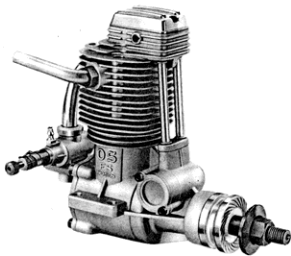


# INSTRUCTIONS FOR O.S. FS-61 FOUR STROKE CYCLE ENGINE



## INSTALLATION

Use sturdy engine mounting beams; i.e., at least as strong as would be used for a 10cc two-stroke engine. Installation should be made in such a way that basic maintenance, such as the checking and adjustment of valve tappet clearances, can be conveniently carried out.

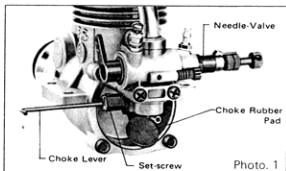
A special O.S. radial mount is available, as an optional extra part, for use where firewall type mounting is required. The needle-valve and throttle lever locations are interchangeable by reversing the carburetor. (For details, see section headed "THROTTLE VALVE ADJUSTMENT".) Decide the most convenient needle-valve and throttle lever locations before mounting the engine in the fuselage.

## INSTALLATION OF CHOKE VALVE

The FS-61 is equipped with a spring-loaded choke valve. This is fixed to the crankcase rear cover plate so that, when the choke flap is actuated, its rubber pad covers the carburetor air intake. (See Photo 1.) Insert an L-shaped actuating rod into the hole in the hexagonal part and secure it by tightening the set-screw. If the rod length is more than about 40mm (1½ in.) its outer end should be supported to avoid vibration.

The choke valve actuating rod is interchangeable by reversing the hexagonal nut and cap screw.

**CAUTION:** Never apply an electric starter with the choke closed. Such an action will cause an excess quantity of fuel to be drawn into the cylinder and result in an hydraulic lock that may damage the engine.



## FUEL

The FS-61 runs on standard commercially available model glowplug engine fuel. Fuels containing castor-oil and/or synthetic lubricants are acceptable, but for the best performance and reliability, a fuel containing 5 - 15% nitromethane is recommended.

## GLOWPLUG

With a four-stroke engine, ignition of the fuel charge takes place at every fourth stroke of the piston instead of every second stroke. Because of this, conventional two-stroke glowplugs may not suit this engine in some cases. For general use, the special O.S. Type F glowplug is recommended.

**IMPORTANT:** Before attempting to operate your FS-61, please read through these instructions 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 new O.S. FS-61 is a 10cc four stroke cycle engine of up-to-date design that has been developed for scale and sport aircraft. It is built to the highest technical standards throughout by the world's oldest and largest model engine manufacturing company; a company which also pioneered the quantity production of model four stroke motors.

The FS-61 has been designed to combine high performance with compact dimensions and moderate weight.

## SPECIFICATIONS

Displacement	9.95 c.c. (.607 cu. in.)
Bore	24.0 mm. (0.945 in.)
Stroke	22.0 mm. (0.866 in.)
Practical R.P.M.	2,000 ~ 11,000 r.p.m.
Weight	540 gr. (19.06 oz.)

## PROPELLER

The choice of propeller depends on the design and weight of the model and on the type of flying envisaged. Determine the best size and type after practical experiment. As starting points, suggested propellers for aerobatic models are 11 x 7-8, and 12 x 6, and, for scale models, 12 x 6, 13 x 6 and 14 x 6. For safety, keep your face and other parts of the body away from the path of the propeller when starting the engine or adjusting the needle-valve while running the engine. Also, refer to the "Safety Instructions and Warnings" leaflet.

**Important:** Use well balanced propellers only. An unbalanced propeller causes vibration and loss of power.

## FUEL TANK

The suggested fuel tank size is 240cc or 8 oz. This will give approximately 12 minutes running time at full power, or about 15 minutes when some part-throttle operation is included.

## STARTING

It is advisable to use an electric starter for starting, although hand-starting is also possible.

The procedure when using an electric starter is as follows.

- 1) Open the throttle valve fully and unscrew the needle-valve approximately 5 turns from the fully closed position.
- 2) It is preferable to use the choke valve for priming, although you can prime the engine through the exhaust pipe if you wish.
- 3) Close the choke valve and turn the propeller counter-clockwise 2 turns by hand.

**CAUTION:** Do not turn the propeller more than 2 turns with choke closed, otherwise the engine may suck in too much fuel and become flooded.

- 4) Turn the propeller counter-clockwise several times so that fuel is drawn well into the cylinder. (When priming through the exhaust pipe, turn the propeller clockwise instead.)
- 5) Connect the glowplug to the battery and apply the electric starter.

- 6) When the engine starts, keep it running, initially, with the original needle-valve setting. If the engine slows down because the mixture is excessively rich, close the needle-valve slowly until the engine runs evenly. Then disconnect the battery from the glowplug and close the needle-valve slowly so that revolutions increase. Adjust the needle-valve gradually. Abrupt adjustment of the needle-valve may cause the engine to stop, especially when it is new and insufficiently run-in.

- 7) To re-start the engine when it is hot, after a run, first prime by closing the choke valve while rotating the propeller twice. Initially, the high temperature inside the combustion chamber will turn the liquid fuel into gas and emit it through the exhaust pipe. Therefore, repeat the priming procedure once or twice until the cylinder becomes cool enough for re-starting. (Again, it is possible to prime through the exhaust pipe.)

**CAUTION:** Do not connect the glowplug to the battery when priming.

The above starting procedure is standard for the FS-61. However, the engine may be safely hand started — except when using a rather lightweight wooden propeller. For safety, be sure to wear a heavy glove or to use a "chicken-stick". The procedure is as follows.

- 1) The propeller should be fixed in such a way that it is positioned horizontally as compression is first felt when turning the propeller counter-clockwise.
- 2) Open the throttle fully and unscrew the needle-valve approximately 5 turns from the fully closed position.
- 3) Prime the engine by closing the choke valve and turning the propeller through two revolutions. (Alternatively, prime through the exhaust pipe.)
- 4) Turn the propeller counter-clockwise several times so that fuel is drawn well into the cylinder. (When priming through the exhaust pipe, turn the propeller clockwise instead.)
- 5) Gradually turn the propeller counter-clockwise until compression is felt.
- 6) Connect the glowplug to the battery and flip the propeller clockwise from the centre of the right blade. The engine will then bounce smartly in the counter-clockwise direction to the point where ignition and expansion of the charge takes place. If the engine stops again, make sure that fuel is reaching the carburettor from the fuel tank, then repeat procedures 3) to 6). Correct priming is the secret of easy starting.
- 7) When the engine starts, keep it running, initially, with the original needle-valve setting. If it slows down because the mixture is excessively rich, close the needle-valve slowly until the engine runs evenly. Then disconnect the battery from the glowplug and close the needle-valve slowly so that revolutions increase. Adjust the needle-valve gradually. Abrupt adjustment of the needle-valve may cause the engine to stop, especially when it is new and insufficiently run-in.
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**CAUTION:** Do not connect the glowplug to the battery when priming.

## RUNNING-IN ("Breaking-in")

For long life and high performance, your FS-61, like any other engine, requires the correct running-in, or breaking-in, procedure. The same basic rules apply as for any other engine — i.e., when new, the engine must be operated on a very rich needle setting in order to promote cool running and maximum lubrication. It is recommended that initial running-in is done on a bench mount using a 12 x 6 propeller.

First, start the engine and run it for about 10 seconds with the needle-valve set for 6,000/7,000 r.p.m., then open the needle-valve to reduce speed to approximately 4,000 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 periods of high speed running until a total of at least 20 minutes running time has been accumulated. For those who do not have a tachometer, the exhaust gas colour can be a help: e.g., as the needle-valve is screwed in, the exhaust gas will turn lighter, from the original grey colour.

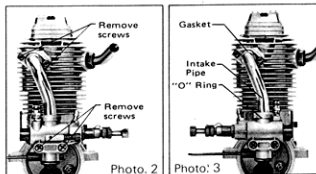
Following the initial break-in of 20 minutes on the bench, the engine should be installed in your model and run-in for a further period in the air. For the first flights, have the needle-valve set as rich as possible, consistent with adequate takeoff power and, if necessary, readjust the throttle rotor stop 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 readjusted for optimum throttle performance.

## THROTTLE VALVE ADJUSTMENT

The needle-valve and throttle lever locations are interchangeable by reversing the carburettor. This can be done as follows: Remove the carburettor complete with intake pipe by unscrewing the two screws which secure each of these parts. (See Photo 2.)

Carefully rotate the intake pipe in the carburettor through 180 degrees. Re-fit the intake pipe to the cylinder-head and the carburettor to the rear cover plate. (See Photo 3.)



The carburettor of your FS-61 has been factory set for the approximate best result, but the settings may, in some cases, vary slightly in accordance with fuel and climatic conditions.

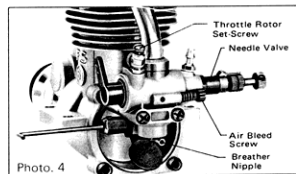
Remember, also, that, while the engine is being run-in and the needle-valve is set on the rich side, the carburettor cannot be expected to show its best response. If, however, the desired throttle response is not obtained after the completion of the run-in period, the carburettor should be re-adjusted as follows.

Three adjustable controls are provided on this carburettor. (See Photo 4.)

### I. The Needle-Valve

### II. The Air-Bleed Screw

### III. The Throttle Rotor Set-Screw



I. The Needle-Valve is used in the same way as on all model engines, i.e., for adjusting the high-speed mixture strength. Start the engine and, with the throttle fully open, gradually close the Needle-Valve until it is running at its maximum speed.

**CAUTION:** Do not close Needle-Valve to too "lean" a setting as this will cause the engine to overheat and slow up. Set the Needle-Valve very slightly to the "rich" side of the peak r.p.m. setting. Make sure that the engine is fully "broken-in" (about 1 hour of total running time in short runs) before operating it continuously at full throttle.

II. The Air-Bleed Screw is for adjusting fuel mixture strength at idling speeds. Having set the Needle-Valve as detailed above, close the throttle. The engine should idle continuously and steadily without further adjustment.

- a) If, however, the engine begins to idle unevenly, first re-open the throttle. If the engine then hesitates before picking up to full speed, it is probable that the idling mixture is too rich. Check this by closing the throttle again and letting the engine idle for a little longer before again opening up. If the engine now puffs out a good deal of smoke and the hesitates or even stops, it will be necessary to screw out the Air-Bleed Screw to weaken the mixture. Do this by turning it "counter-clockwise". About 1–2 turns should be sufficient.

- b) If instead of being set too rich, the Air Bleed Screw is set too lean, the engine will stop when the throttle is closed, or will lose speed while idling and then cut-out abruptly (without smoking!) when the throttle is opened again. In this case, turn the Air-Bleed Screw about 1–2 turns "clockwise".
- Air-Bleed Screw adjustment is not critical and by remembering the symptoms of rich and lean running quoted above, it is a very simple matter to establish the best setting.

III. The Throttle Rotor Set-Screw is for establishing the minimum idling speed. If the engine runs too fast with the throttle closed, the Rotor Set-Screw should be turned counter-clockwise to allow the throttle opening to be reduced.

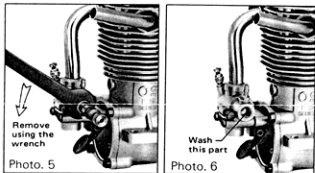
#### Subsequent Operation and Care

Once the required carburettor settings have been established, it should be unnecessary to alter them. Such slight needle-valve alterations as may be needed to cope with differences in atmospheric conditions or fuels, do not affect the other two adjustments.

It is important that the carburettor operates under clean conditions. Make sure that fuel is properly filtered before use. We advise fitting a filter in your fuel can and another in the delivery tube between tank and engine, to reduce the risk of the carburettor jet becoming partially clogged and upsetting running adjustments.

Remember to clean the filters occasionally.

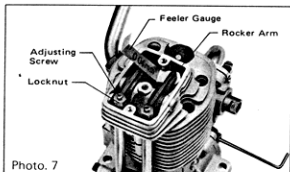
Provided that fuel is double filtered in this way, the carburettor should not need any special attention. If, however, it is suspected that dirt or fluff has become lodged in the carburettor, it should be dismantled and cleaned by removing the needle-valve assembly using the wrench supplied and washing the part in alcohol or gasoline. (See Photo 5 and 6.)



#### VALVE CLEARANCE ADJUSTMENT

Valve clearances are correctly set before the FS-61 leaves the factory. However, as the engine becomes properly run-in, the smoothing and polishing of the valve gear surfaces gradually widens the tappet gap. Therefore, when a total running time of about 1 hour has been accumulated, valve clearances should be checked by using the feeler gauges supplied with the engine.

**Note:** Valve clearances on this engine must be checked and re-set only when the engine is COLD.



- 1) Remove rocker cover by unscrewing the Allen screws from the rocker box on top of the cylinder head.
- 2) Turn propeller until compression is first felt, then turn it one quarter turn and stop. Both valves should now be closed.
- 3) The required valve clearance is between 0.04mm 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 clearance. The 0.04 mm feeler should pass through the gap: the 0.10 mm gauge should not.

- 4) If the gap is found to be less than 0.04 mm or more than 0.10 mm, carefully slacken the locknut on the rocker-arm with the special 5 mm offset wrench supplied, turn adjusting screw to open or close gap with 1.5 mm hex. wrench supplied, then re-tighten locknut. Re-check gap and readjust if necessary.

**IMPORTANT:** Incorrect valve clearances may cause difficult starting (due to valve not closing properly) or loss of power (due to valve not opening sufficiently). Therefore, it is advisable to re-check clearances periodically.

#### EXHAUST PIPE ADJUSTMENT

The direction of the exhaust pipe 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 special 10 mm spanner supplied.

#### CRANKCASE BREATHER

The nipple located in the rear cover plate is the crankcase breather. As some surplus oil will be emitted from this, use silicone tubing of approx. 2.5 mm I.D. to discharge it outside the model.

#### LUBRICATION

All parts of the FS-61 are automatically lubricated by the oil content of the fuel mixture.

#### NEEDLE VALVE EXTENSION

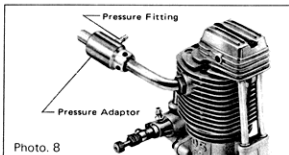
The needle-valve supplied with this engine is designed to incorporate an extension so that, when the engine is enclosed within the fuselage, the needle-valve may be adjusted from the outside. An L-shaped rod, of 1.6 – 1.8 mm dia. and appropriate length, should be inserted into the needle's centre hole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

#### PRESSURE ADAPTOR

A pressure adaptor is supplied with this engine. Its purpose is to serve as an exhaust pressure pick-up device for pressurizing the fuel system.

If, in the case of an upright engine installation, the design of the aircraft requires the fuel tank to be fitted too far below the carburettor, the engine may be starved of fuel, as the tank empties. Therefore, to ensure an adequate fuel supply under such conditions, fit the pressure adaptor to the end of the exhaust pipe as shown in photo 8. Fit one end of a length of silicone tube to the pressure adaptor and the other end to the vent pipe on the fuel tank.

If the tank has two vents, the second one must, of course, be capped or plugged to prevent loss of pressure.



#### SILENCER (Muffler)

Although the exhaust noise level of this engine is generally acceptable without the addition of a silencer, a special silencer is available as an optional extra part for quieter flight.

Installation procedure is as follows:

1. Remove the exhaust pipe from the engine.
2. Screw the exhaust header pipe (supplied with the silencer) into the exhaust port in the cylinder head until it stops, then unscrew it to locate desired exhaust outlet position and tighten the lock-nut firmly by means of the wrench supplied with the engine. Now screw the silencer into the exhaust header and tighten lock-nut firmly.

If a pressurized fuel system is required (normally not essential) install the pressure nipple (supplied with the silencer) in place of one of the silencer assembly screws.

## CARE OF YOUR FS-61

The FS-61 should be treated with the utmost care at all times. At the conclusion of a flying session, do not leave the engine "wet" with raw fuel by stopping it after rich-mixture running or prolonged idling. Instead, let it run for a few moments at full throttle with the correct needle setting, to bring it up to normal running temperature, then cut off the fuel supply – preferably by removing the fuel line from the carburettor. Extra protection against internal corrosion should be given by injecting some special moisture-displacing oil or light machine oil through the crankcase breather and rotating the crankshaft for several revolutions to draw the oil into the bearings, etc.

Keep the engine in a clean, dry atmosphere when it is not in use.

When the engine is installed in the inverted position, there is a tendency for oil to drain towards the cylinder head. It is therefore advisable, before attempting to start the engine, to make sure that the accumulated lubricant is not so excessive as to cause an hydraulic lock. Attempting to start the engine in this condition, especially with an electric starter, could cause damage. Therefore, first check, by carefully turning the propeller by hand, that the piston can pass over compression freely and do not over-prime. If necessary, remove glowplug, turn propeller a few times to pump out excess lubricant and blow oil from glowplug cavity before replacing it.

When the engine is not in use for a lengthy period, it is advisable, with inverted installations, to store the aircraft upside-down, so that oil drainage into the combustion chamber and glowplug does not leave the ball-bearings, etc., too dry. Do not dismantle the engine needlessly.

## PARTS LIST

Code No.	Description	Code No.	Description
45601000	Crankcase	45231100	Camshaft Bearing
45601100	Cam Cover	45660000	Valve Assembly
45602000	Crankshaft	45361000	Rocker Arm Assembly
45603100	Cylinder Liner	45661500	Rocker Shaft
45603200	Piston	26381501	Rocker Shaft Set-Screw
26603400	Piston Ring	45662000	Camshaft
45604100	Cylinder Head	45664000	Cam Follower
45604000	Cylinder Head (w/Valve Ass'y)	45666000	Push Rod
45604200	Rocker Cover	45666100	Push Rod Cover Assembly
45605000	Connecting Rod	45681000	Carburettor Complete
45606000	Piston Pin	45269000	Exhaust Pipe Assembly
45607000	Cover Plate	45669400	Intake Pipe Assembly
45608000	Drive Washer	22681953	Breather Nipple
29008219	Woodruff Key	45484000	Choke Valve Assembly
28009002	Propeller Washer	45270000	Pressure Adaptor
45010002	Propeller Nut	72200030	Feeler Gauge Set
45613000	Screw Set	*45625000	Silencer Complete
45614000	Gasket Set	*71905000	Radial Motor Mount
26731002	Crankshaft Bearing (Front)	*45024000	Spinner Nut
45630000	Crankshaft Bearing (Rear)	*45662090	Reverse-Rotation Camshaft

\*Optional parts

These specifications are subject to alteration for improvement without notice.

Silencer Complete



Radial Motor Mount



Spinner Nut

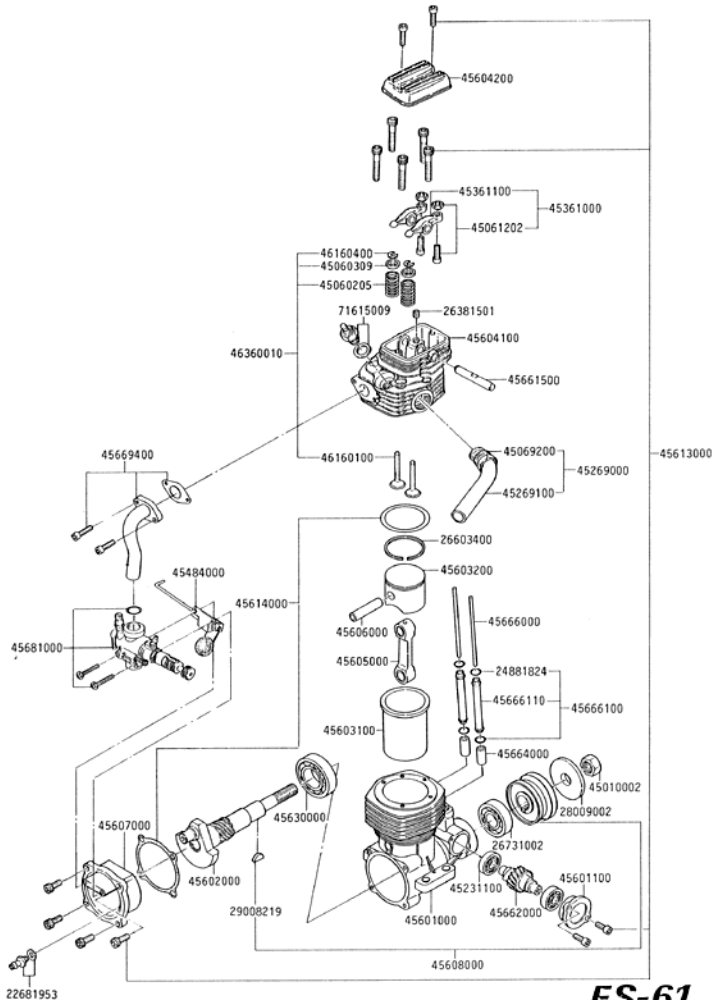


Exhaust Pipe Set



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