throttle until the engine starts to run badly.
- Adjust the slow run set screw to give smoothest running characteristics just a little on the rich side of fastest setting.
- Having made this adjustment, slow the engine further until it runs badly again – now re-adjust the idle set screw until the engine runs smoothly, and continue this process until the desired idle has been reached.
- Remove the glow-plug driver and repeat the whole process.
- If the engine cuts dead in the middle of adjustment it's usually because the setting is too lean. If the response is slow and delayed it is still too rich.
- Once we have reached a good idle check if the engine will pick up properly. Open the throttle to full speed as fast as a servo will move it.
- If the engine picks up but splutters a little, the low end set screw is on the rich side.
- If the engine appears to miss and then picks up suddenly the low speed is slightly lean, and if the engine cuts dead when the throttle is opened, richen the low speed set screw and try again.
- If the engine starts to pick up pretty well and then cuts at about half speed or so, try opening the main needle two or three clicks.
- Note:- On many engines (usually the cheaper brands) there has to be a compromise or two to get the low speed, midrange, top speed and pickup to "gel" into a usable whole; usually the compromise is that somewhere in the range the carby has to be set a little richer than would be considered ideal.

ENGINE RUNNING IN
for FOUR STROKE MOTORS

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Exactly the same principle applies to four-strokes, just some of the symptoms are slightly different.

When running-in manufacturers recommend using a fuel with 20% castor and 80% methanol for the first hour.

A four stroke engine cannot be made to four-stroke when rich, it's already doing it but what does happen is the engine misfires in a rather uneven manner, the richer the setting the more pronounced the misfire. The main needle, after running-in should be set in exactly the same manner ie. just on the slightly rich side of maximum RPM, when the engine is thoroughly hot.

If the main needle is set too lean the engine may slow down with the exhaust exhibiting a more leaden note than usual and may progress to the point where the engine stops with a bang due to "detonation" and throws the propeller off in flight, or on the ground and perhaps at whoever is standing in the way!

"Detonation" is like early ignition but the difference is that instead of the mixture burning progressively from the glow-plug outwards, the temperature and pressure in the cylinder are such that the whole fuel charge ignites at the same time, before TDC stops the piston dead, and blows it back the other way.

"Knocking" or "Pinging" are akin to a more mild form of detonation that occurs late enough in the compression stroke for the flywheel effect of the propeller to get the piston over TDC and therefore for the engine to keep running. Always close the throttle when this happens as it overstresses the engine.

The main defence against these phenomena is to run the engine a little richer.

This works in two distinct ways, first the richer mixture will keep the engine a little cooler, thus making the conditions for commencement of knocking harder to attain and secondly and very importantly, a rich mixture is much less prone to detonation than a lean mixture. These two effects work together, either for you or against you depending whether you set the main needle rich or lean.

The low speed needle is adjusted in the same manner as a two-stroke engine.

Note:- Cheaper engines require a longer and more careful running-in period.

Cheaper engines do not usually last as long as the better quality well known engines brands and in the long term are not as reliable and definitely much more troublesome! Buyer beware – you get the quality you pay for!