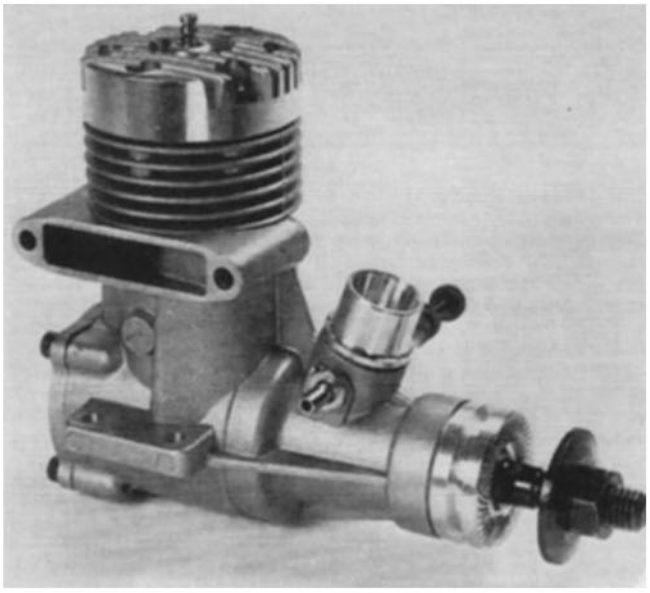
Engine Test by Peter Chinn

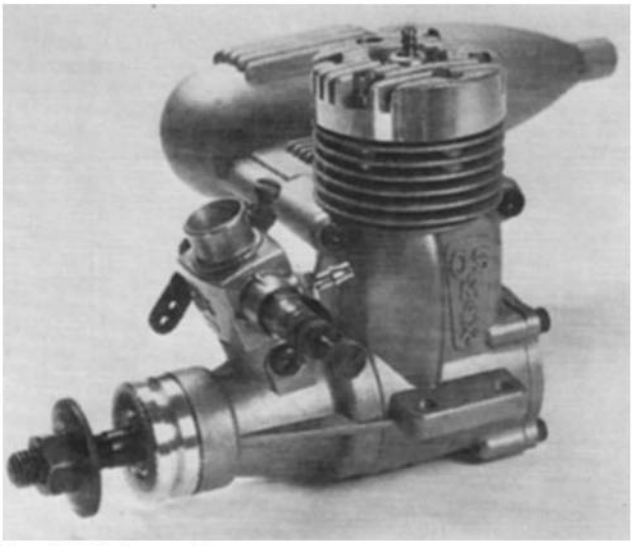


At the present time, the O.S. engine range covers no less than 37 models which, very shortly, will be increased to 39 with the introduction of production versions of the 15cc Max–90 and the 20cc FT–120 four-stroke flat-twin. O.S. are, of course, noted for their larger engines such as the powerful Max 60FSR, much favoured for R/C aerobatic models and helicopters, for their pioneer work on rotary engines (the remarkable 5cc O.S. Wankel engine is still the only motor of this type to be produced commercially) and for having initiated the present wave of interest in quiet 4-stroke engines with the 10cc O.S. FS–60 o.h.v. engine.

However, O.S. still produce many small and medium size engines in both throttling and non-throttling versions and offer a wide choice in the ·20 – ·25cu in. ($3\frac{1}{4}$ – 4cc) capacity group. Here, four basic models are available in a total of no less than 10 versions. For the record these are: first, the crossflow-scavenged bronze-bearing sport type Max–20, Max–20 R/C and Max–20 R/C Marine; second and of similar design and construction, the Max–25 and Max–25 R/C; third, the Schnuerle-scavenged, twin ball-bearing Max 21FSR–C (R/C car) and Max 21FSR–M (Marine) racing engines and, fourth, the Max 25FSR, 25FSR–S and 25FSR–H (helicopter) engines.

As only one of these engines has previously been featured in the AEROMODELLER Engine Test series (namely, the Max 25, which was covered in the October 1973 issue) it was decided to deal with one of the more recent models, the Max 25FSR, in this month's report. This particular model first reached the UK market early in 1977. It has the same bore and stroke as the Max 25 but there the similarity ends. Like other O.S. engines carrying the suffix letters 'SR', it has Schnuerle type porting for increased performance. It also has a bigger diameter crankshaft main journal (12mm, instead of 10·5mm) that permits a bigger valve port and gas passage and the shaft is supported in ball bearings, fore and aft, instead of a bronze bush. The engine is a good deal more powerful than the standard Max 25. It is also heavier and appreciably more expensive, has a bigger and better silencer, an improved needle-valve assembly and, in the throttle-equipped version, a more advanced carburettor with automatic mixture control.

As already noted, the 25FSR is put out in three versions. The stock 25FSR, as supplied for test, is actually the R/C version – in other words, it is equipped with a throttle type carburettor. The 'standard' model for free-flight and control-line (25FSR–S) is supplied with a machined aluminium intake venturi and a spraybay type needle-valve assembly of improved design. The 25FSR can be easily converted to the 25FSR–S specification, or vice-versa, by simply exchanging the two intake assembles. The 25FSR–H is essentially the 25FSR with the addition of a black anodised extruded



Max 25FSR is readily convertible between R/C and standard versions by switching intake assemblies. Engine here shown with 25FSR-S intake venturi and needle valve assembly for C/L or F/F use.

aluminium alloy heatsink, a flywheel and cooling fan and a special silencer with twin outlet pipes. All three engines have the same port timing. Measurement of our test unit indicated that the rotary-valve is open for 190° of crank angle, closing at 45° ATDC, that the exhaust period is 146°, that the main transfer ports are open for 120° and the third port for 108° of crank angle.

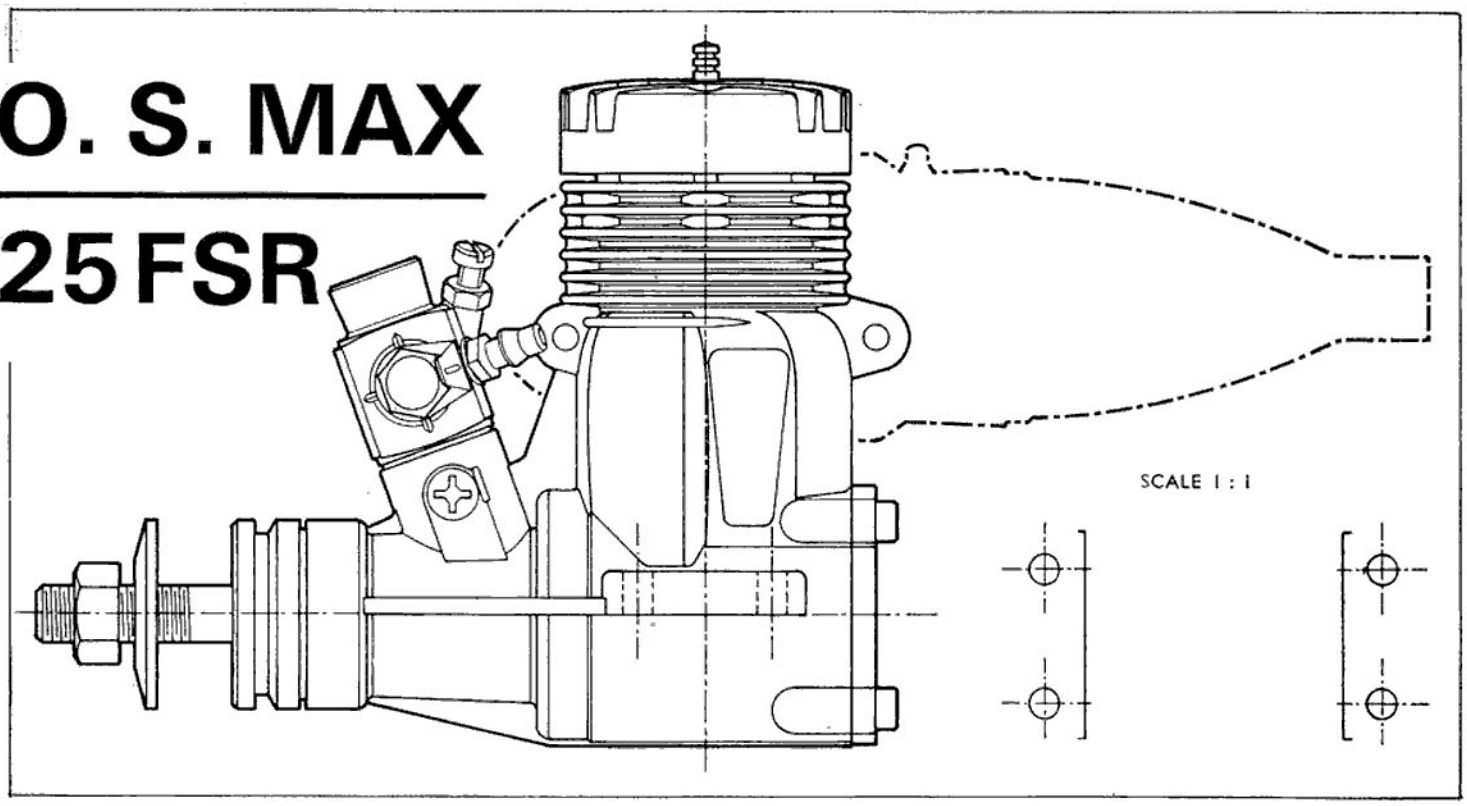
An unusual feature of the Max 25FSR's porting, incidentally, is that it is not, strictly speaking, a side exhaust engine. Nor is it a rear exhaust design. It is, in effect, somewhere between the two: the cylinder liner has the conventional Schnuerle porting layout but is rotated 35° in the cylinder casing so that the exhaust is brought to the right rear quarter and the transfer ports are re-located accordingly. The three channels in the surrounding casing are, of course, also re-located to line up with the ports. The advantages of this arrangement is that it provides a clean bore surface, fore and aft, uninterrupted by ports, for a fully-floating gudgeon-pin, thereby eliminating the need for circlips and the thicker piston bosses that would have been necessary for adequate support.

PERFORMANCE

The 25FSR is not the most powerful engine in the O.S. ·20 – ·25 cu. in. range. The 21FSR models, which have been developed from the 25FSR for the 3·5cc model car and power boat classes, are, despite their 15 per cent smaller swept volume (3·463cc) or 0·2113cu. in.),

Below, parts of OS Max 25FSR.

O. S. MAX 25FSR

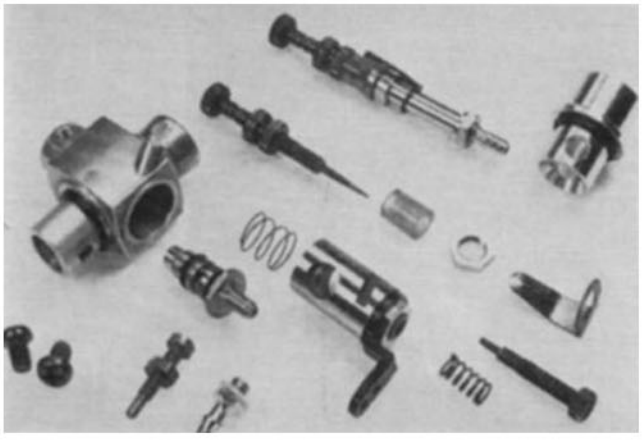


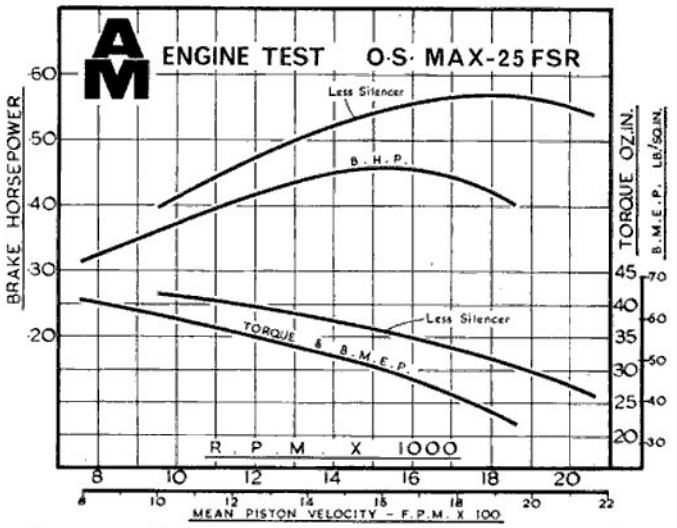
capable of delivering appreciably higher peak brake horsepower. This has been achieved by enlarging the cylinder ports and lengthening the port timing, by increasing the size of the rotary-valve port and gas passage, by closing the rotary-valve much later, by substituting an O.S. Type 2C carburretor with approximately 60 per cent choke area and by slightly raising the compression ratio while, at the same time, stressing the engine for high nitromethane content racing fuels. O.S. do not, however, offer an aircraft version of the 21FSR at the moment, since there is no internationally recognised 3·5cc racing aircraft class.

The 25FSR is, therefore, the preferred engine for aircraft, having been designed to produce high performance on the most useful prop sizes and reliable operation through aerobatics. On test, the Max 25FSR did, in fact, show a willingness to pull a very wide variety of props, thanks to the unusual combination of a relatively high bhp peaking speed and high torque at low rpm.

The tests were carried out on our standard 5 per cent nitromethane test fuel and, as the curves indicate, a gross output of 0·57 bhp at 18,000 rpm was determined, which dropped to a net figure of 0·46 bhp at 15,500 rpm with the reasonably effective Type 762 silencer fitted. However, because of the manner in which torque improves as load is increased, right down to below 8,000 rpm, power curves are very flat and the user is not, therefore, limited to a narrow band of prop sizes but can, if need be, choose a larger size more suited to the characteristics of his model.

Parts of the Type 2B carburettor, which features automatic mixture control. Also shown are spraybar/needle-valve assembly and intake venturi for standard Max 25FSR-S version of engine.





For example, 9×4, 9×5 and 8×6 props can be expected to provide a good performance with most models. With the silencer fitted, our test motor turned 9×4 Taipan glassfibre-nylon props at between 13,800 and 14,100 rpm and an 8×6 Power-Prop wood at 14,200 rpm. Allowing for acceleration in flight, therefore, these props should extract maximum power from the 25FSR, but if a larger diameter is called for, in the interests of improved take-off thrust (e.g. for a heavy scale model), there is still plenty of power available to drive such a diameter at relatively high rpm. For example, our test unit (still with silencer) turned a 10×4 Taipan glassfibre-nylon at 11,700 rpm and, allowing for rpm build-up in the air, this will still absorb about 93 per cent of the engine's peak power. Taking this examination a stage further, the 25FSR also coped quite well with an 11×4 Top Flite wood. This it turned at 9,800 static and, in the air, the engine would still be developing about 83 per cent of full power on this prop. Other static rpm recorded included 11,300 on a 9×6 Power-Prop maple, 11,500 on a 9×6 Taipan, 12,600 on a 9×4 Top Flite nylon, 13,800 on an 8×6 Taipan and 16,000 on an 8×4 Taipan. Incidentally, these figures were increased by between 700 and 1200 rpm with the silencer removed.

continued on page 637

ENGINE TEST – OS MAX 25 FSR

Continued from page 621

Handling characteristics of the 25FSR were good. It hand-started quickly from cold and only slightly less so when hot. There was a slight tendency, when hand-flicked with the throttle closed, for it to idle in the reverse direction until stopped and re-started. Running qualities were also good. The engine ran steadily over a wide load speed range and with modest vibration levels.

As already noted, the test engine was the Max 25FSR with O.S. Type 2B carburettor, but the power output of the 25FSR–S model with its regular venturi and needle-valve assembly should not be very much different. As noted in the specification table, this has an effective choke area of approximately 14sq.mm which should give a good balance of fuel draw (for C/L stunt) and power.

The Type 2B carburettor worked well. It was simple to adjust and throttle response was quite linear. A safe idling speed of 2,400 rpm was obtained on a 9×4 prop and the transition from two-stroking to four-stroking, as the engine was throttled down, took place smoothly and without any abrupt drop in power at between 6,500 and 7,000 rpm.

In all, we found the 25FSR a most likeable engine. It is easy to handle, powerful, versatile and, like all current O.S. motors, well designed and finely made. Examined at the end of the tests, it was found to be in perfect condition. The O.S. No. 8 glowplug survived all testing including protracted running at speeds of over 20,000 rpm.

Power/Weight Ratio (as tested on 5 per cent nitromethane):
0·79 bhp/lb with silencer
1·20 bhp/lb less silencer

Specific output (as tested on 5 per cent nitromethane):
113 bhp/litre with silencer
140 bhp/litre less silencer

SPECIFICATION

Type: Single-cylinder, air-cooled, glowplug-ignition, Schnuerle-scavenged, two-stroke with crankshaft rotary-valve and twin ball bearings. Standard venturi and jet assembly interchangeable with throttle type carburettor. Silencer included.
Bore: 18mm (0·7087in.)
Stroke: 16mm (0·6299in.)
Swept Volume: 4·071cc (0·2485 cu in.)
Stroke/Bore Ratio: 0·889:1
Measured Nominal Compression Ratio: 10:1
Checked Weights: 199g – 7·0oz
(std. intake, less silencer)
248g – 8·7oz
(std. intake, with silencer)
215g – 7·6oz
(Type 2B carb, less silencer)
264g – 9·3oz
(Type 2B carb, with silencer)

TEST CONDITIONS

Running time prior to test: Approx 1 hour.
Fuel used: 5 per cent nitromethane, 20 per cent castor-oil, 75 per cent methanol.
Glowplug used: O.S. No. 8 platinum filament 1·5 volt, 4·8mm reach.
Air temperature: 20°C (68°F)
Barometric pressure: 1024mb (30·24in.Hg.)
Silencer: O.S. Type 762 pressure die-cast aluminium alloy expansion chamber. Volume 36cc. Outlet area: 28sq.mm.