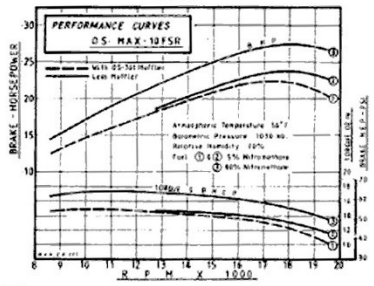
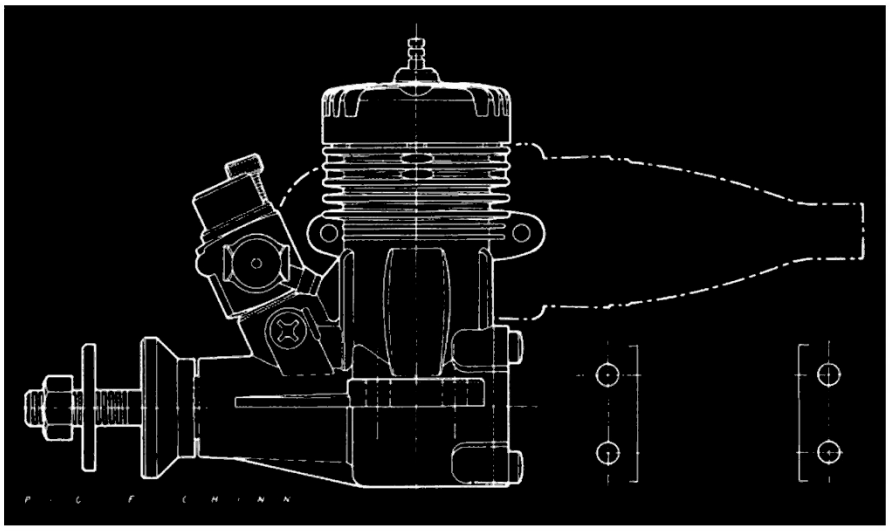
O.S Max-10FSR–R/C

Engine Review





BY PETER G. F. CHINN . . . Successor to popular Max-10, Schnuerle scavenged Max-10FSR is one of the best small R/C engines available. Powerful, well made!

• Of the many and varied engines available in the current O.S. range which now offers a choice of almost 40 models the smallest is the .107 cu.in. Max-10FSR which was first announced two years ago. In line with the O.S. policy of steadily moving up market, the introduction of the 10FSR not only signaled the withdrawal from production of the older crossflow scavenged Max-10R/C, it also followed the demise of the low priced O.S. "Pet" .099 beginner's engine that had progressed through three versions in almost 20 years.

The Max-10FSR is of more advanced design, more refined and a great deal more powerful than either of its predecessors. However, it is a docile and easy to handle little motor and can still be regarded as the O.S. company's contribution to the "small beginner's motor" market, even though it is somewhat more expensive than the previous O.S. .099 and .10 models.

As the suffix letters "SR" denote, the Max-10FSR is a Schnuerle scavenged motor but, in contrast to all the other O.S. Schnuerle engines (now covering eight different displacements from .21 to .90 cu.in.) it is of much simpler construction as indeed one would expect of an engine of less than 2.5cc or .15- cu.in. piston displacement.

It uses, for example, a bronze bushed main bearing in place of the twin ball bearings of all the other O.S. Schnuerle motors and, instead of having the bypass passages formed in its one-piece crank-case/cylinder-jacket casting, these are actually contained entirely within the cylinder liner itself. This has been achieved by making the cylinder-liner from a thick walled steel casting with its four ports cast-in, instead of being machined. The cylinder wall thickness is sufficient to accommodate the three bypass channels in its outer wall, without any corresponding passages in the inner wall of the surrounding aluminum casing. The scavenging system so produced is, nevertheless, in the basic Schnuerle plus third port tradition of two main transfer ports flanking the exhaust and angled to direct gas to the opposite side of the cylinder, where a steeply inclined third-port subsequently opens to sweep gas upward into the combustion chamber.

Before we describe the engine's construction in detail, it is worth mentioning, for the benefit of Max-10FSR owners, that some small changes have been made to the engine since we published the first description of it in the "Engine Round Up" feature in the August 1977 issue. Current examples employ a longer cylinder

liner and, to accommodate this, these later models also have a modified crankcase. These parts are not interchangeable! Therefore, any Max-10FSR owner requiring either a new crankcase or a new piston/cylinder assembly, should make sure of ordering the correct part by first checking the identity of his particular motor and quoting the appropriate part number.

Early models with the short liner can be identified by the maker's code letters FA, FD or GY, which are stamped on the machined underside of one of the mounting lugs, and the appropriate O.S. part numbers for these are 21101007 (crankcase) and 21103001 (cylinder/ piston assembly).

Engines carrying any other code letters with the exception of the letters "GS." are of the later type. The correct part numbers for these are 21101016 (crankcase) and 21103010 (cylinder/ piston).

A small number of engines, i.e., those carrying the code letters “GS,” may be of either type. In this case it will be necessary to check whether the engine has the earlier, short (24.5mm) cylinder or the later, longer (26.0mm) type, in order to identify it.

Like all current O.S. engines, the 10FSR is of quality construction and finely finished. It comes complete with its own special muffler and, in addition to the stock R/C aircraft version dealt with here, it is available in a standard control- line/free-flight version (Max-10FSR-S) and as a marine model (Max-10FSR- Marine). The 10FSR-S has a conventional needle-valve and spray bar assembly in place of the O.S. barrel-throttle carburetor, while the 10FSR-Marine retains the R/C carburetor but has a water cooled cylinder-head and crankcase back plate. In all other respects the two engines arc identical to the version dealt with here.

MAIN CASTING: This comprises the crankcase, cylinder-casing and front end and is cleanly produced in pressure die cast aluminum alloy. It includes a large exhaust stack with holes for muffler attachment, the usual beam mounting lugs and an 8.5mm i.d. intake boss for the carburetor. All joint faces are machine finished. The cast-in phosphor-bronze main bearing is 24mm long and includes a fine longitudinal oil groove.

CYLINDER LINER: The investment cast steel cylinder liner has an o.d. of 18mm and a wall thickness of just under 2.3mm. It does not have the usual upper flange. Instead, it is vertically located by an annular seat at the bottom of the sur-rounding cylinder-casing. The seat is narrowed at three points so as not to obstruct gas entry to the bypass ports.

As with the Max-21FSR and Max-25FSR models, the liner is rotated in the casing so that the exhaust port is relocated slightly to the rear and the other ports are repositioned accordingly. This has the advantage of leaving a continuous vertical cylinder wall surface, fore and aft, uninterrupted by ports, against which the piston’s full-floating wrist-pin can safely bear by means of Teflon type pads. This eliminates the need to positively locate the wrist pin in the piston with snap rings.

According to our measurements of the test motor, the 10FSR has the following port timings: exhaust 146 degrees of crank angle; main bypass ports 124 degrees; third port 108 degrees.

PISTON AND CONROD ASSEMBLY: The deflectorless, lapped cast iron piston has a flat head and a plain skirt. Head thickness is 1.0mm and minimum skirt thickness is 0.6mm. The hardened tubular wrist pin is 3.5mm o.d. and. as already noted, is full-floating in both piston and conrod and has Teflon end pads. The connecting-rod is of machined high duty aluminum alloy and has plain un bushed eyes with an oil hole at the lower end.

CRANKSHAFT AND PROP DRIVE ASSEMBLY: The hardened steel crank shaft has a 9mm o.d. main journal and a 4mm dia. solid crankpin on a full disc crank web with integral crescent counter-weight.

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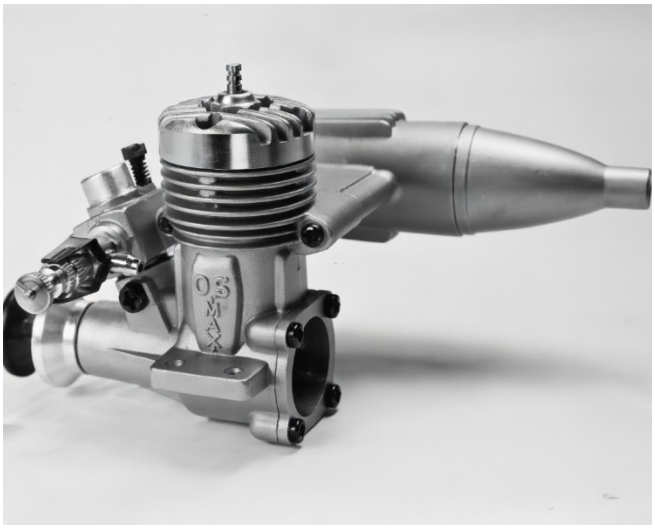
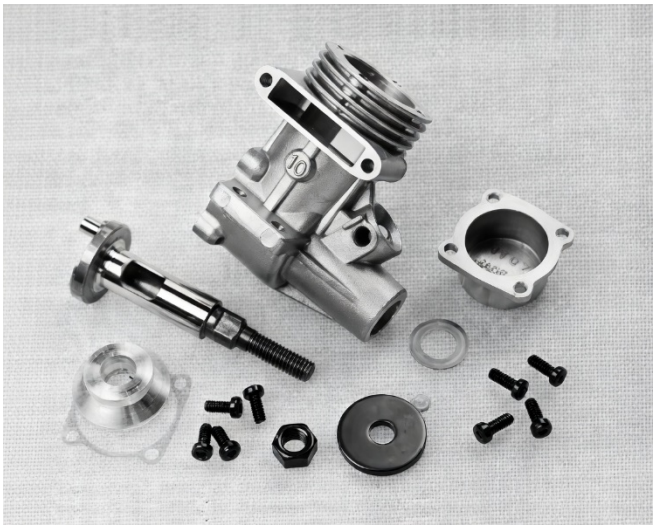


OS-761 muffler causes only a very slight power loss but works well. The engine and muffler are unmistakably O.S. in their appearance.

On test, the 10FSR was well-mannered and easy starting, yet its peak power was comparable with that of some sport .15 motors.

Muffler and carburetor, plus intake venturi, spray bar and needle valve assembly for conversion to free-flight or control-line use.



Neat pressure cast crankcase includes wide exhaust stack which conducts gas from exhaust port in rear right quarter of the liner.

Parts of the Max-10FSR barrel-throttle carburetor. Throttle works well In spite of lack of an adjustable idling mixture control.

Unique feature of Max-10FSR is its cast steel cylinder liner incorporating Schnuerle ports and passages within very thick wall.

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The journal is bored 6.6mm for the induction passage and the rectangular valve port, 9mm long, registers with a parallel sided induction port to give a rotary-valve timing (our measurements) of 35 degrees after bottom dead center to 48 degrees after top dead center.

The machined alloy prop driver is keyed to a flat on the shaft. Between the rear face of the driver and the machine finished crankcase nose, a thin steel shim washer is fitted to separate the two soft metals and prevent excessive wear when an electric starter is employed or when the engine is used with a pusher prop.

CYLINDER HEAD: The head is a machine finished pressure casting with neat tapered section cooling fins and is attached to the main casting with four Phillips screws, the gas tight joint being made between the head and the top edge of the cylinder liner with the aid of a 0.2mm (.008") soft aluminum gasket. The head has a wide (2.6mm) squish band surrounding a small central depression. Measured nominal compression ratio of our test motor was approximately 9.0:1.

HEAD OPTIONS: As already noted, the Max-10FSR is obtainable in a marine version. Alternatively, the air cooled engine can be converted to marine specification by fitting the appropriate Max-10FSR water-cooled cylinder head assembly which is available separately in a marine conversion set. Also. O.S. are now listing a liberally finned heat-sink that can be clamped to the standard head for R/C car or helicopter use.

CARBURETOR: The carburetor has a pressure east aluminum body into which is fitted a ground brass throttle barrel with an adjustable nylon throttle arm on the right hand side. The nickel plated needle-valve assembly, complete with fuel inlet tee fitting, is mounted on the opposite side of the body. There is the usual throttle stop screw serving the dual function of retaining the throttle barrel in the body as well as providing the means of adjusting the idling speed. Unlike the larger O.S. carbs, the 10FSR carburetor has no means of adjusting the idling mixture strength. However, a measure of automatic mixture compensation is built-in to prevent the mixture from becoming too rich at idling speeds: on the air side of the barrel the carb is bored 5.5m whereas below the barrel it is reduced to 4.8mm, so that the tendency for crankcase depression to draw too much fuel when the throttle barrel nears the closed position, is counteracted by the admission of extra air.

The throttle barrel has a 4mm dia. choke and (after allowing for the jet tube) a choke area of approximately 10 sq.mm, although it is possible to vary the effective choke area between about 8 sq.mm and 11.5 sq.mm (depending on whether maximum suction or maximum power is required) by screwing the jet assembly in or out.

MUFFLER: The OS 761 muffler sup-plied with the 10FSR is a neat pressure cast expansion chamber that attaches to the engine's exhaust stack with two long screws. It has a volume of approximately 16cc and an outlet area of 18 sq.mm.

PERFORMANCE: As the Max 10FSR is aimed at raw beginners, as well as more experienced modelers, the manufacturer has wisely included detailed elementary advice on starting and operating the engine in the instruction leaflet that is included with it.

The engine is, however, quite easy to handle. As with most small motors, any reluctance to start is more likely to be caused by flooding than by lack of fuel. This is easily dealt with by closing the needle-valve, removing the glow-plug and pumping out excess fuel. Normally, the 10FSR starts promptly from cold with a small prime and the needle-valve opened up slightly from the normal running setting. When restarting the engine warm, we found that it responded immediately (usually to the first flip) on the idle and without choking if the fuel line was full. One choked flip was the only preliminary necessary when restarting the

engine with the throttle open. The 10FSR was also pleasantly docile i.e., it had no tendency to backfire or “bite.”

The instruction leaflet contains the usual recommendations and warnings in regard to breaking in but, in fact, the design and construction of the Max 10FSR is such that it has a natural tendency to run relatively cool and our two test motors easily held maximum rpm well within the suggested 40 minute break in period.

Recommended fuel formulae (home brew or commercial equivalents) are 75/25 methanol/castor oil for break-in and ordinary use, 72/23/5 methanol/castor oil/nitromethane for improved throttle response and 37/23/40 methanol/castor oil/nitromethane for maxi-mum power. We followed these suggestions implicitly. The 5 percent nitro mix conveniently corresponds to our standard R/C test fuel and was used for most of our tests. The glow plugs used were O.S. No. 8.

As was to be expected of its more modern Schnuerle scavenged design, the 10FSR proved to be considerably more powerful than previous O.S. motors of this displacement. For example, the original Max-10 R/C, which we tested soon after it first appeared on the U.S. market back in 1966, recorded 0.142 bhp at just under 14.000 rpm on 5 percent nitro, with the O.S. Jetstream-S type muffler fitted. On the same fuel, with its Type 761 muffler, the 10FSR was approximately 58 percent more powerful, reaching 0.225 bhp at just short of 17.500 rpm. Maximum torque was up from 12.5 oz.in. at 8.000 rpm to nearly 15 oz.in. at between 10.000 and 11.000 rpm.

Checking the Max-10FSR for gross output (i.e., less muffler) on 5 percent nitro, it was soon evident that the Type 761 muffler caused remarkably little loss of power. There was virtually no difference in maximum torque: only when load was reduced to allow the engine to approach its peak bhp did the removal of the muffler make any noticeable difference and, even at the peak, the power loss due to the muffler was only of the order of 5-6 percent. In terms of prop rpm, the differences on the props most likely to be used in practice (i.e., 8" to 7" dia., 3 " to 5" pitch) would be only around 200-300 rpm.

Typical prop rpm recorded with the silencer included 11.800 on an 8 x 3½ Top Flite standard wood, 12.400 on an 8x4 Cox grey nylon, 12.500 on a 7 ½ x 4 Zinger maple wood, 12.900 on a 7 x 5 Freedom glass fiber epoxy, 13.100 on a 7 x 4 Zinger maple, and 15.000 on a 7½ x 3 ¾ Bartels (Rev-Up type) glass fiber epoxy and 16.500 on a 7 x 3 ½ Bartels (Cox type) glass fiber epoxy.

As the performance curves (and prop figures) indicate, the performance on ordinary 5 percent nitro fuel is excellent and should be more than adequate for models calling for engines of around the .10 cu.in. mark. However, as a final check, we also ran some open exhaust tests on the 40 percent nitro mixture approved by the manufacturer where extra power may be required. This resulted in a sharp increase in maximum torque (to approx. 17.5 oz.in. at 11.000 rpm) and a peak power output of 0.275 bhp at 18.000 rpm.

The Max 10FSR’s running qualities were very good. It held steady speeds on most props and both the muffler and the throttle worked well. Minimum idling speeds included 2.600 rpm on the 8 x 4 Cox nylon rising to 3.200 on the 7 ½ x 3 ½ Bartels glass fiber epoxy, with good recovery and reliable mid-range operation.

Stripped down and examined at the end of the tests, the Max-10FSR was found to be in excellent condition. Apart from periodic checking against another plug to make sure that its performance had not fallen off, a single O.S. No. 8 glow plug was used and survived all the testing, including speeds up to 21.000 rpm.

O.S Max-10FSR–R/C

SUMMARY OF DATA

Type: Single cylinder, Schnuerle scavenged, two stroke cycle with crankshaft rotary valve and bronze bushed main bearing. Barrel throttle type carburetor, interchangeable with standard venturi and spray bar assembly. OS 761 muffler included.

Checked Weights: 4.28 oz., less muffler 5.25 oz., with muffler.

Displacement: 1.759cc (0.1073 cu.in.) Bore: 13.44mm (0.5291") Stroke: 12.40mm (0.4882")

Stroke/Bore Ratio: 0.923:1

Measured Nominal Compression Ratio: 9.0:1

Specific Output (as tested):

2.10 bhp/cu.in. (5% nitromethane, with muffler

2.22 bhp/cu.in. (5% nitromethane, less muffler)

2.56 bhp/cu.in. (40% nitromethane, less muffler)

Power/Weight Ratio (as tested):

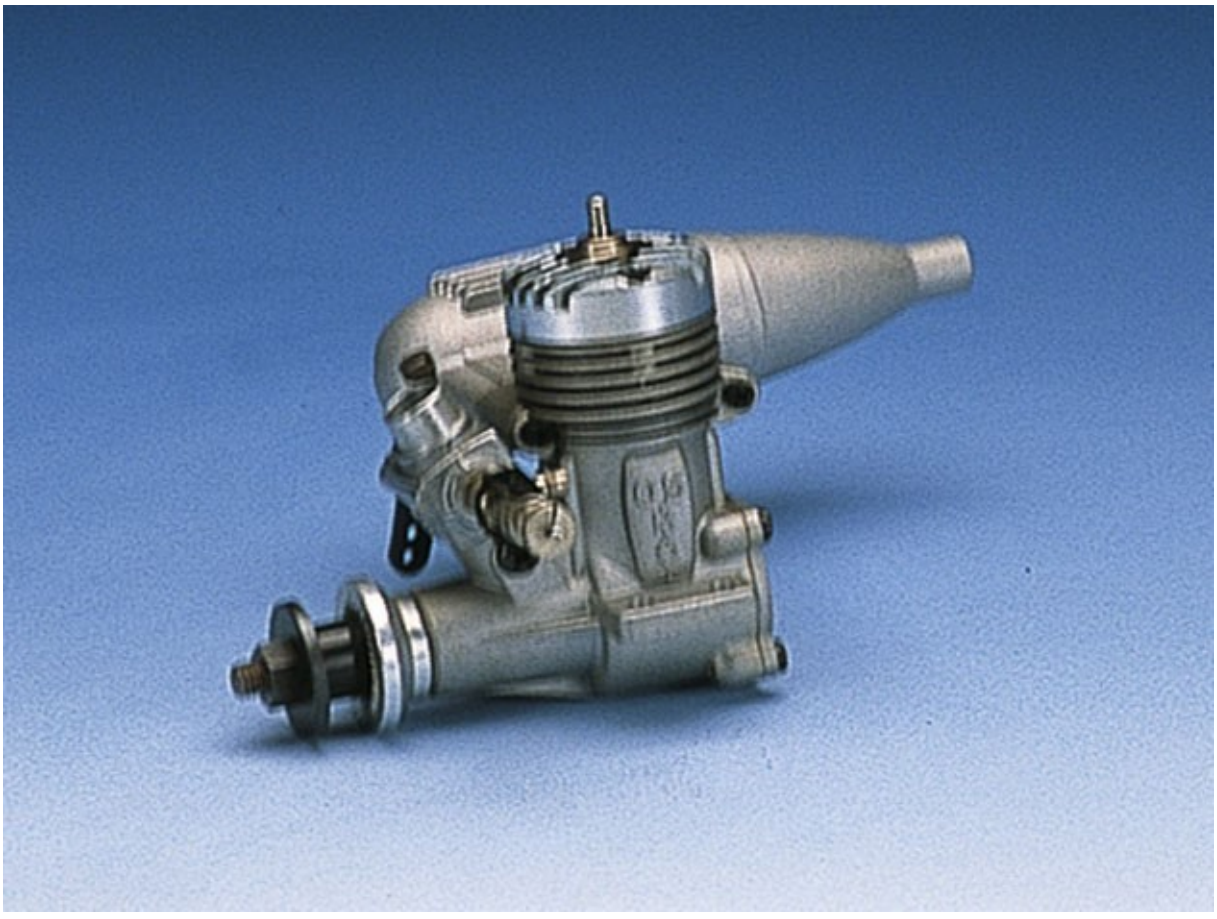
0.69 bhp/lb. (5% nitromethane, with muffler)

0.89 bhp/lb. (5% nitromethane, less muffler)

1.03 bhp/lb. (40% nitromethane, less muffler)

Manufacturer: Ogawa Model Manufacturing Co. Ltd., Osaka 546, Japan.

U.S. Distribution: World Engines Inc., 8960 Rossash Avenue, Cincinnati, Ohio 45236.



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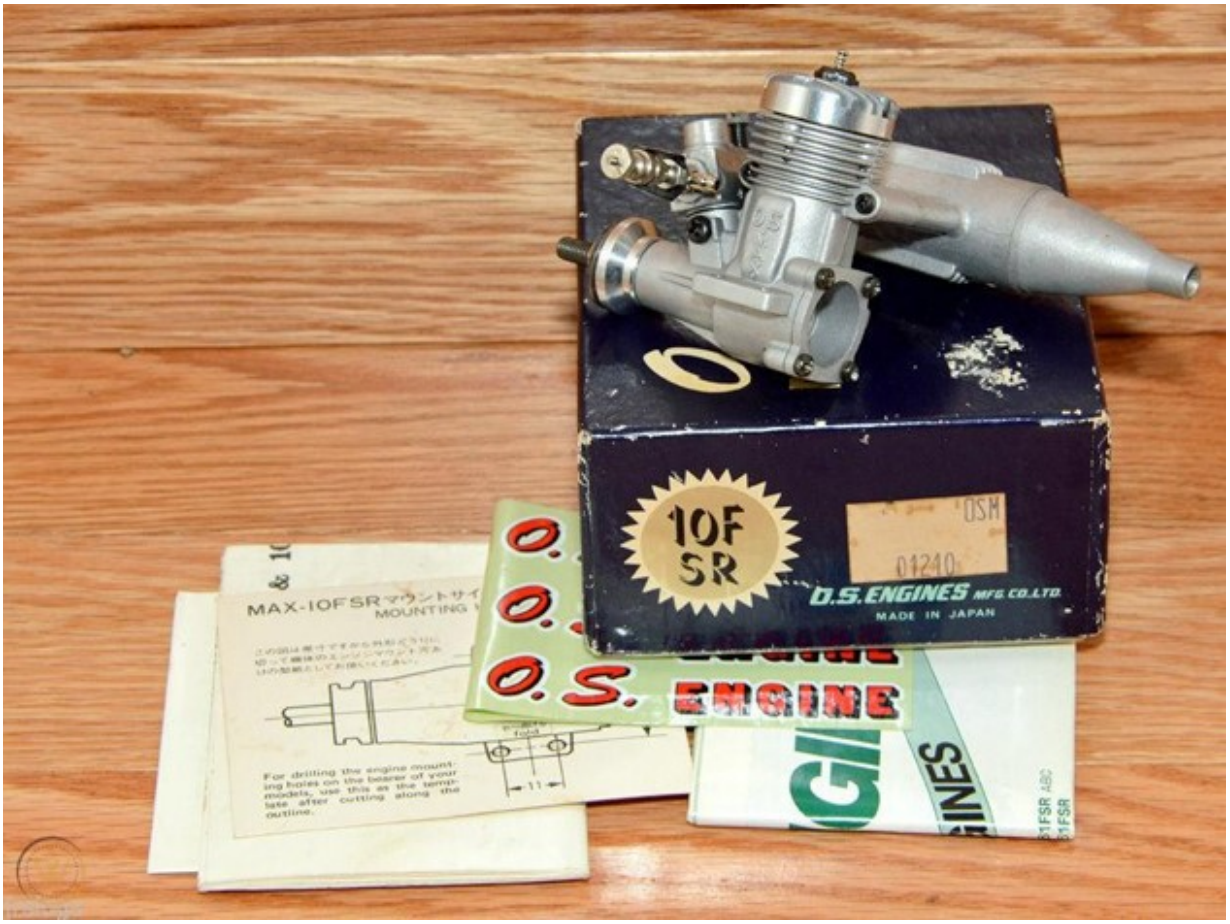

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