Diesel Engine Basics by Ian McQueen

Elfin 2.49 diesel

2.49 cc Front Induction.

Made in England from 1947 to 1958

The Elfin was popular for all kinds of aeromodelling applications and it still is with SAM.

A model diesel engine is a "compression ignition" engine, physically the same as a glow two-stroke engine apart from the design of the cylinder head, and we'll get to that part later.

One of the facts of physics is that if a gas is compressed quickly, its temperature rises. If the compression ratio is high enough and the compression rapid enough that very little heat is lost from the gas, the temperature achieved is high enough to ignite an air-ether mixture.
This ether (di-ethyl ether, once used as an anesthetic) is a critical component of model diesel fuel because of its low ignition temperature.
Typically it makes up 32% or more of the mixture.

The main power ingredient is kerosene (or jet fuel, which is more highly refined). It has more energy per unit volume than ether. The ether is required to ignite it. The rest of the fuel is lubricant, usually castor oil. It is much better if there is also 1.5 - 2% of an ignition improver like the amyl/hexyl/octyl/iso-propyl nitrate. This makes starting easier, makes the engine run more smoothly, and reduces loads on internal parts by reducing the compression ratio required to run the engine.

Those are the fundamentals, but they don't begin to explain the advantages of a diesel engine. I consider the biggest feature of a diesel to be its great flexibility, its ability to turn a large variety of propellers. Why this is important leads first to a discussion of propellers.

Propellers

A given engine can drive a propeller of large diameter and low pitch or one of small diameter and high pitch. A large-diameter, low-pitch prop moves a large volume of air at moderate speed and provides high thrust.
It is like low gear in a car: lots of pulling power, but not able to move the vehicle very fast.
And a small-diameter prop turning at high speed provides a high-speed blast of a relatively small volume of air. It is like high gear: it doesn't have the thrust to get the car moving from a standstill, but can drive it to high speed once the car is moving.
On a racing plane, a large, low-pitch prop would scarcely get the model flying. On a slow-flying model, a small prop turning at very high speed would generate very little thrust and

would have difficulty getting the model moving.

For a slow-flying model, the optimum large prop will be turning at a relatively leisurely pace, say 6,000 - 11,000 rpm, while the smaller prop of a fast model will be going a zillion rpm. Converted from metric, a zillion might be 11,000 up to more than 30,000 for racing. In any case, the pitch must be high enough to move the plane at the intended speed when it is turning at the speed that the engine is able to turn it.

Glow engines are usually designed to develop their power at quite high rpm, say 11,000 to 15,000 rpm or more. They are happiest with relatively low loads, in the form of props with relatively small diameters.
If loaded down with a large prop, they may overheat due to pre-ignition.
Here's a brief description of why.

In a glow engine, the fuel will begin to burn at a fixed point on the upstroke (with some caveats). With a suitable, relatively small, propeller, this point will be such that the engine fires at just the right time so that the maximum pressure is reached just at TDC.
If you put a large prop on that engine, it will still fire at exactly the same point on the upstroke. However, the higher drag of the prop is causing the crankshaft to turn more slowly and prevents the piston from moving as quickly. The result is that maximum pressure will be reached <before> the piston reaches TDC. This is preignition and puts a strain on all moving parts of the engine: the piston crown, piston pin, con rod, and crankpin. It can often be heard as a pinging or cackling, and the effect is that the engine will overheat. It can be seriously damaged. (Note that the fuel in a properly-operating engine <burns>. Very rapidly, but it is still burning. It does not "explode" or "detonate". Those words describe undesirable pre-ignition.)

A diesel, on the other hand, can turn the ordinary props used on glow engines at very respectable speeds, but it can also swing larger props because the ignition timing can be varied so that the fuel begins burning at just the right point on the upstroke, just as the spark is timed precisely in an automotive engine. How is this done?
A model diesel has a screw of some kind in the head. (There are a few exceptions, but they're not important.) It pushes against a contrapiston, a movable "plug" inside the top of the cylinder that forms the top of the combustion chamber. Pushing the contrapiston down with the screw decreases the volume and thus increases the CR, so the point on the piston upstroke where the required temperature is produced is lowered. This advances the timing. Conversely, turning the screw out allows the contrapiston to be pushed farther up the cylinder when the piston rises and the trapped gas presses against the bottom of the contrapiston. (Sometimes it sticks, but that's one of the things that make diesels so interesting!) Raising the contrapiston lowers the CR and retards the timing so that a larger prop can be driven with no risk to the engine.
To show the effectiveness of this control, the people at PAW once put a huge 18-6 prop on a PAW 35 engine and started it. It could turn only 3500 rpm, but it ran for <five hours> straight with no damage to the engine! The test was stopped just because the people wanted to go home.

Mills Diesels

The English Mills diesels in 1.3cc and 0.75cc are remarkably efficient in turning really large propellers. A number of replicas have been made of these still popular sport flying engines.

To vary the ignition point of a glow engine it is necessary to try different glow plugs, install or remove head shims to reduce or raise the compression ratio (in effect, a glow-engine is a glow-assisted diesel!), and play around with the percentage of nitromethane in the fuel.
Compare this with merely turning the compression-adjusting screw of the diesel engine.

Other advantages

- In addition to the greater flexibility of a diesel engine vis a vis glow, a diesel offers the following other advantages:
  -lower noise level
- -more pleasing, more "masculine" sound quality -longer running time on the same volume of fuel -no need to buy glow plugs or batteries
- -a certain aroma that is guaranteed to identify the modeller as a real "diesel man"

Starting and Adjusting Fuel - Top of this Page

The fuel consists of kerosene for power, ether to ignite the kerosene, lubricant, and an ignition improver. Here are some notes about the ingredients.

Lubricant

There have been many fuel formulas, with oil content ranging from 12% (for racing in ABC engines) to 33% (old "British" formula). Recently I saw up to 40% for breaking in the MP Jet engine, but that seems <really> high!
In the typical diesel, with an iron (Meehanite) piston and hardened steel cylinder, the minimum oil content recommended is 23%. It's a characteristic for proper lubrication of those two materials. A safe bet is 25% oil for any engine. That way there's lots of

lubrication for the connecting rod. PAW recommends 30% for break-in, and it isn't going to do any harm to run higher oil (over 25%) all the time, but the surplus is going to go out the exhaust and may not contribute much to lubrication beyond 25%.
"Oil" is taken to mean castor oil, the best lubricant for model engines.
There is greater force on the con rod bearings of a diesel than of a glow engine, so the insurance of the castor oil is well worth the added mess from the exhaust spray.

Ether

A typical ether content is 32%. This assures good atomization, and also gives a safety margin for loss due to evaporation, for the ether will evaporate quickly if the container is left unsealed (especially when the air is hot).
Engines will run on lower percentages; apparently 25% is no problem, and probably one can go lower yet. But at some point the fuel will not atomize as finely and power can be expected to drop. There might also be some effect on combustion, and possibly it would be necessary to increase the compression to get the fuel to ignite early enough on the upstroke.
This is not a good idea, for it will impose heavier loads on the moving parts.
Some fuels are even higher than 32% in ether. They will burn cooler than "standard" fuel and will produce less power, but there may be some times when this is an advantage, as with a Davis head for a Cox engine; the lower temperature is not as likely to melt the Teflon disc that seals the top of the cylinder. This disc melts when "normal" fuel is used and the engine is tuned for full power. It is my understanding that fuel for the Davis-converted Cox engines should have about 40% ether.
Higher ether content can apparently be used if an ignition improver chemical is not available, but I have no real information on this.

Ether used to be easy to obtain when it was still being used as an anesthetic. But it is not used for that purpose any more, so there is little incentive for drug stores to carry it. And ether is also used in processing some illegal drugs, which has made it difficult for legitimate users to obtain it. Starting spray for full-size engines contains ether. One source is John Deere dealers. One freezes the container and punctures it to release the ether, but I have never done this, and these instructions are not enough to teach you how to do it safely!

Ignition improver

The ignition improver, like Ethyl's DII(3) (octyl nitrate), causes the ether to ignite at a lower compression ratio, and also smoothes the combustion process. Without it, a diesel has a cackly, rattly sound, and compression has to be set higher, which puts more load on the moving parts.
With it, a diesel runs smoothly and purrs like a tiger. A typical formulation is 2% for engines up to about .19 and 1.5% for larger engines.

Kerosene

Kerosene or jet fuel makes up the balance. Kerosene has higher energy per volume than ether, so a higher percentage of kerosene is desirable. But this is limited by considerations of ignition and lubrication.

Commercial fuel

The simplest way for most modellers to obtain diesel fuel is to obtain it from one of the commercial manufacturers/suppliers. Companies that I know of that sell diesel fuel in the USA are:

- -Eric Clutton (Dr. Diesel)
- -Aerodyne
- -Red Max
- -Ed Carlson
- -Davis Diesel

Operation

The following instructions begin with starting a diesel engine, then branch to adjusting it for full power output (for a broken-in engine) and for break-in (for a new engine).

Starting the Engine - Top of this Page

Probably the most difficult part of running a diesel engine is getting it to fire the first time.

This may not seem like a particularly profound statement, but they do have to be set within a small range of adjustments to fire properly. One would think that it is only necessary to crank the compression high and it should fire. But it doesn't work that way. The engine can be just as reluctant to start if the compression is too high as it is if the compression is too low, maybe even more so.

The following method of starting a diesel is my own, which I immodestly call the "McQueen Method" since I have never seen the key part described anywhere else. The key part? Whereas other starting instructions always seem to include the words "Fill the tank" at the beginning, I emphatically say "Do <not> fill the tank!!" Determine the correct starting settings by running the engine only on a prime. <Then> fill the tank, get the engine to run continuously, and adjust it for full power.

Why this way?

The reason is because a diesel is easy to flood, and a flooded diesel is very difficult to start. The idea is to put a controlled amount of fuel into the engine and to start the engine on that. But if there is fuel in the tank, it is very likely to dribble into the engine and interfere with your efforts to put in that right amount of fuel.

Note that there <are> ways around the problem of flooding if it occurs, and I'll include them below, but they require a lot of unscientific fiddling and tomfoolery that can be avoided if you follow these instructions carefully and understand why you are doing what you are doing. (Much of the information here can be usefully adopted for starting glow engines.).

The most important single instruction is: DO NOT FLOOD THE ENGINE!

Preparations

Mounting the engine

Mount the engine on a strong mount (or in a model). It is convenient if the engine can be removed from a mount without too much difficulty in case it is necessary to invert it and drain out excess fuel, though this will not be a problem if you are careful and don't flood it. And excess fuel <can> be cleared if you just flip the prop long enough. (Reduce the compression initially to reduce load on the innards.)
Do not mount the engine inverted.

Fuel system

The fuel tank should be positioned as with any model engine, as close as possible to the engine and with the center line of the tank no higher than the spraybar. (Some sources say to put the top of the tank level with the spraybar. Partly this depends on the ability of the engine to draw fuel.) And, as touched on above, keep the spraybar higher than the tank (or the supply line pinched off) when the engine is not running, to keep fuel from dribbling into the engine.

For flexible fuel line, use only neoprene. Silicone tubing should not be used because it swells up in contact with diesel fuel, though you should get by using it for a day if you are prepared to replace the tubing. Ordinary PVC (vinyl) tubing can be used where flexibility is not needed. It will become stiff after prolonged contact with fuel.

Propeller

Select a prop of suitable size from the engine manufacturer's instructions. For break-in, a "suitable size" is one of greater length and lower pitch within the mid-range of sizes suggested in the instructions (so that it will not place a heavy load on the engine). And the heavier the prop, such as nylon, the better, for greater flywheel action. Mount the prop so that the piston comes up against compression at the "ten past eight" position

Compression setting

The screw in the head, and thus the position of the contrapiston, are usually in the right ballpark when the manufacturer packages the engine. You DID resist the temptation to turn that little screw, didn't you?
PAW test run every engine to make sure that it will start. Other manufacturers might, also. If it has been moved from the initial position,
try to remember where the screw was and return it to that position.

Grasp the prop and try turning the engine over. The engine should turn over freely, though compression should be good. If it feels difficult to turn over TDC, compression may be too high. Back the compression screw out at least a quarter turn (it can be more if "little fingers" have been playing with the comp screw) and flip the prop. This should push the contrapiston up, and the resistance due to compression should be reduced.

If the engine turns over freely, it should be in the ballpark. If the engine turns over very easily, it is possible that the compression has been set too low. It is just as well to do nothing at this point, but keep in mind that it may be necessary to increase the compression later.

As noted earlier, starting is not easier when compression is too high. It seems to make the engine actually harder to start. Often the engine may be undercompressed but a really hard flip will get it to fire anyway. It won't run properly, but it will still show some life. These uncertainties are what make diesels so much fun!

Throttle setting

Set the carb wide open.

Priming

Obtain a small squeeze bottle that you can fill with fuel and then use to measure out fuel <drop by drop>. This ability to measure drops accurately is very important to avoid flooding.

I always prime an engine through the venturi or carburetor, not into the cylinder. Some modellers are successful with prime against the side of the raised piston. But if there's a muffler this becomes impossible anyway.
Note that putting even a small amount of fuel into the cylinder decreases the volume, thereby raising the compression ratio. If the CR is just right with the prime, what happens when the fuel burns? The volume decreases, so does the CR, and the engine will likely stop. Or, if the CR is just right for running, the extra volume of fuel may be enough to raise the CR beyond the point where the engine will fire.

A prime into the intake allows the fuel to be vaporized and carried into the cylinder in the same way as when the engine is running normally. A correct prime is literally only <a couple of drops>. Literally! For small engines, .06 and smaller, it should be a <single> drop, or even a partial drop into the venturi. (Make a drip on the end of the tube and then touch it to the venturi to make it drop into the intake.) For one over, say, .19, it could be two drops and maybe three for a big engine. But don't go over two drops at first. That should be enough to get the engine to fire and run briefly.

Putting the right, small, amount of fuel into the engine is the single most important part of getting your engine running!

Starting the Engine

Prime the engine as just described. Hold the prop in your hand and turn the engine over slowly. This is to ensure that the engine is turning freely and that the dreaded hydraulic lock has not occurred. Bring the prop up against compression and then flip it as hard and as quickly as you can. A sharp snap is the key to good starting.

If you are really lucky, the engine will start and run for about a second with a good burst of power. This is the optimum response and your target with this exercise. My engines usually do not fire until the second or third flip, so don't be discouraged if you are not successful on the first flip. Repeat the hard flip, several times if necessary. The following responses are possible:

- -If the engine starts with a good burst of power, perfect. The compression setting is good.
- -If the engine starts, but runs weakly with a "soft" sound and/or misfires (skipping), and soon dies, it is undercompressed. Turn the comp screw in a small amount, about 1/16 of a turn, and flip again a few times without repriming in case there is still fuel left in the crankcase. If the engine does not fire, prime and try again. Repeat these steps as necessary until there is that good burst of power, and then repeat once to make sure that the action is repeatable. (A slight complication is that running the engie several times will warm it up a little, and that has the same effect as increasing the CR a small amount.)
- -If the engine starts, but runs with a harsh, metallic, rattly, or clattery sound, and stops abruptly, it is overcompressed. Turn the comp screw out 1/8 - 1/4 turn and flip again a few times to push up the contrapiston and to clear out any fuel. It may start while you are doing this. If not, reprime and try again. Repeat these actions until the engine fires and runs reliably with a good burst of power, then proceed to "RUNNING AND ADJUSTING THE ENGINE".

Flooding

If the engine does not start after several tries of these instructions, it may be flooded. Full instructions for clearing a flooded engine are given at the end. Clearing a flooded engine is a general pain, and the fiddling necessary to clear it can get aggravating. Try to avoid flooding it.

Running and Adjusting the Engine - Top of this Page

At this point the engine has run out the prime with a good burst of power. Make a note of the position of the comp screw. (I make a scratch on the head to match a mark or feature on the screw.) That position is your starting point (unavoidable pun) in future for a prop of that size. In colder weather, you may have to turn the screw in slightly from that point; likewise if you later fit a prop of less diameter and/or pitch (reduced load). And you may have to back the screw out slightly in hot weather or if you fit a prop of larger diameter and/or pitch (increased load). At this point you are ready to run the engine.

Needle valve and throttle positions

Needle valve: The instructions with the engine should give an indication of a suitable starting position for the needle valve. For an unfamiliar engine being run for the first time, especially for break-in, I usually open the needle valve three to five turns from fully closed. (An alternative method used by diesel expert David Larkin is to start with the needle valve open only about half a turn and to open it a quarter turn with each unsuccessful attempt to keep the engine running, but the engine might then run at quite high speed when it catches, and this can be undesirable for an unrun engine.)

Throttle: The throttle should be wide open. (With experience you can start at reduced settings; for engines converted from glow with a Davis head, set the throttle about half-open.)

Filling the tank

Fill the tank. Be sure that your fuel is fresh. If too much ether has evaporated from the fuel, you will be wasting your time! While filling the tank, clamp off or disconnect the fuel line to the engine so that no fuel can leak into the engine. And, when starting the engine, either pinch off the fuel line with a finger or hold the nose of the model high (if it's a small-enough model) so that gravity will keep fuel from leaking into the engine. When the engine fires, then release the line or return the nose to horizontal. The engine should run long enough on the prime to draw in fuel and keep running. Usually there is no need to draw fuel up to the spraybar beforehand. Fuel will usually be drawn to the engine when it starts.

Starting the engine

With the fuel line pinched against the engine or model with a finger (or the nose held high), prime the engine and flip it the same way that you did successfully above. As soon as the engine fires, remove your finger from the fuel line (or bring the nose to or below the horizontal). Fuel will usually be drawn to the engine and the engine will keep running. If the engine doesn't keep running, immediately clamp the fuel line (or lift the nose), open the needle valve 1/4 to 1/2 turn and repeat.

When you get the engine to keep running, congratulations! You are well on the way now!

And if you are using the method of opening the needle valve in steps from closed and if the engine doesn't keep running after the prop has been flipped several times, immediately clamp the fuel line (or lift the nose), open the needle valve 1/4 to 1/2 turn, prime, and flip again. Repeat as necessary.

Adjusting the Engine

At this point the engine is running and needs to be adjusted. Instructions are given first for starting and setting an engine that has already been broken in. Instructions for a new engine are given later. The compression screw and needle valve settings interact with each other. The main adjustment is the compression screw. But when the CR has been set properly, the next step may be to lean the fuel mixture more. That will make the engine run hotter, which advances the ignition point, and that in turn may require reducing the CR to retard timing slightly. The following should enable you to adjust the right one at the right time and get the engine adjusted correctly. This may seem daunting the first time, but it becomes instinctive quickly when you understand why you are making an adjustment.

I'd like to be able to post a flowchart at this point, for it simplifies the rest of the instructions. But I can't, so just follow the words.

Let the engine run for half a minute to warm up, then go through the following questions and actions.

Is it running softly, misfiring, skipping, loping, etc? If so, CR is too low. Turn the comp screw in 1/8 turn.

Alternatively:

Is it running harshly, sounding labored, rattly, cackly? If so, turn the comp screw out 1/8 turn.

Repeat these evaluations and adjustments until the engine is running smoothly, then continue to adjusting the needle valve.

Note: We got to this point by gradually adjusting the needle valve until the engine would keep running, so it should be in the ballpark of the correct setting.

Is the engine exhaust very oily? Is the engine four-stroking? If so, it is running too rich. Close the needle valve 1/8 to 1/4 turn, allow a few seconds for the change to take effect, and check again. Repeat this check until the engine is "singing" at a good speed.

When the engine is tuned for nearly full power, it will heat up and this advances the ignition. Has the engine sound become labored, harsh, rattly, or cackly? If so, reduce the CR 1/8 to 1/4 turn and check the sound again.

Continue to close the needle valve in small steps. If the engine speeds up, you are going in the right direction. Repeat the procedure. If it begins to misfire, it is probably too lean. Open the needle valve enough to restore smooth operation.

If misfiring occurs, the compression may be set too low. Turn the comp screw in 1/8 to 1/4 turn. If the engine speeds up, you are going in the right direction. If the engine sound becomes labored and harsh, back the comp screw out to the former setting or even beyond.

This procedure will have you close to the full power output. If the engine is in a model, try flying it.

NOTES:

-Once the model is released and it accelerates, it is possible that the engine will start to misfire, especially if the engine is fitted with a large, high-load prop. Do not try to fly if it is misfiring. It may not be developing enough power. The needle valve may be too lean, and probably the CR is a little bit too low. (As the plane moves forward, the load on the prop is reduced and the engine can turn faster, needing

more fuel. And the ignition point may need to be advanced a little.) Turn the comp screw in about 1/16 turn and open the needle valve a little. Try again. Repeat the adjustments as required.

In general it will probably be necessary to richen the mixture slightly and increase the compression slightly from the initial settings to develop maximum power in the air.

Miscellaneous notes

- -You do not have to worry about a lean setting damaging a diesel the way it would a glow engine. If a diesel is set too lean it will misfire or simply stop.
- -Once you have become familiar with your engine, particularly if it is .19 or larger, you may be able to prime the engine by choking the inlet and turning the prop enough to draw fuel to the inlet. But this can be tricky, for there is the risk of flooding, especially for small engines.
- -Diesels run cool and the exhaust is much cooler than glow-engine exhaust. You can put a piece of ordinary PVC tubing on the outlet of the muffler to guide exhaust away from the model. The tubing can be up to a foot (30 cm) long without detriment to engine operation.
- -Except when the engine is running very rich, the exhaust has a color. With a light load, the exhaust will be a light tan. But the more heavily it is loaded with a large prop, the more the exhaust will tend toward black. Hence the usefulness of the tubing to keep exhaust oil off the model. (Minimize the amount of this exhaust that gets onto your clothes, for it has a distinctive aroma that not everyone appreciates! Especially wives.)

Break-In - Top of this Page

The instructions with your engine will probably cover this, but here are a few tips anyway.

Iron-steel engine: The procedure is to run the engine for a couple of minutes, stop it and let it cool, then run it again. The engine is initially run in a very rich four-stroke, with just enough compression to keep it running smoothly.

I build up about 20 minutes at the richest setting, then close the needle valve 1/4 turn for each successive run until the engine is beginning to break into two-stroking. I give it short bursts of moderate-speed two-stroking, again with just enough compresson for smooth running, followed by richening it again to keep the engine from running hot too soon. This two-stroking is gradually increased in duration and maximum speed.

When the engine (any engine) is manufactured, the surfaces of the piston and cylinder are like microscopic mountains facing each other. The slow break-in allows removing the tips of the peaks an atom or two at a time instead of gouging out chunks of metal. The finished product is a pair of smoothly polished surfaces to run against each other. The reason for slow running and not letting the engine run hot at first is to prevent metal expansion that would push the peaks into hard contact with each other so they break off.

ABC engine: The procedure is completely different for ABC engines. The principle here is to get the engine reasonably hot as quickly as possible, for the fit between cylinder and piston is usually very tight at TDC and one wants to expand the top of the cylinder enough to provide the normal running clearance. One should use a relatively small propeller so the engine can turn freely and quickly find optimal CR and needle valve settings to run relatively rich at high speed. (K&B, in their instructions for breaking in a<glow> 6.5RIRE ABC pylon engine recommended a prop cut down so the engine would four-stroke at.....20,000 rpm! Use this information for guidance.)

Troubleshooting - Top of this Page

Clearing flooding

You will flood an engine at some time. Here are some tips on clearing it. They are based on an engine in a model so it can be inverted easily. If the engine is in a test stand, there are ways to clear flooding, but removing the engine for draining remains an option.

Block the fuel line. Invert the engine and drain fuel out of the intake and the exhaust. Rock the prop back and forth several times to ensure that the ports open. Turn the engine upright, back off the comp screw 1/2 to 1 full turn. Hold the prop with your hand and turn it over against compression. If it turns easily, continue. However, if there is resistance, keep backing off the screw until it will turn freely.
Begin flipping the prop. The engine may start at some time. This will either clear out all the fuel, and the engine will run and then come to a soft stop. Or it could draw up a slug of liquid fuel if the engine was really badly flooded. In this case the engine could stop abruptly. If this happens, drain out any fuel possible, reduce the compression more, and flip again. Eventually the excess fuel will be cleared out, compression will again feel soft, and you will need to increase the compression a little at a time. When the engine is somewhere around the normal starting setting, follow the starting procedure from the beginning.

This business of clearing a flooded engine is a general pain, and the fiddling necessary to clear it can get aggravating. If you are careful
not to flood the engine you should be able to avoid this monkey-foolery completely. But some time your engine is going to get flooded and you have to know how to clear the problem.

Poor compression

The engine must have good compression if it is to start easily. There are ways around poor compression, and I have had to use them with several engines converted to diesel operation with Davis heads. This is not a reflection on the heads, but on the engines.

My problems came with one O.S. 25FSR and all three of my 10FSR engines. All of the 10FSRs had poor compression from new, as did a replacement piston-sleeve set that I put into a 25 engine worn by fine dust at our flying field. I don't know if O.S. was making them so loose that users could not seize them up with lean runs as glow engines, but the 10s were so loose that they were very difficult to start even as glow engines.

If your engine has poor compression, it is better to repair it (new internal parts). However, there are ways around the problem.

If you have an electric starter, you can try using it, but <very> carefully. If the CR is too high, or if hydraulic lock occurs, you can
quickly bend a con rod. Be sure that the CR is a little on the low side, and be sure that there is no fuel in the engine (not flooded). Set the
throttle to the maximum and the needle valve out enough turns for running. Then apply the starter to the prop, as lightly as possible so the rubber cone can slip if the engine resists turning over.

If the engine does not turn over easily, stop immediately and reduce the CR. Also check for excessive fuel inside the engine.

I could always start the 10FSRs quickly with a starter.

If you don't have a starter, set the CR and needle valve to approximately the running settings. But this time you have to get just
enough liquid fuel into the crankcase that you can invert the engine and have liquid drain around the piston and seal it. Then turn it right-side-up and immediately begin flipping. (Don't use a starter this time!) With luck the fuel will give enough compression seal to get it going.

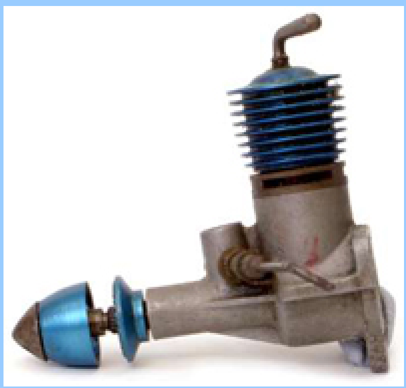
Sometimes I have had to do the flipping inverted and then right the model when the engine fired, but this was with small models that I could hold in one hand.

If you have a new engine you should never need to use these emergency methods.

Good luck and good dieseling!

Ian McQueen

(Ian is a regular contributor to SAM Talks Yahoo discussion group, webmaster)



McCoy Diesel

GB500 Replica by Gordon Burford and David Owen, accepted by the Engine Committee as a pre 1950

	diesel. (Photo Model Engine News)	