IMPORTANT: Before attempting to operate your engine, please read through this instruction booklet so as to familiarize yourself with the controls and other features of the engine. Also, pay careful attention to the recommendations contained in the "Safety Instructions and Warnings" leaflet enclosed.

The O.S. Sirius (FR5-300) is a five-cylinder radial overhead valve four-stroke engine of 49.75 cc (3.04 cu.in.) total displacement.
The FR5-300 has been designed to meet the requirements of those whose interests lie in the field of very large radio-controlled aircraft and who demand the high standards of refinement that are not available in large displacement two-stroke engines based on chainsaw and other light commercial power units.

Production of the FR5-300, as with the twin-cylinder Gemini Series and four-cylinder Pegasus engines, was preceded by an exhaustive programme of research, development and prototype testing.

TOOLS AND ACCESSORIES

The following tools and accessories are supplied with your FR5-300.

1. Radial Motor Mount Set
   - Radial Motor Mount (fitted to the engine) 1
   - Engine Fixing Screws (fitted to the engine) 5
   - Mount Fixing Screws (M5 x 25) 5
   - Lock Washers (ø5) 5
   - Blind Nuts (M5) 5
2. Set of leads for wiring glow plugs
   - Leads for glow plug with snap-on connectors 5
   - Lead for earth (ground) 1
3. Valve Adjusting Tool Kit (in plastic case)
   - Feeler gauge 0.04 mm 1
   - Feeler gauge 0.10 mm 1
   - Hexagonal (Allen) Key (1.5 mm) 1
   - Special Offset Wrench (5 mm) 1
4. Needle-valve extension cable 1
   - Knob for needle-valve extension 1
   - Hook for needle-valve extension 1
5. Choke valve rod 1
6. Woodruff key (spare) 1
7. Hexagonal (Allen) key (2.0 mm) 1
   Hexagonal (Allen) key (2.5 mm) 1
   Hexagonal (Allen) key (3.0 mm) 1
   Hexagonal (Allen) key (4.0 mm) 1
8. Wrench (5-5.5 mm) 1
   Wrench (5-6 mm) 1
   Wrench (7-8 mm) 1
   Wrench (10-12 mm) 1
   Wrench (14-17 mm) 1
9. Screwdriver for mixture control adjustment 1
10. Drain plug 1
11. Display Stand 1

Outside Diameter - 234 mm (9 ½ ")

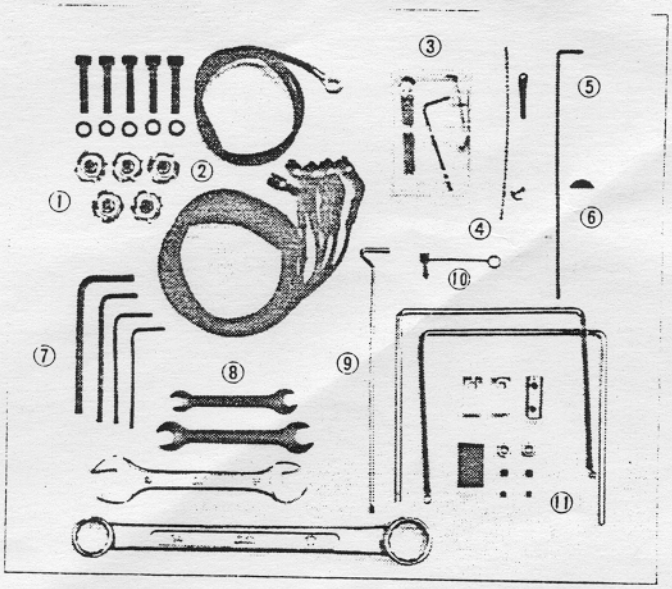


Photo 1

NAME OF ENGINE PARTS

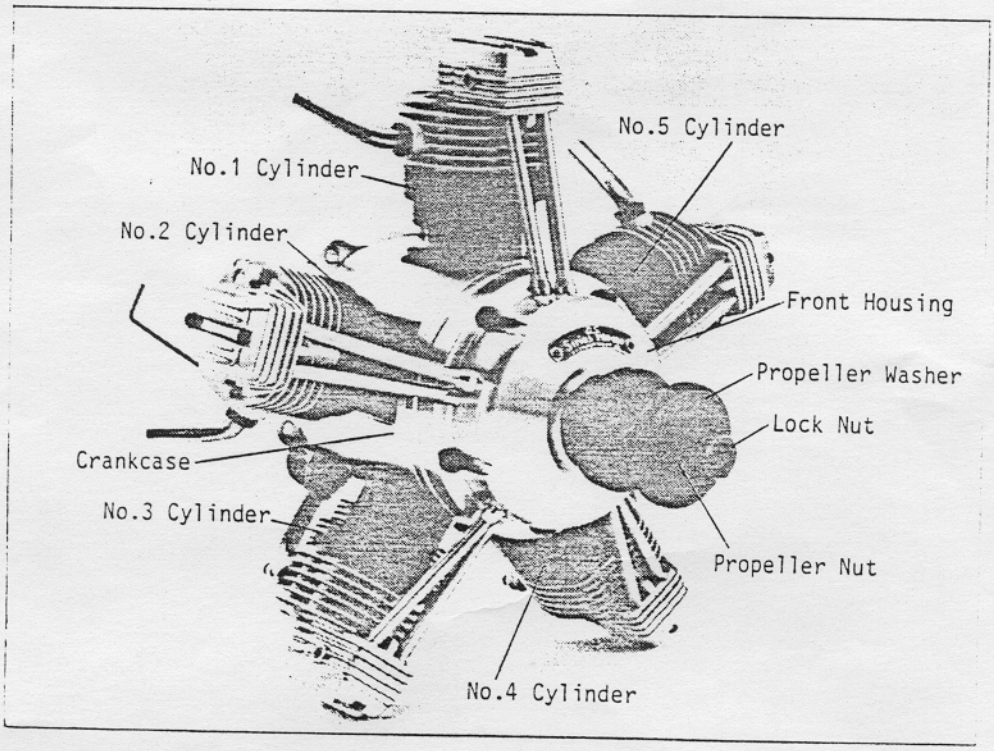


Photo 2

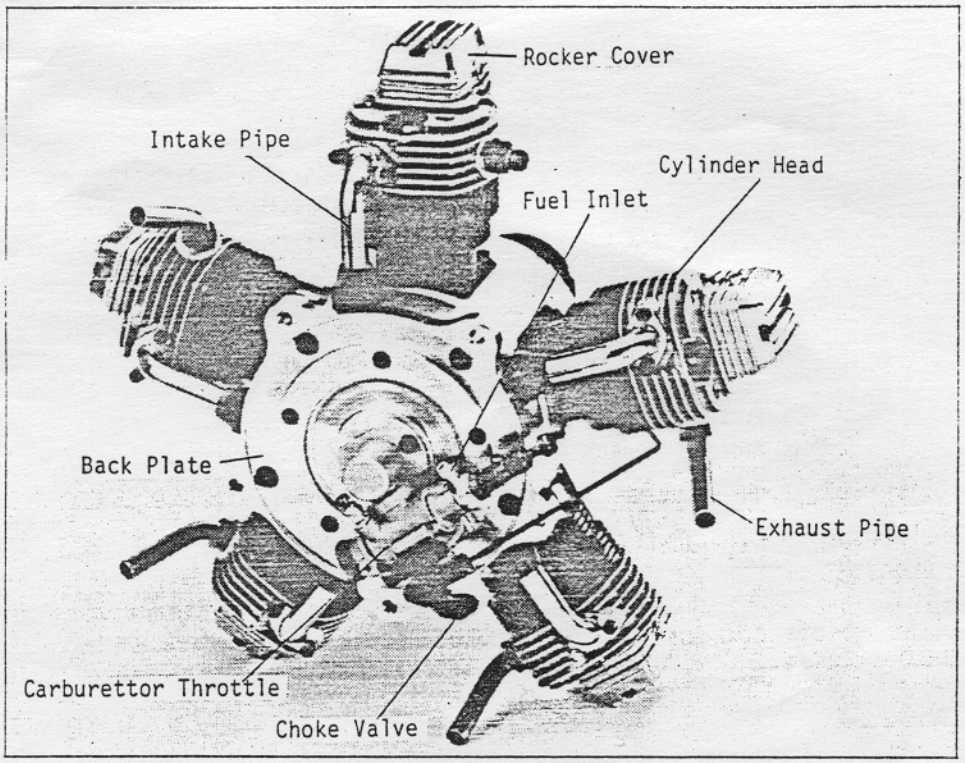


Photo 3

INSTALLATION

° The FR5-300 is equipped with a strong cast aluminium radial-type mount to enable it to be bolted securely to the firewall (front bulkhead) of the aircraft.

° It is essential that the firewall is strong and rigid (e.g. at least 15 mm thick) and firmly integrated with the structure of the aircraft.

° Installation procedure is as follows.

1. Draw centre lines and 61 mm radius (4-13/16" dia.) circle on the firewall.
2. Remove the mount from the engine and align it with the firewall as illustrated. Mark and drill holes for 5 mm screws (M5 x 25).
3. Secure the mount to the firewall by means of the screws, nuts and washers supplied.
4. Install the engine using the screws supplied so that the nameplate on the front housing is located at the top.

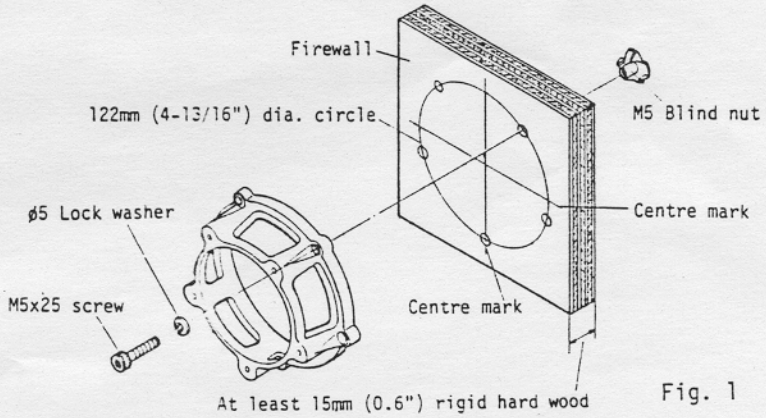


Fig. 1

Needle-valve extension

The needle-valve supplied with this engine is designed to incorporate an extension so that, when the engine is enclosed within the fuselage the needle-valve may be adjusted from the outside. An L-shaped rod, of 1.6-1.8 mm dia. and appropriate length, should be inserted into the needle's centre hole and secured by tightening the set-screw in the needle-valve knob with the small Allen key provided. For longer extension, it is recommended to use the extension cable supplied with the engine, together with the knob and support hook also supplied.

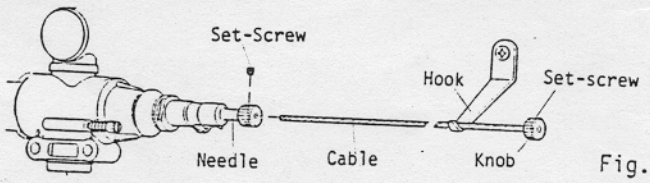


Fig. 2

Do not use an excessively long unsupported extension as this may vibrate and cause the needle-valve setting to vary or even damage the needle-valve thread. Always provide a suitable support at the outer end.

Note: The carburettor cannot be reversed in order to reverse the needle-valve location. Do not position the support for the needle-valve extension near the exhaust pipe.

Choke Valve

The choke valve operating lever can be located right or left by reversing the hexagon nut and cap screw.

- Unscrew the cap screw while holding the hexagon nut with 6 mm wrench supplied, and re-fit the lever to required location.
- If the rod supplied is too long, reduce it to required length.

A needlessly lengthy rod may vibrate. The rod should be as short as possible or have its outer end supported.

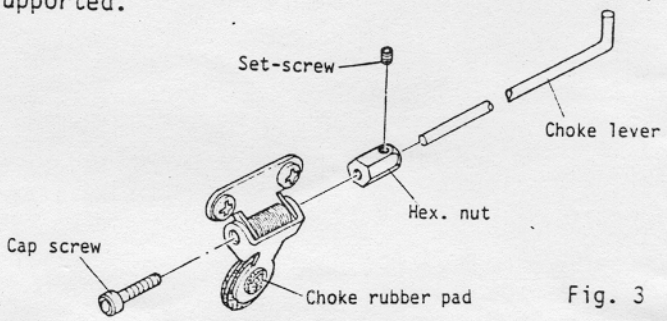


Fig. 3

Fuel inlet

The fuel inlet nipple on the carburettor can be adjusted to the most suitable position for connecting to the fuel delivery tube from the tank. Slacken the needle-valve holder with the 8 mm wrench provided, reset the inlet nipple at the required angle and re-tighten.

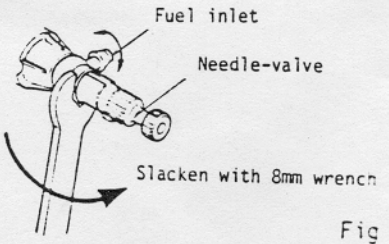


Fig 4

Exhaust pipe adjustment

The direction of the exhaust pipes may be altered in accordance with individual installation requirements. The angle is easily adjusted by loosening the nut that secures the exhaust pipe to the cylinder head. Use the 12 mm wrench supplied.

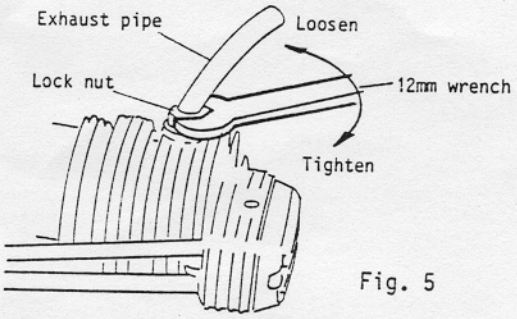


Fig. 5

Carburettor cleanliness

- It is recommended that the fuel is passed through a filter when the tank is filled and that a good in-line filter is installed between the fuel tank and carburettor.
- Occasionally remove the needle-valve holder from the carburettor and rinse out the locations shown in Fig. 6 and Fig. 7 with methanol or fuel. Be careful not to lose the gasket when removing the needle-valve holder from the carburettor.

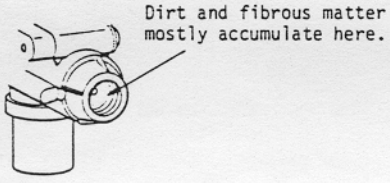


Fig. 7

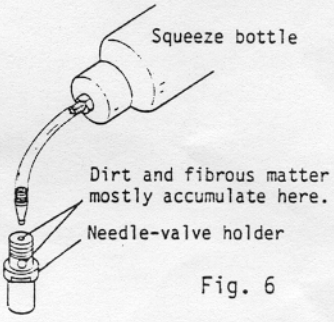


Fig. 6

PROPELLER

The choice of propeller depends on the size and weight of the model and on the type of flying envisaged. Determine the best size after practical experiment. As a starting point, choose a propeller by referring to the data on page 20.

For safety, keep your face and other parts of the body well away from the path of the propeller when starting the engine, or when adjusting the needle-valve while the engine is running, as the propeller arc is very wide with the large size propellers used on this engine (dia. 46cm - 51cm or 18in. - 20in.). Also, refer to the "Safety Instructions and Warnings" leaflet enclosed.

Use well balanced propellers only. An unbalanced propeller causes vibration and loss of power. Make sure that the prop has no nicks, splits or cracks or any other sign of wear or damage.

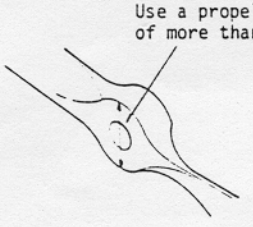


Fig. 8

Fixing the propeller

It is recommended to use the Safety Propeller Locknut Assembly supplied with the engine to prevent the propeller from fracturing or flying off, even if it loosens. Tighten the propeller nut securely. Installation procedure is as follows:

1. Ream the propeller centre hole to 13.4 mm. Make sure that the propeller is properly balanced.
2. Fit the propeller nut and washer to propeller, screw onto shaft and tighten firmly with 17 mm wrench supplied.
3. Finally, insert the Safety Propeller Locknut. Tighten locknut firmly (but not with excessive force) using 14 mm wrench.

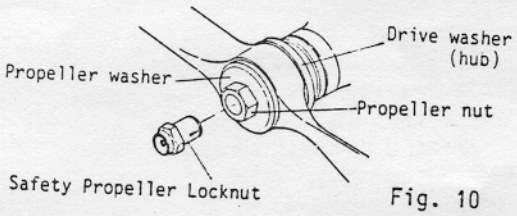


Fig. 10

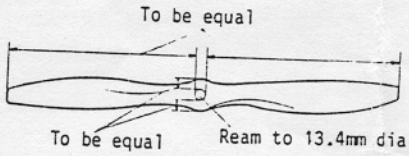


Fig. 9

The Safety Propeller Locknut supplied can be used provided that the propeller thickness is between 18mm (23/32") and 28mm (1-1/8"). If thickness is less than 18mm, use an appropriate washer between propeller washer and propeller nut. Alternatively, "Safety Propeller Locknut S" is available as an optional part for use when prop thickness is between 15mm (5/8") and 22.5mm (7/8").

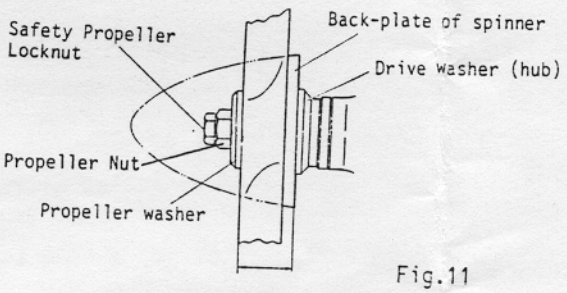


Fig.11

Note: Make a habit of always checking the tightness of the propeller before starting the engine. Remember that, especially with wooden propellers, there is a tendency for the material to shrink, or for it to be reduced by the serrated face of the drive hub. Retighten the propeller nut if necessary after loosening the Safety Propeller Locknut. The locknut should be tightened firmly after retightening the propeller nut.

GLOWPLUG HEATING

Glowplug

Five O.S. Type "F" glowplugs are fitted to the FR5-300. The O.S. Type "F" glowplug has been designed especially for four-stroke engines and is recommended for the best all-round performance with this engine.

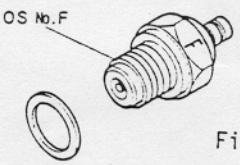


Fig. 12

Note: If you use glowplugs other than Type "F", the same type of glowplug should be fitted to each cylinder. Please observe that the special snap-on connectors supplied with this engine do not fit most other makes of plug.

Glowplug battery

It is necessary to use a glowplug battery of fairly large capacity (10 Ah or more) as this is required to heat five glowplugs simultaneously. A heavy-duty 1.5-volt dry battery or (preferably) 1.2-volt rechargeable Ni-Cd battery may be used. A 2-volt lead-acid cell (accumulator) may also be used but only if provision is made for reducing the voltage at the plugs since these are nominally rated at 1.5-volt. See next paragraph.

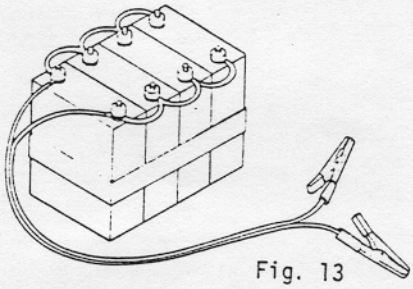


Fig. 13

° Lead-acid 2-volt rechargeable cell

If a lead-acid cell (minimum capacity 10 Ah) is used, it is necessary to reduce the applied voltage at the glowplugs to approximately 1.5 volt. The recommended method is to insert a suitable resistor in each individual plug lead. It is possible, of course, to use a rheostat attached to the 2-volt cell, or to use extra long leads (at least 2 metres) to obtain the required voltage drop. However, the disadvantage of this method is that if one glowplug should fail or become disconnected, voltage to the other four will be increased with the risk of burning out their elements.

Glowplug leads

° The plug leads are fitted with special snap-on connectors that ensure firm contact with O.S. plugs. They are a "click" fit and are not suitable for use with most other makes of glowplug.

° The earth (ground) lead is fitted with a lug terminal which should be connected to the engine by means of one of the mounting screws.

° Make sure that no part of the wiring touches the cylinder head or cooling fins.

° Keep wiring away from the fuel tank where it might cause a fire in the event of a short-circuit.

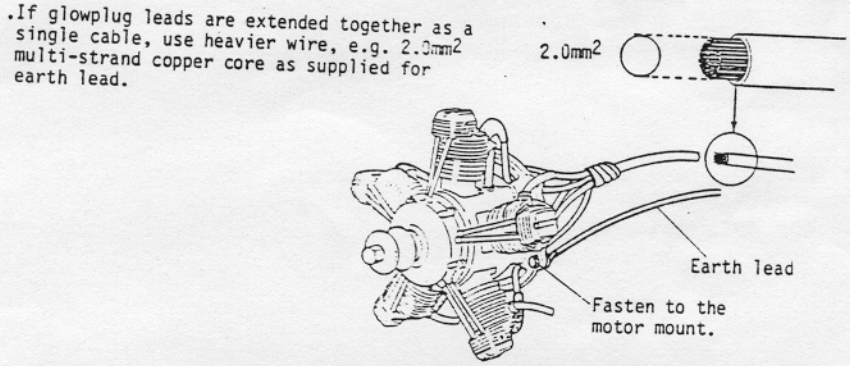


Fig. 14

The five glowplug leads supplied with the engine should be brought together (Fig. 14) and connected to a conveniently located common external point on the fuselage. This can either be a terminal with a separate terminal for the earth (ground) lead (Fig. 15) or a suitable socket or jack with connections for both glowplug and earth (ground) leads (Fig. 16). Note that the earth (ground) lead supplied is much heavier (2.0 mm^2 multi-strand copper core) than the plug leads as this has to have the capacity to carry the current for all five plugs. Similar heavy wire should be used if a single lead is employed to extend the glowplug leads (Fig. 14).

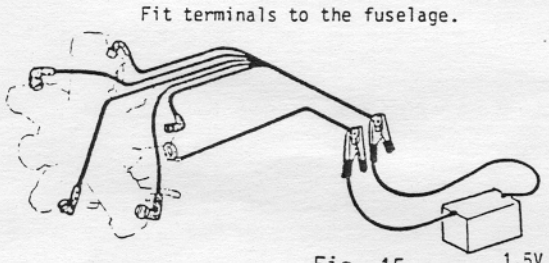


Fig. 15

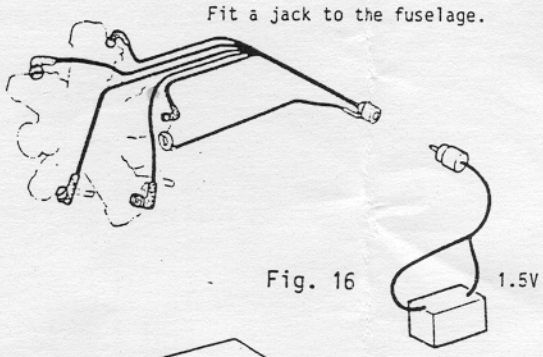


Fig. 16

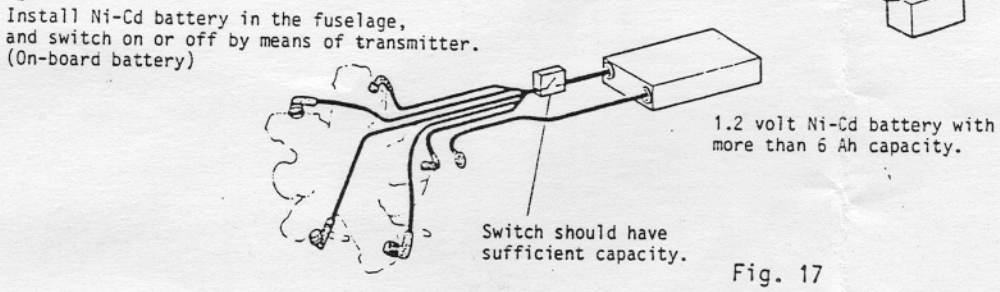


Fig. 17

Glowplug re-heat

Under normal conditions, the FR5-300 will idle sufficiently slowly with the throttle closed to permit a safe landing approach. However, if conditions (atmospheric, fuel, tank location etc.) are unfavourable, there may be a tendency for one cylinder to cease firing if the engine is throttled down to a very low idling speed. This can be prevented by installing a small on-board Ni-Cd battery which will automatically re-heat the glowplugs when the engine is throttled down to idling speed (Fig. 17). A suitable switch should be installed so that it is actuated by the throttle servo only when the engine is throttled down. Safe idling speeds of less than 2,000 rpm may be obtained in this way and without undue drain on the battery.

FUEL

For consistent performance and long life of the engine, it is advisable to use good quality fuel containing MORE THAN 16% LUBRICANT, castor-oil if possible, until a total of one to two hours running time has been accumulated including the running-in period.
Generally, a fuel containing a lower lubricant content improves the running characteristics of a four stroke engine slightly, but it may also shorten engine life.

Nitromethane	7-10%
Lubricant	16-20%
Methanol	77-70%

Lubrication

All parts of the FR5-300 are automatically lubricated by the oil content of the fuel mixture.

. At the conclusion of the flying session, drain out the excess oil in the crankcase by removing the drain plug. While running the engine, the drain plug must be fitted. (See Photo 4 and Fig. 18).

. Make a habit of draining out the excess oil in the crankcase at the end of each flying session. Leaving excess oil in the crankcase for a long time will cause rust. Also residual castor-oil will tend to solidify and lock the engine.

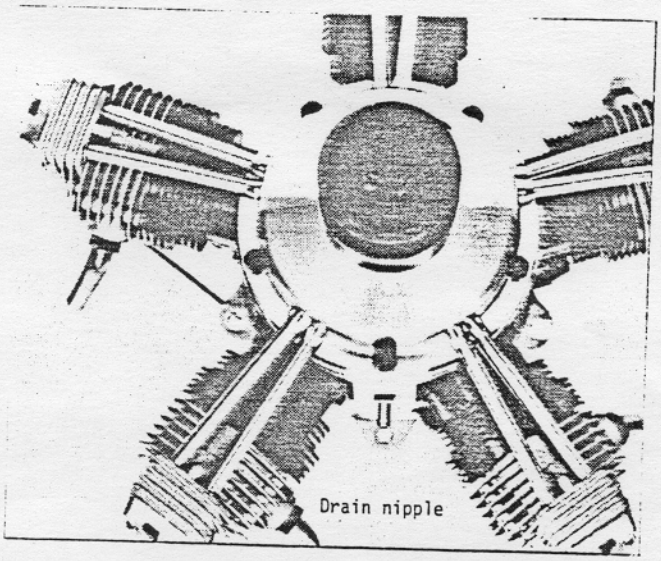


Photo 4

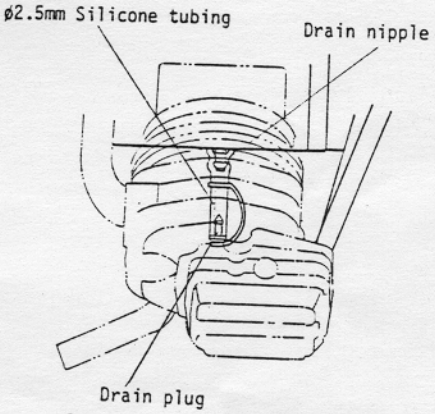


Fig. 18

STARTING

Precautions

For safety, please observe the following instructions before attempting to start the FR5-300.

. Read and follow the "Safety Instructions and Warnings" leaflet.

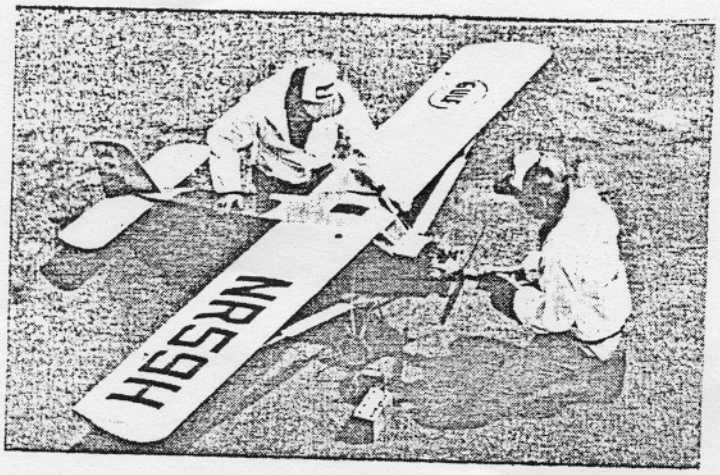
. The engine should be started by rotating the propeller counter-clockwise (i.e. normal running direction) when viewed from the front.

. The engine may be hand-started, but the use of a suitable electric starter is preferable.

. Never start the engine with the throttle fully open. To do so will cause the aircraft to move forward suddenly due to the strong thrust of the propeller. Make sure that your assistant uses both hands and holds the model firmly at the leading edge of the wing.

. Do not carry out carburettor adjustments (except to needle-valve) while the engine is running.

. After the engine has been run, residual oil will tend to accumulate in the lower two cylinders. This also happens with full-size radial engines and, between flying sessions, this accumulation may be sufficient to prevent the pistons from passing over top dead centre on the compression stroke - i.e. an 'hydraulic lock' will occur. Any attempt to start the engine in this condition may cause serious damage. Make sure that such damage does not occur by first removing the glowplugs to allow the excess oil to drain out.

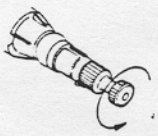


Be sure to call assistant's attention when opening or closing the throttle.

Starting procedure is as follows:

1) Open the needle-valve 2 to 3 turns from the fully closed position (Fig. 19).

2) Make sure that the glowplug battery is not connected. The glowplugs must not be heated while the engine is being primed (Fig. 20).



Open 2 to 3 turns.

Fig. 19

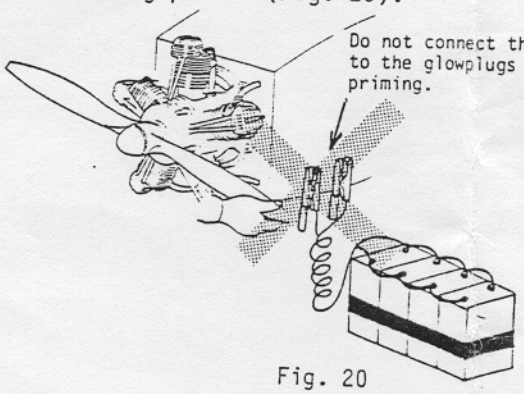


Fig. 20

3) Open the throttle valve fully, close the choke valve and turn the propeller counter-clockwise through two revolutions (Figs. 21 & 22).

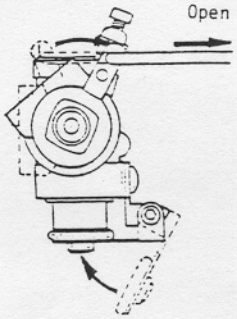


Fig. 21

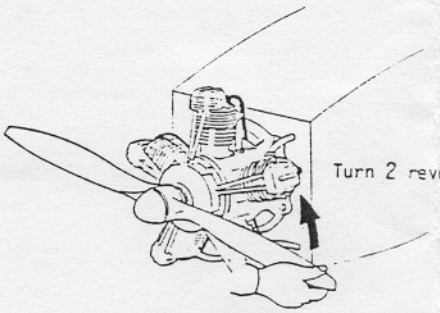


Fig. 22

. If very strong compression is felt when trying to rotate the propeller counter-clockwise, too much fuel has been drawn into the engine. In this case, do not use force! Make sure that the choke valve is open and turn the propeller slowly clockwise to eject excess fuel through the exhaust pipes.

. Warning! Never close the choke-valve when applying the starter. To do so will cause an excess quantity of fuel to be drawn into the cylinders and result in hydaulic lock and the risk of serious damage (Fig. 23).

. Excess fuel may drip from the carburettor when the choke valve is reopened. Therefore, if the engine is cowled, make sure that such excess fuel is free to escape. (Also be sure that any adjacent surfaces are protected with fuelproof paint to prevent fuel from penetrating the airframe structure.)

4) Release the choke control and immediately turn the propeller counter-clockwise several times so that fuel is drawn well into the cylinders (Fig. 24).

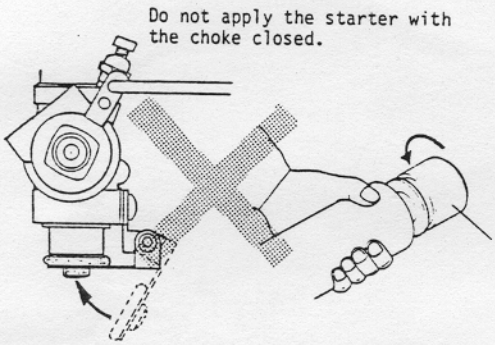


Fig. 23

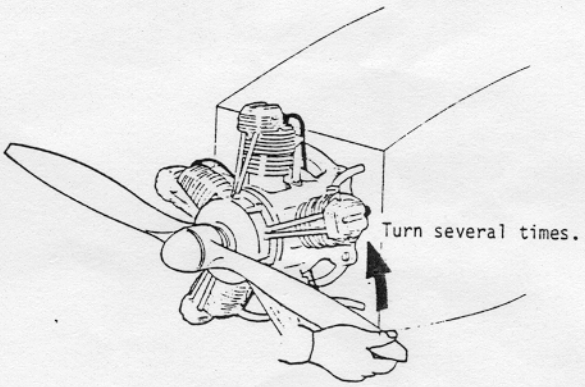


Fig. 24

5) Set the throttle valve approximately 1/4 open from the fully closed position (Fig. 25).

6) A. Starting with an electric starter (Fig. 26)
   . Make sure that the direction of rotation of the starter is correct.
   . Connect the glowplug battery.
   . Apply the electric starter.

   B. Hand starting
   For safety be sure to use a heavily padded glove or a "chicken stick".
   . The propeller should be fixed in such a way that it is positioned horizontally as compression is felt.
   . Connect the glowplug battery.
   . Swing the propeller smartly counter-clockwise from the centre of the right blade.

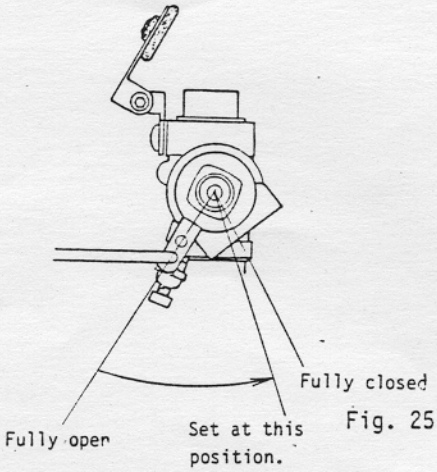


Fig. 25

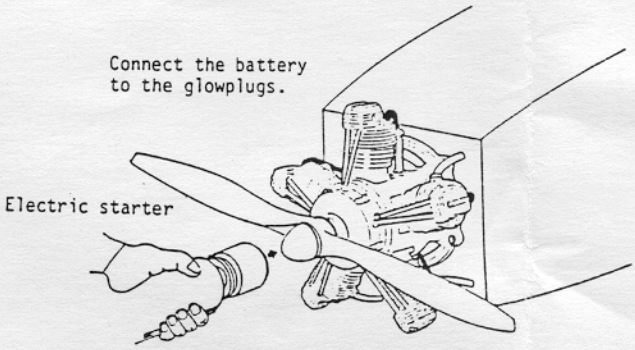


Fig. 26

7) When the engine starts, open the throttle valve fully and keep it running initially (approx. 10 seconds), with original needle-valve setting.

8) Make sure that all five cylinders are firing

   ° The engine is running properly if white smoke is emitted through every exhaust pipe equally. A slight spray of fuel may be discharged through the exhaust pipe of any cylinder that is not firing.

   ° If a cylinder ceases firing, reduce the throttle setting to approximately 1/4 open from the fully closed position and re-connect the glowplug battery. Revolutions will increase when all cylinders are firing steadily.

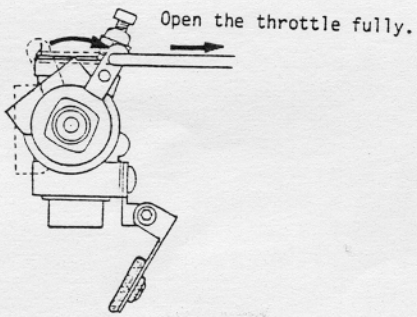


Fig. 27

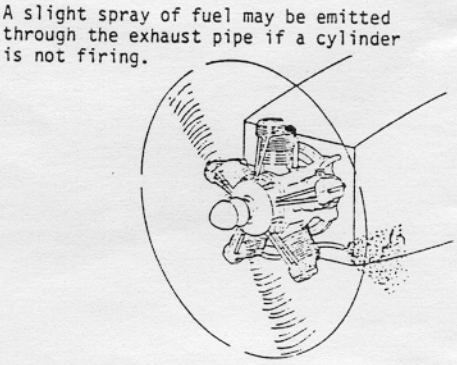


Fig. 28

9) Adjust the needle-valve

   . Abrupt adjustment of the needle-valve may cause the engine to stop, especially when it is new and insufficiently run-in.

   Now disconnect the glowplug battery.

   . As the speed of the engine does not instantly change with needle-valve readjustment, small movements, with pauses between, are necessary to arrive at the optimum setting.

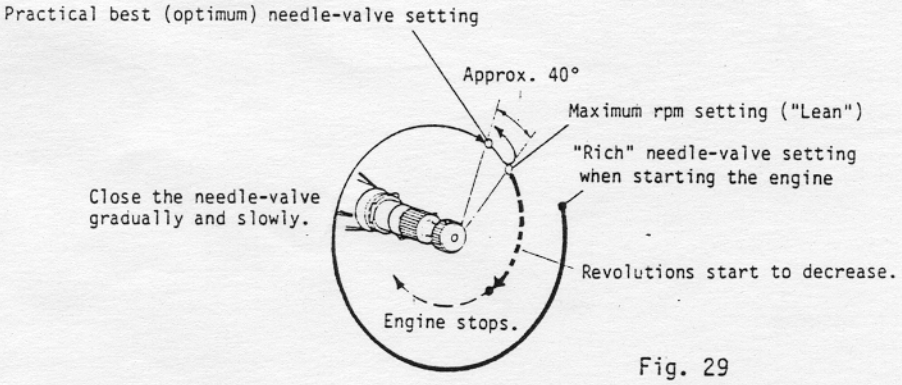


Fig. 29

Re-starting the engine when warm

To re-start the engine when warm, simply re-energise the plugs and reapply the starter with the throttle in the idling position. If the engine does not start, disconnect the battery from the glowplugs and re-prime by closing the choke valve while rotating the propeller twice with the throttle open. Initially, the high temperature inside the combustion chambers may turn the liquid fuel into gas and emit it through the exhaust pipes. Therefore, repeat the priming procedure once or twice until the cylinders become cool enough for restarting.

RUNNING-IN ("breaking-in")

All internal-combustion engines benefit, to some degree, from extra care when they are run for the first few times - known as running-in or breaking-in. This is because the working parts of a new engine take a little time to settle down after being subjected to high temperatures and stress. However, because O.S. engines are made with the aid of the finest modern precision machinery and from the best and most suitable materials, only a very short and simple running-in procedure is required and can be carried out with the engine installed in the model. Obtain an 18x10 or 20x8 propeller for running-in.

Running-in procedure is as follows:

Start the engine and run it for about 10 seconds with the needle-valve set for about 6,300 r.p.m., then open the needle-valve to reduce speed to approximately 5,000 r.p.m. and run for 20 seconds at this cooler setting. Keep the throttle fully open, using only the needle-valve to reduce speed. Repeat this procedure, alternately running the engine fast and slow with the needle-valve, but gradually extending the short period of high speed running until a total of at least 10 minutes running time has been accumulated. Following the initial break-in of 10 minutes on the ground, run-in for a further period in the air. For the first flights, have the needle-valve set as rich as possible, consistent with adequate take-off power and, if necessary, readjust the throttle trim on the transmitter so that the engine does not stop when the throttle is fully closed.
With each successive flight, close the needle-valve slightly, until, at the end of 10 flights, the needle-valve is set for maximum power. The carburettor can now be adjusted for optimum throttle performance following the instructions given in the next section.

THROTTLE VALVE ADJUSTMENT

The carburettor of your FR5-300 has been factory set for the approximate best result with the fuel tank located in the normal position (i.e. close to the back of the engine and where the level of the needle-valve is at 2/3 height of the tank), but the setting may, in some cases, vary slightly in accordance with fuel and climatic conditions. Remember, also, that, while the engine is being run-in and the needle-valve is set on the rich side, the carburettor cannot be expected to show its best response. Therefore, it is recommended that you first run the engine with the throttle settings as received. After the engine has been run-in, check the operation of the throttle according to the following chart.

Re-adjust the controls only when necessary.

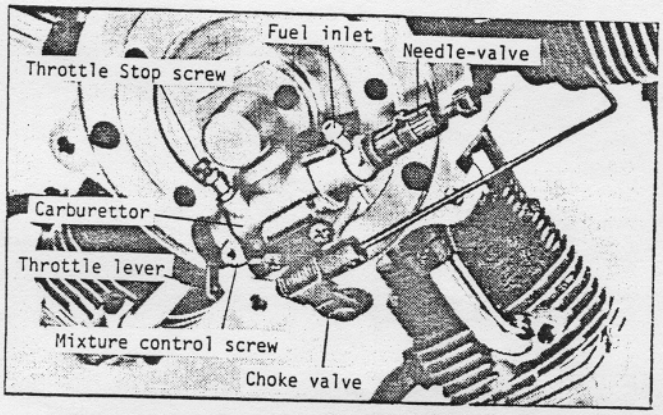


Photo 6

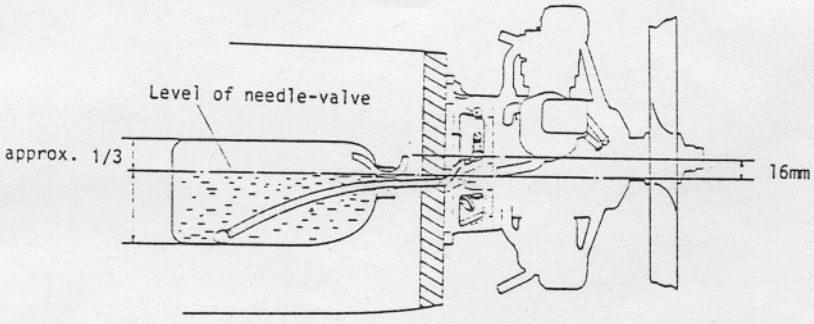
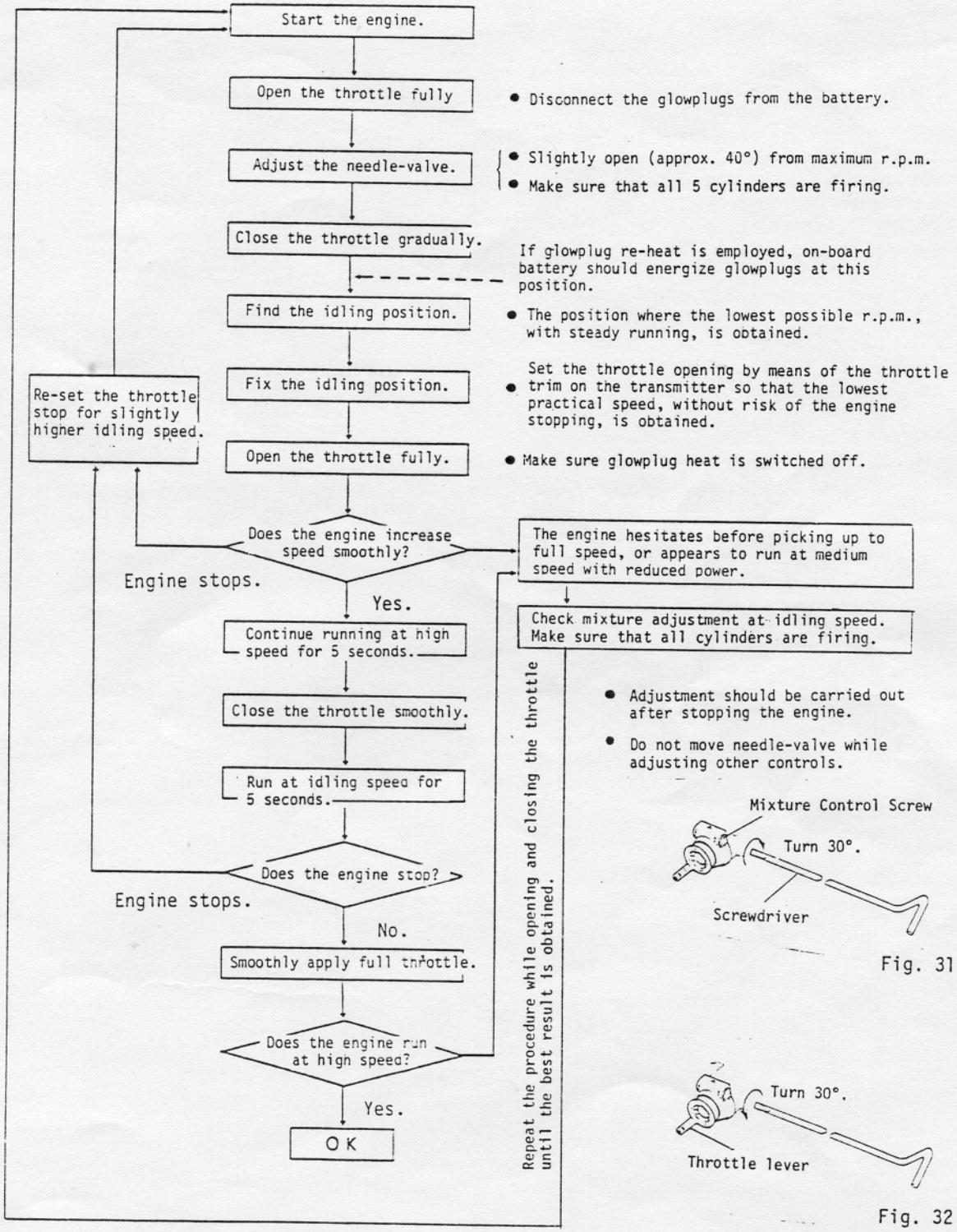


Fig. 30



- Adjustment should be carried out after stopping the engine.
- Do not move needle-valve while adjusting other controls.

Fig. 31

Fig. 32

Attention: Do not leave the battery connected while adjusting the carburetter.

Adjusting the mixture control valve

The special O.S. carburettor fitted to the FR5-300 controls the amount of fuel admitted according to the throttle opening and thereby maintains the correct mixture strength at all speeds from idle to full power. The mixture control valve is factory set but should be rechecked, after the engine has been run-in, as follows.

1) Start the engine, warm it up, then close the throttle. Allow it to idle for a few moments then reopen the throttle for full power.

2) If, at this point, the engine hesitates, puffing out a good deal of smoke, before picking up to full speed, it is probable that the idling mixture is too rich. In this case, it will be necessary to turn the Mixture Control Screw in the reverse direction from the + mark (i.e. clockwise) to weaken the mixture. About 1/12 turn (30°) should be sufficient (Fig. 31).

3) Alternatively, if the engine stops or is slow to pick up speed, without smoking or a strong exhaust note, it is probable that the idling mixture is too lean. In this case, it will be necessary to turn the Mixture Control Screw in the direction of the + mark (i.e. counter-clockwise) approximately 1/12 turn (30°) (Fig. 32).

4) Thirdly, if revolutions increase but the engine appears to run with reduced power, it is probable that one of the cylinders has ceased firing. You may detect this by the difference in exhaust note and revolutions compared with previous full-throttle running. The cutting out of one cylinder may be caused by the idling speed being set too low or the idling mixture being too rich or too lean.

   In the case of the idling speed being too low, re-set the idling position a little higher by means of the throttle trim on the transmitter. In the case of the idling mixture being too rich, turn the Mixture Control Screw in the reverse direction of the + mark about 1/12 turn (30°). On the other hand, turn the Mixture Control Screw in the direction of the + mark about 1/12 turn (30°), in the case of the idling mixture being too lean. Normal safe idling speeds are in the region of 2,000 to 2,200 r.p.m.

Note: As this is a five cylinder four-stroke-cycle engine, you may, at first, have an impression that the engine is idling at higher r.p.m. than the actual running r.p.m. It is recommended to check the engine r.p.m. with a tachometer.

Changing the make of glowplug or fuel may sometimes require re-adjustment of the carburettor.

Realignment of mixture control screw

In the course of making carburettor adjustments, it is just possible that the Mixture Control Screw setting may be upset. Its basic setting can be re-established as follows:

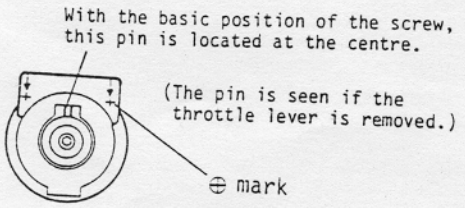


Fig. 33

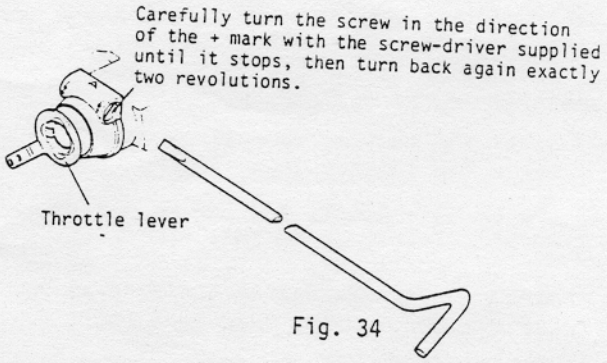


Fig. 34

Note: If an on-board glowplug re-heat system is fitted, mixture adjustment at idling speed should be carried out with this in operation.

FLIGHT

Checking before flight

- Make sure that all five cylinders are firing.
- Make sure that the engine runs steadily at idling speed.
- Make sure that the engine is fully warmed up.
- It is necessary to warm up the engine as with a full-size aircraft or automobile. Do not attempt to take-off immediately after the engine has been started. Allow the engine to run at full throttle for at least 10 seconds before releasing the model.

CARE AND MAINTENANCE

To ensure that you obtain long life and peak performance from your engine, observe the following.

1) Avoid running the engine under dusty conditions. If necessary, lay a sheet of plywood or hardboard in front and under the nose of the model when starting the engine.

2) Foreign matter in the fuel can cause the carburettor jet to be partially clogged.
Therefore:
   - rinse out the fuel tank with methanol or fuel before installing it
   - fit a fuel filter in the fuel delivery tube between tank and carburettor
   - fit a fuel filter to pump inlet of the manual or electric fuel pump
   - do not leave your fuel container open needlessly
   - check filters periodically and clean them when necessary

3) Do not close the needle-valve to too "lean" a setting. This will cause the engine to overheat and slow down and also will generate much nitromethane oxide due to extremely high temperature which will cause internal rusting of the engine. Always adjust the needle-valve very slightly to the "rich" side of the peak r.p.m. setting.

4) Clean the exterior of the engine with a clean cotton cloth. If this is not done, oil and dirt will burn onto the outside of the engine each time it is run and the engine will soon become blackened.

5) If the engine is to be withdrawn from use for a while (more than two months), remove the glowplugs and rinse out the interior by injecting kerosene (not gasoline) into the cylinders via the glowplug holes and into the crankcase via the drain nipple. Slowly rotate crankshaft to distribute kerosene and dissolve residue, then drain out mixture, spinning prop to assist ejection from cylinders. Finally, inject light machine oil through glowplug holes and drain nipple, rotating crankshaft slowly to distribute oil to all working parts.

VALVE CLEARANCE ADJUSTMENT

Valve clearances are correctly set before the FR5-300 leaves the factory and, in normal use, will seldom require adjustment. However, if, after a considerable amount of running time has accumulated, a loss of power is detected, or if the engine has to be disassembled or repaired as a result of a crash, valve clearances should be checked and readjusted as necessary. For checking and adjusting the valve clearances, a valve adjusting tool kit is supplied with the engine.

Note: Valve clearances of this engine must be checked and re-set WHEN THE ENGINE IS COLD.

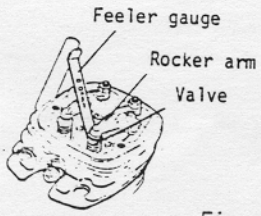


Fig. 36

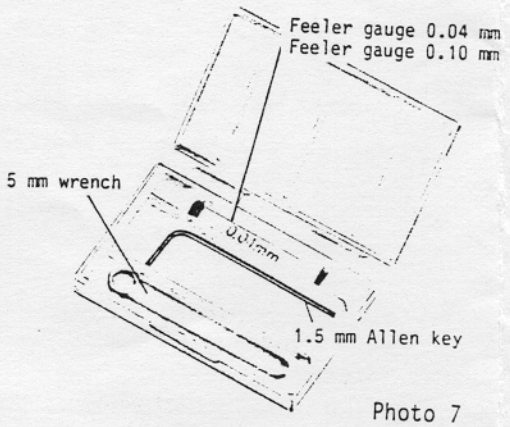


Photo 7

1) Remove the rocker cover from each cylinder head by unscrewing two socket-head cap-screws from the rocker box on top of the cylinder head with Allen key supplied.

2) Remove all the glowplugs except the one fitted to the cylinder that you want to check.

   Note: Each glowplug should be re-fitted to the original cylinder. You may start to check and adjust with any cylinder.

3) Turn the propeller until compression is felt, then turn it further and stop it at the top dead center of that cylinder. Both valves should now be closed in that cylinder.

4) The required valve clearance is between 0.04 mm and 0.10 mm (0.0015 to 0.004 inch) measured between the valve stem and rocker arm. Use the 0.04 mm and 0.10 mm feeler gauges to check clearances.
Usually, the 0.04 mm feeler will pass through the gap: 0.10 mm gauge should not.

If the gap is found to be too small or too large, re-set the valve clearance as follows.

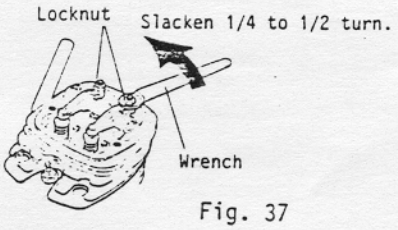


Fig. 37

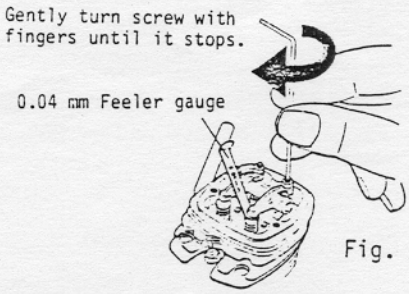


Fig. 39

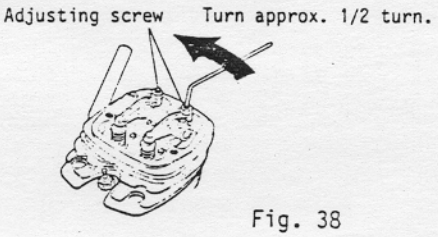


Fig. 38

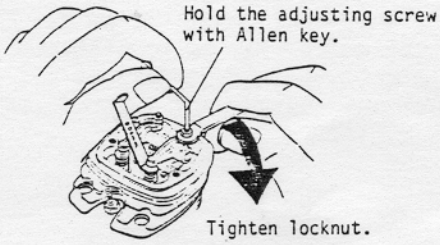


Fig. 40

1) Carefully slacken the locknut on one rocker arm with the special offset wrench supplied. (Approx. 1/4 to 1/2 turn. See Fig. 37.)
2) Turn adjusting screw approx. 1/2 turn counter-clockwise to open gap with 1.5 mm Allen Key supplied. (See Fig. 38.)
3) Insert 0.04 mm feeler between valve stem and rocker arm, and gently turn adjusting screw clockwise between finger and thumb until it stops. (See Fig. 39.)
4) Re-tighten the locknut while holding adjusting screw with the Allen key. (See Fig. 40.)
5) Remove 0.04 feeler, rotate prop through exactly two turns and re-check gap. If the valve clearance is correctly adjusted, check other valve and adjust if necessary. Then replace rocker cover and remove glowplug.
6) Fit glowplug to the next cylinder to be checked and repeat steps 1 to 5 above.
7) Check the other three cylinders and adjust, if necessary, in the same way.

REFERENCE

The following are specifications of two models that have been used for factory tests.

	Type of Model	Wingspan	Length	Wing area
O.S. Original Curtiss Robin	Monoplane, Stand-off Scale	3,150mm (124in.)	1,950mm (77 in.)	142sq.dm (2,200sq.in.)
O.S. Original	Monoplane	2,500mm (98 in.)	1,900mm (75 in.)	110sq.dm (1,704sq.in.)

	Weight	Propeller	Fuel Tank	Duration
O.S. Original Curtiss Robin	12.6 Kg (27.8 Lbs.)	18x12, 20x10	700cc (24.7oz.)	12-16 min.
O.S. Original	8.5 Kg (18.7 Lbs.)	18x12, 20x10	700cc (24.7oz.)	12-16 min.

The choice of propeller used on this engine depends on the size and weight of the model and on the type of flying envisaged. Determine the best size after practical experiment among 18x12, 18x14, 20x8, 20x10, 22x8 propellers. Typical r.p.m. obtained with various "Zinger" maple wood props are as follows:

Propeller (in.)	r.p.m.
Zinger 18 x 10	7,800 - 8,000
Zinger 18 x 12	6,800 - 7,000
Zinger 18 x 14	6,400 - 6,600
Zinger 20 x 8	7,500 - 7,700
Zinger 20 x 10	6,600 - 6,800
Zinger 22 x 8	6,500 - 6,700

Fuel Containing 10% Nitromethane and 20% lubricant used

OPTIONAL PART

If you prefer to use the standard propeller nut and six screws to fit the propeller to obtain more scale-like appearance, optional extra Scale Propeller Washer Set (propeller nut, propeller washer and six screws) is available. (Code No.47009000)

Choose a propeller that has a boss at least as large as the diameter of the drive hub so that it is not weakened when drilled for six retaining screws. If the propeller boss is small and the propeller nut or screws are inadequately tightened, this can (due to detonation or "knocking" if the engine is run too lean or under too heavy a load) cause the propeller to split and fly off. Obviously, this can be very dangerous. Therefore, choose a propeller that has a large boss and secure the prop nut and screws as follows.

1) Drill holes through the propeller boss to align precisely with the holes in the prop-washer fitted to the engine.
   Important Note: Holes must be exactly parallel to the shaft hole and exactly sized to accept the 3 mm screws.
2) Fit propeller and prop washer to shaft. Insert screws through washer and prop and into drive hub and fit prop-nut.
3) Tighten prop-nut, then tighten screws progressively and evenly in the order shown in the sketch.
4) Repeat the above procedure several times to make sure that the prop is really secure.

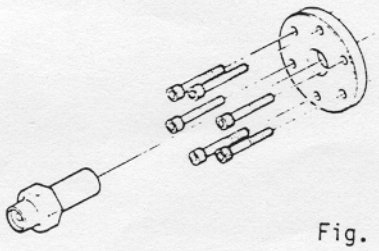


Fig. 41

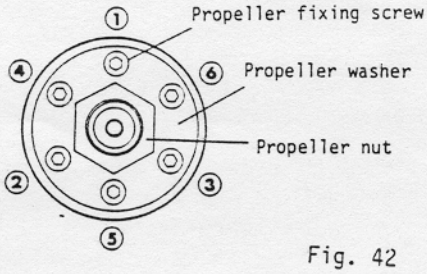


Fig. 42

Regardless of the type of propeller fixing used, make a habit of always checking the tightness of the propeller before starting the engine. Remember that, especially with wooden propellers, there is a tendency for the material to shrink, or for it to be reduced by the serrated face of the drive hub.

When removing the propeller from the engine between flying sessions, it is recommended to withdraw it complete with drive washer, instead of removing the six retaining screws. Be careful not to lose the Woodruff key at this time. (One spare Woodruff key is supplied with the engine.)

SPECIFICATIONS

Displacement	9.95 c.c. x 5 (0.607 cu.in. x 5)
Bore	24.0 mm (0.945 in.)
Stroke	22.0 mm (0.866 in.)
Practical R.P.M.	1,800 - 8,000
Weight	2,540 g (5.60 Lbs.) (without motor mount) 2,670 g (5.89 Lbs.) (including motor mount)

PARTS LIST

Code No.	Description
47001000	Crankcase
47001600	Front Housing
47001610	Front Plate
47001100	Pin for crankcase and front plate alignment
47001800	Back Plate
47001810	Pin for crankcase and back plate alignment
47007000	Cover Plate
47014300	Cover Gasket
47002000	Crankshaft
47002100	Crankshaft Spacer
47002200	Crank Pin Washer
47002300	Master Con-rod Spacer
46202300	Master Con-rod Retaining Screw
47003100	Cylinder Liner
45603200	Piston
47003300	Cylinder Jacket
26603400	Piston Ring
47004010	Cylinder Head (w/valve ass'y)
47004100	Cylinder Head
45604200	Rocker Cover
47005000	Master Connecting Rod (w/bearing)
47005300	Link Rod
47005400	Link Pin
47005500	Link Pin Retainer
45606000	Piston Pin
47008000	Drive Washer (w/key)
29208200	Woodruff Key
46209400	Propeller Spacer
46210100	Safety Propeller Locknut (L)
29031009	Crankshaft Bearing (front)
29030001	Crankshaft Bearing (rear)

Code No.	Description
47031000	Reduction Gear Bearing
47030000	Cam Holder Bearing
46360010	Valve Assembly
45361000	Rocker Arm Assembly
45661500	Rocker Shaft
26381501	Rocker Shaft Fixing Screw
47062000	Intake Cam
47062100	Exhaust Cam
47062200	Cam Thrust Washer (A)
47062300	Cam Thrust Washer (B)
47062400	Cam Holder
47062500	Cam Gear
47062600	Cam Assembling Screw
47062700	Reduction Gear
47064000	Cam Follower
47066000	Push Rod Set
47066100	Push Rod Cover Set
47068000	Intake Manifold Assembly
47068100	Intake Pipe Holder Assembly
46168500	Intake Boots
47068200	Intake Pipe
45269000	Exhaust Pipe
24025923	Drain Nipple (w/washer)
47014000	Head Gasket Set
71912000	Radial Motor Mount
47013000	Screw Set
47081000	Carburettor Complete
45484000	Choke Valve Assembly
72200060	Valve Adjusting Tool Kit
72200120	Booster Cable Set
71516000	Screwdriver for mixture control adjustment
72600010	Display Stand
*47009000	Scale Propeller Washer Set
*46210200	Safety Propeller Locknut (S)

* Optional parts

The specifications are subject to alteration for improvement without notice.