O.S Max-60FP R/C

O.S. MAX-60FP

By Clarence Lee

RCM PRODUCT REVIEW

Our review engine for this month, the O.S. Max-60FP is an engine that was almost never made. In the early eighties the demand for O.S. engines had outgrown the production capacity of the O.S. manufacturing facility in Osaka and the company was seriously considering devoting their production entirely to 4 strokes and top of the line models while discontinuing production of the lower cost sport engines. However, many of O.S.'s distributors in the U.S. and abroad were very unhappy with the proposal and protested loudly. With the rising cost of the Japanese engines, the U.S. and other foreign distributors would no longer have competitive engines in the lower to mid-price range and could not be competitive with the engines being manufactured in Taiwan, China, etc., many of which were direct copies of the O.S. engines to begin with. This resulted in O.S. making the decision to build a new manufacturing facility in Nara, Japan, about 25 miles from the parent plant in Osaka. This new plant incorporated the very latest in automation and production techniques. Correspondence with the O.S. people tells me that a minimum of human labor is utilized during production of the engines. To what extent they do not say- assembly only, etc. With the opening of the new production facility, O.S. was able to continue to manufacture their full line of engines and introduce the economically priced FP sleeve bearing series.

The FP series now includes engines in .10, .15, .20, .25, .35, and .40 displacement sizes, and now the latest addition, the 60FP. Some of the smaller displacement engines are also available in marine and car versions. The new Max-60FP is an entirely new engine design and does not use any of the parts from other .60 displacement size engines in the O.S. engine line-up other than the prop nut, prop washer, screws, and gaskets.

When you want to reduce the cost of a model engine, some of the more expensive parts have to be eliminated and some of the machining steps either simplified or eliminated as well. Since the ball bearings are the most expensive part of a model engine, the substitution of a bronze bushing instead of ball bearings is the first cost cutting step. Although ball bearings are certainly desirable from a high rpm and longevity standpoint, a properly lubricated sleeve bearing is perfectly acceptable for an engine operating at lower rpm and will give many years of reliable service. Note the key words here properly lubricated! Sleeve bearing engines do require more lubrication than a ball bearing equipped engine if the engine is to have a long life expectancy. Some of the low oil content fuels on the market now days and sleeve bearing engines are not compatible and it is a good idea to be sure that the fuel you are using contains at least 18% lubrication preferably 20% - 22%.
If in doubt it does not hurt to add additional oil to your fuel preferably castor.

Let's take a look at the Max-60FP's design/construction features and see what other steps besides elimination of the ball bearings have contributed to manufacturing the engine at a lower cost.

With a bore of 23mm (.9055") and stroke of 24mm (.9449") the engine is of definite ''long stroke" design which is in keeping with the engine's

O.S Max-60FP R/C

A minimum of parts are required for a sleeve bearing engine. Note how front portion of crankcase exhaust is blocked off.

design intent of developing its maximum power and torque at lower rpm with the side benefit of a lower sound level.

The engine utilizes a one piece, pressure die-cast aluminum crankcase with removable head and back cover. As with all engines in the O.S. line, the crankcase has been machined with the latest computer controlled (CNC) machinery resulting in exceptional internal surface finishes. Although the engine has the standard side exhaust configuration, the sleeve has been rotated in the crankcase 35 degrees so that the exhaust exits the back half of the exhaust stack with the front portion of the exhaust stack blocked off. This was done so that a floating wrist pin with Teflon end pads could be used rather than the wrist pin being retained in the piston by wire snap rings, thus eliminating the additional machining steps required for the snap ring grooves. With the sleeve positioned per standard side exhaust configuration, the wrist pin aligns with the front and rear transfer ports and, unless retained in the piston, would fall into one of the ports. By rotating the sleeve 35 degrees the wrist pin can run on the solid portion of (he sleeve between the transfer port and boost port at the front and exhaust port and rear transfer port at the back. This is a modification common to all of the engines in the FP series. Rather clever these Japanese.

The engine is of typical Schnuerle plus boost port design with a single transfer port on either side of the single exhaust port and a single boost port opposite the exhaust. The exhaust was timed for a total open duration of 146 degrees, the transfer ports 120 degrees, and the boost port 106 degrees. Very conventional timing for a muffler equipped sport type engine.

A very thick walled (.097") brass sleeve is utilized that has been given O.S.'s hard nickle plate finish rather than chrome, making the engine's true metallurgy designation ABN rather than ABC. The piston has been machined from a casting and, due to the high silicon content of the aluminum, no bronze bushings are used for the 6mm diameter, tubular, hardened steel wrist pin. O.S. has left the inside of the piston as cast with no further machine work; again, eliminating an additional machining operation. However, this was not exactly a step in the right direction as this leaves the piston with an exceptionally heavy wall thickness of .060" and makes for a rather heavy piston weight of 10 grams. This, in conjunction with a crankshaft counterbalance weight that is a little on the light side, showed up in the form of what might be considered higher than normal vibration, especially with the smaller prop sizes. When the engine was propped for under 11.000 rpm it was fairly smooth, but when exceeding 11.000 rpm with the 11 x 7 and 11x8, it became a real shaker. Hopefully, O.S. is aware of this problem and will take correcting measures. Lightening the piston by internal machining would make a considerable difference in the engine's vibration level. Heavy pistons, in conjunction with long stroke crankshafts, are known to cause higher vibration as opposed to lighter pistons and short stroke crankshafts.

O.S Max-60FP R/C

The connecting rod has been machined from bar stock aluminum and bronze bushed at both the crank pin and wrist pin ends. It is nice to see that O.S. did not resort to a casting or forging, or eliminate the bronze bushings, especially at the wrist pin end, as a cost cutting measure as many of the engine manufacturers do.

The crankshaft has been machined in one piece from bar stock steel, hardened, and finish ground on all bearing surfaces including the crank pin. No cost cutting measures taken here. A 16mm (.630") main journal diameter is utilized with a rather small 10mm (.393") gas passage through the center. As a comparison, the O.S. Max 61SF front intake, side exhaust ball bearing equipped engine utilizes a 17mm (.670") diameter main journal with a 11.7mm (.460") gas passage. The intake port opens 40 degrees after BDC and closes 44 degrees after TDC for an open duration of 184 degrees. Again, as a comparison the Max 61SF utilizes 35 degrees 50 degrees intake timing fora duration of 195 degrees. It would appear that the O. S. designers have purposely detuned the engine as an aid to easier starting and overall handling.

The counterbalance is of the constant thickness design milled away on either side of the crank pin for counterbalance action. The counterbalance would balance out the full weight of the con rod and not quite the weight of the wrist pin. It's just a little on the light side which, in conjunction with the heavy piston, would account for the engines higher than normal vibration level with the smaller prop sizes. Bear in mind, however, that being of long stroke design, the engine was intended to use the larger diameter or higher pitch props and not be run at higher rpm with the smaller prop sizes.

Two machine operations have been omitted from the 60FP crankshaft that are normally incorporated in O.S.'s higher priced engines. The crank pin has been left solid rather than having a lightening hole drilled through the center, and the back side of the crank disc directly behind the crank pin has been left unaltered, whereas, the 61SF and 61RF (rear exhaust) engines have had

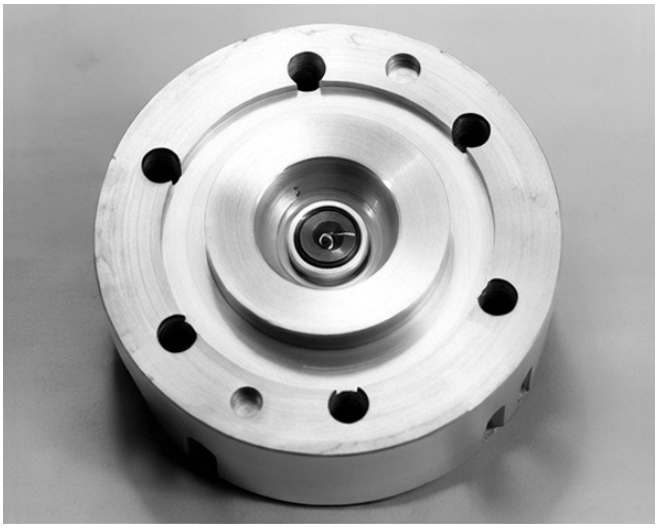
Crankshaft and prop drive washers and nut. Note massive width of counterbalance. Prop drive washer ıs driven by flats on crankshaft rather than a collet or key. 5/16"-24 prop threads used.

material removed at a 45 degree angle to increase the counterweight action. Hollow drilling the crank pin hole would be rather difficult for the average modeler due to the hardness of the crankshaft, but those with a small bench grinder could perform the 45 degree material removal. If in doubt here, refer to our review of the O.S. BGX-1 in the February '91 issue that clearly shows this crankshaft modification.

The engine utilizes a one piece, die-cast aluminum head with a .200 deep, bowl shaped combustion chamber surrounded by a. 195" wide squish band area. It is unusual that the glow plug extends approximately .050" into the combustion chamber surrounded by a .040" wide wall. This was evidently done so that if the engine were used in an inverted installation, fuel would not run into the glow plug cavity and put out the fire. This extended plug did, however, cause problems in checking the combustion chamber volume in our usual manner, i.e., filling the combustion chamber with light oil to the bottom of the glow plug hole. With the glow plug extending into the combustion chamber an air bubble would be trapped. To prevent this, we bored a hole in a round disc of Plexiglas the same depth as the distance from the bottom of the squish band to the top of the piston which, in turn, was a tight fit over the outside diameter of the squish band and seated against the head gasket. With the head inverted, the combustion chamber was filled with oil (glow plug in place) through a small hole in the Plexiglas. The measured combustion chamber volume was .81cc which computes to a compression ratio of

O.S Max-60FP R/C

Piston, sleeve, rod, and wrist pin assembly. Even though an economy engine, the rod is bronze bushed at both the crank pin and wrist pin ends.



Combustion chamber side of head. Note how the glow plug extends into the combustion chamber.

9.83:1 figured with the closing of the .267" high exhaust and a full stroke compression ratio of 13.30:1. A compression ratio of 9.83:1 could be considered a little on the high side but this was evidently done so that the engine would perform well on low or no nitro fuels.

O.S. uses what they refer to as their 60A type carburetor on the engine which, as far as I know, is exclusive to the Max-60FP. This carburetor is of the simple rotating barrel type with an air bleed screw for adjustment of the idle mixture. The carburetor has a 7mm (.276") throat diameter which is actually quite small for a .60 displacement size engine. Generally a throat size in the area of 8mm (.315") can be used without muffler pressure, and with muffler pressure even larger. The Max-61SF for example utilizes a whopping 9.5mm (.374") throat size. As we have pointed out previously, O.S. has obviously detuned the engine to provide more "user friendly" handling characteristics and in the case of the carburetor throat size, strong fuel draw ability which makes the tank position, etc., less critical. In operation, the carburetor, although of very basic design, performed very well with one exception which will be covered in the performance section that follows.

O.S. recommends two fuel formulas for the engine. For break in and general sport use, a mixture consisting of 75% methanol, 20% castor oil, and 5% nitromethane should be used. For higher performance, if more power is wanted after the break-in period, a mixture consisting of 65% methanol, 20% castor oil, and 15% nitromethane can be used. Note here that in both cases the oil percentage is 20%. O.S. also states that in no case should less than 18% lubricant be used, and only then after the engine is fully broken-in.
A high quality synthetic oil may also be used but O.S. cautions that the engine should be run richer in case of leaning out during the flight. For the purpose of our review our standard test fuel consisting of 18% Klotz KL-200, 2% castor oil, and balance methanol was used.

Recommended propeller sizes range from 11x8 through 12x7 depending on the application sport, scale, etc. We tested the engine with both smaller and larger sizes for comparative purposes with other engines tested in the past. All test propellers were Zingers.

O.S. recommends that the O.S. No. 8 plug he used but one did not accompany the engine. We used the K&B R/C (idle bar) glow plug as past experience has shown this plug to perform as well as the O.S. or others. The engine does come equipped with a muffler which was installed for the testing. The temperature of the day was a warm 82°F, the relative humidity a low 34%, and the barometric pressure 29.99' ' of mercury ideal running conditions. The following power figures were recorded.

O.S Max-60FP R/C

11 x 7	11.950
11 x 8	11.200
11 x 10	10.200
12 x 6	11.200
12 x 7	10.000
12 x 8	9.700
13 x 6	10.250
13 x 8	8.250
14 x 6	8.650

Although the above figures are very good for a .60 displacement size engine and on par with other .60 size muffler equipped engines we have tested, they could not be considered anything outstanding. Much of this could be attributed to the small carburetor intake and likewise small 8mm (.315") inside diameter of the muffler tail pipe. The small diameter tail pipe was evidently used to keep the engine noise at acceptable levels. A lot of the engine's power potential is being reduced by the small carburetor and restrictive muffler.

The engine was easily hand started when cold but could prove balky at times when hot. Difficult hot starting is often characteristic of restrictive mufflers that, in turn, affect the engine's internal breathing providing, of course, that the engine is in good mechanical condition otherwise.

The engine had an excellent idle of 2.250 rpm with the 11 x 8 and would hold 1.750 rpm with the 14 x 6. Quite exceptional. The acceleration was very good with a minimum of hesitation through the mid-range but rapid deceleration would cause the engine to momentarily load and sometimes die. This could be attributed partially to the air bleed type carburetor that does not meter the mid-range fuel mixture, but is mainly due to the restrictive muffler that creates fairly high tank pressure when using muffler pressure to pressurize the fuel tank. When you close the throttle quickly, residual tank pressure has to bleed off and, until it does, the idle mixture will be too rich. The answer here is quite simple don't use muffler pressure which solves the problem. With the 7mm intake carburetor, muffler pressure is not necessary.

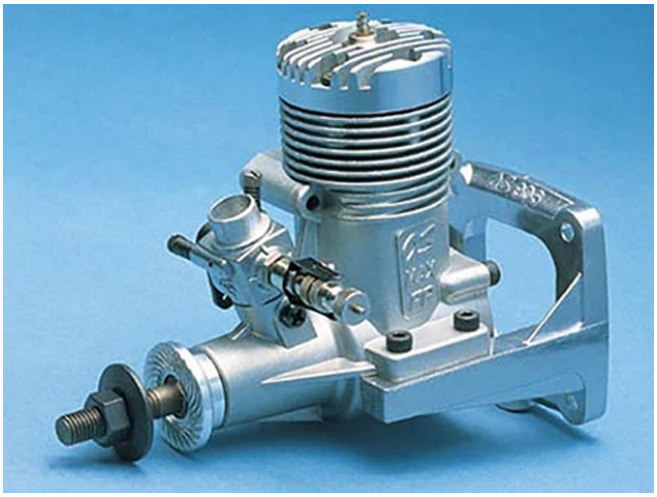
Although O.S. has eliminated several machine operations to hold down the cost of the engine, nothing has been sacrificed when it comes to the usual O.S. quality. The quality is as high as any of the more expensive engines in the O.S. line. The only area we could fault would be the higher than normal vibration level with the smaller prop sizes which I am sure has been brought to O.S.'s attention and will be remedied. O.S. has an excellent reputation for correcting any faults in their engines as soon as they are known. The engine is actually at its best with the 12 x 7, 12 x 8, and 13 x 6 prop sizes. In the rpm range of these props, even after unloading in the air, the vibration should be within acceptable levels.

Although the engine has a list price of $159.95, Tower Hobbies, Great Planes' retail outlet has the engine listed at $109.99 in their magazine ads $70.00 cheaper than its comparable ball bearing equipped brother the Max-61SF ABC. For your money you are getting a quality product at a very reasonable price.

SPECIFICATIONS

Type: Single cylinder, 2 stroke cycle, sleeve bearing, Schnuerle scavenged, ABC, glow ignition
Bore: 23.0mm (.9055 in.)
Stroke: 24.0mm (.9449 in.)
Displacement: 9.97cc (.6085 cu. in.)
Compression ratio: 9.83:1
Horsepower: 1.6 @ 15,000 rpm
Weight: Bare 18 ozs. with muffler 23.3 ozs.
Manufacturer: O.S. Engines Mfg. Co. Ltd., Osaka, Japan
U.S. Importer: Great Planes Model Distributors, Champaign, Illinois

O.S Max-60FP R/C



More: https://flyinghlsat.com/search.php?search_keywords=O.S-Engines