ENGINE REVIEW

by Peter Chinn

1980 FOX 36RX

SPECIFICATIONS

Type: Single-cylinder, Schnuerle-scavenged, rear-exhaust, two-stroke cycle with crankshaft rotary-valve and bronze bushed main bearing. Throttle type carburetor with automatic mixture control. Special 'in-cowl' expansion box muffler.

Checked Weights: 362 grams (12.8 oz) including 60 grams (2.1 oz) for muffler.

Displacement: 0.3594 cu in. (5.889cc)

Bore: 0.800 in. (20.32 mm)

Stroke: 0.715 in. (18.16 mm)

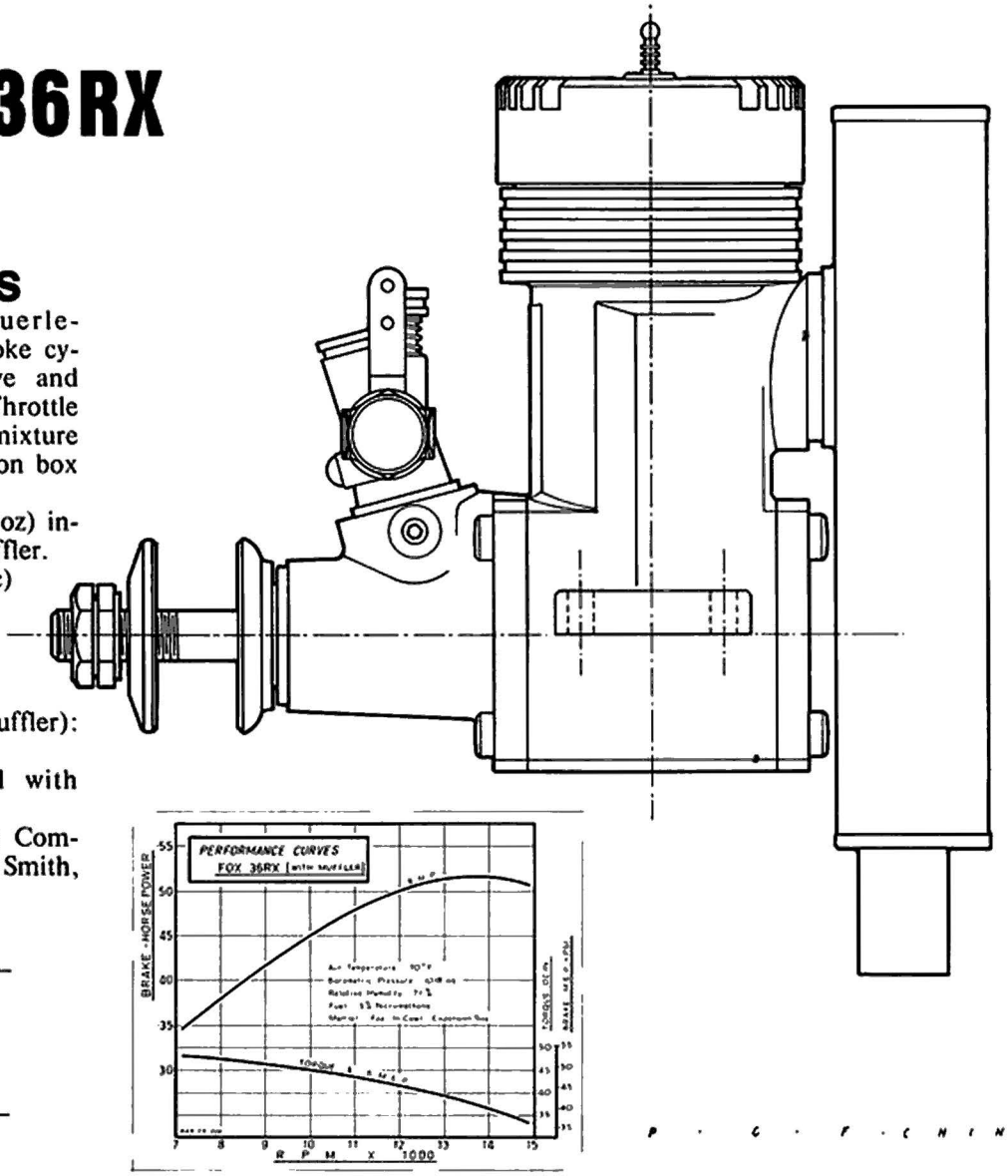
Stroke / Bore Ratio: 0.894:1

Measured Compression Ratio: 7.7:1

Specific Output (as tested with muffler): 1.44 bhp/cu in.

Power / Weight Ratio (as tested with muffler): 0.65 bhp/lb

Manufacturer: Fox Manufacturing Company, 5305 Towson Avenue, Fort Smith, AR 72901.



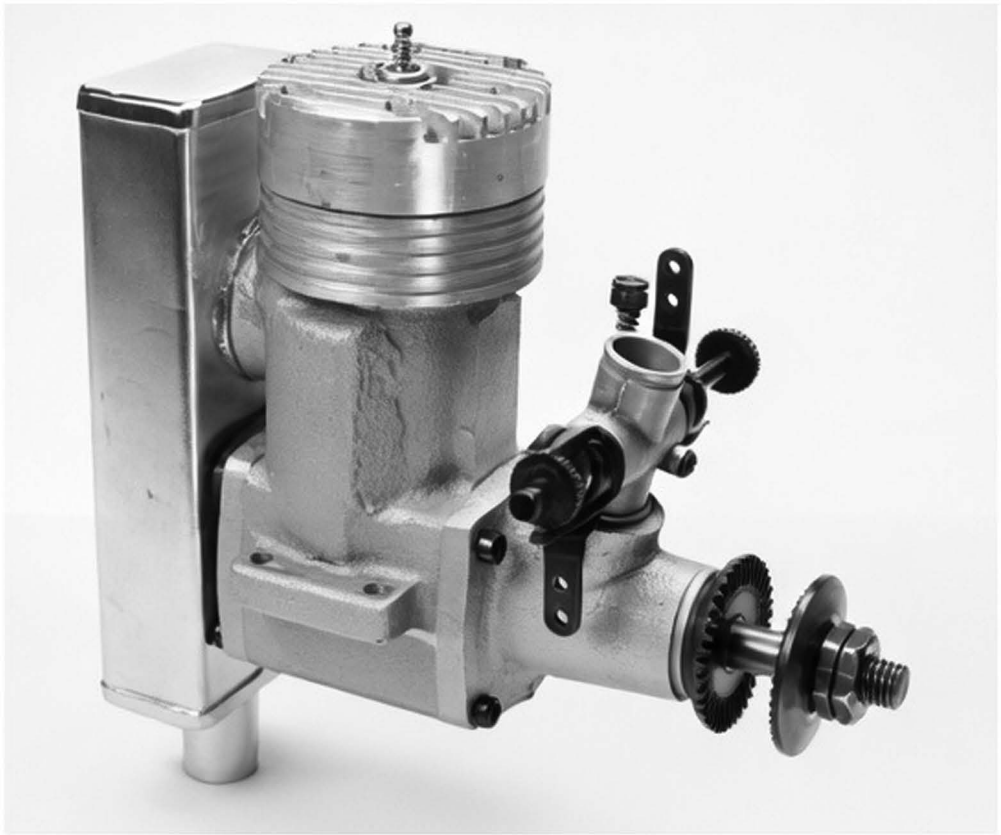
• Although the rear-exhaust Fox 36 was first announced four years ago in a choice of four different models covering CL Stunt, Profile Carrier, Free Flight and RC (see "Engine Review Round-Up," June 1977 *M.A.N.*), the present model is a new version that was introduced in May of this year for the RC sport flier.

With this engine, Duke Fox is probing the market, testing reaction to the idea of a radio-control engine in which the muffler, virtually an integral part of the power package, is installed vertically behind the cylinder and crankcase, fitting between the motor mounts so that it can be fully enclosed within the engine cowl.

The idea is an attractive one. For years, scale buffs have been in favor of such an arrangement in order to avoid having to spoil the appearance and authenticity of a scale model by using the conventional type of muffler outside the cowl. Until now, in fact, the modeler has been obliged, if he wished to avoid such an unwelcome excrescence, to concoct an in-cowl muffler of his own design and construction. This, particularly with a side-exhaust engine, is not an easy matter.

Before we pursue this subject any further, however, we would like to add a note of warning.

In-cowl mufflers can create problems unless special attention is given to cooling. The important point here is to ensure a generous flow of cooling air *through* the cowl. It is not enough simply to have a large opening in the front through which air can enter. The essential requirement is an even larger exit area to allow the air, now heated and therefore expanded in volume, to escape. Failure to do so will simply mean a progressive increase in the temperature of the air within the cowl, resulting in overheating of the engine and, eventually, damage to it. Even if the engine does not actually seize up, overheating of this nature can have effects which the user may not immediately associate with lack of cooling. For example, it can cause the piston ring to be sealed in its groove with baked castor oil, resulting in a complete loss of compression and a refusal to start when the engine is cold. Similarly, as its higher coefficient of expansion causes the aluminum cylinder casing to pull away from the steel cylinder liner, lubricant is forced between the two where



Fox 36RX is a new kind of power package for the sport flier. Muffler is designed to fit between engine bearers and inside cowl; engine uses sand castings.

With in-cowl muffler, increased flow of cooling air is needed.

Carb features separate high- and low-speed jets, individually adjustable.

Special two-piece cylinder head and original Schnuerle type porting without third port are used.

Crankshaft runs in a bronze main bearing. Front housing, like main casting and backplate, is a sand casting.

it eventually carbonizes with the excess heat, bonding the liner to the casing and causing cylinder distortion.

So remember, whenever a cowl is used, a constant stream of fresh cool air must be able to pass through it and around the engine. If the cowl also encloses any sort of muffler, provision must be made to increase the volume of air flowing through the cowl.

As already noted, the Fox in-cowl muffler is installed immediately behind the engine. It is of the expansion chamber type: a vertical rectangular box which slips over the 36RX's circular rear exhaust stack and has a downward pointing outlet pipe for convenient discharge beneath the cowl, although it could, if more appropriate to a particular installation, be rotated through 360 degrees to any other position.

Unlike all other Fox engines, the 36RX uses sand castings, rather than die castings, for the crankcase, etc. Naturally, these do not give such a crisp, clean appearance as die castings and it is probable that the latter will be adopted in the future for the 36RX, if the engine's new concept proves acceptable to Fox customers. Meanwhile, owners of the 36RX can content themselves with the thought that the existing components are probably rather stronger than equivalent pressure-cast ones.

Let's have a look at the 36RX's design and construction in more detail.

MAIN CASTING. This comprises the crankcase barrel, open at both ends, and a full-length cylinder casing. It has narrow, but stout, beam mounting lugs and a circular section exhaust stack at the rear, machined to 0.807 in. o.d. There is a cast-in bypass channel on each side, angled to direct gas toward the front of the cylinder, but no third port channel. This arrangement, in fact, follows that of Dr. Schnuerle's original scavenging system.

CYLINDER LINER. The drop-in steel cylinder liner, located in the usual way by a flange at the top, features two very large bypass ports that are open, according to our measurement of the test engine, for a modest 104 degrees of crank angle. The centrally divided exhaust port, which is open for 136 degrees of crank rotation, has less than half the total area of the two bypass ports, but has its upper edge shaped

to promote an initial release of gases near the center at approximately 6 degrees of crank angle before the exhaust port's full width is uncovered and 16 degrees before the bypass ports are opened. This should have the effect of both reducing charge loss and lowering exhaust noise level.

PISTON AND CONROD ASSEMBLY. The aluminum piston is machined from a permanent mold casting. It has a flat head and is fitted with a single compression ring, radially pinned at the front to prevent rotation of the ring gap into the ports. The machined aluminum connecting-rod has plain unbushed eyes with a lubrication slit at the lower end. The rod is long, 1.42 in. between centers, which has the beneficial effect of reducing rod angularity and, in consequence, piston side thrust is diminished. A long conrod usually means that engine height is increased, but in the 36RX this is partly offset by placing the wristpin higher in the piston. The wristpin itself is tubular, has an o.d. of 0.182 in., and is retained by wire snap rings. Weights are moderate: the piston and ring scale 6.5 grams, or 8.2 grams with wristpin added, and the rod weighs 3.7 grams.

CRANKSHAFT. The one-piece, case-hardened, counterbalanced shaft has a 1/2 in. dia. journal and a 0.216 in. dia. solid crankpin. The gas passage through the shaft is 3/8 in. (9.5 mm) bore and is fed from a 1/2 in. long rectangular valve port that opens at 38 deg. after bottom dead center and closes at 52 deg. after top dead center—according to measurement of our test motor. As on most Fox engines, the drive to the prop is conveyed through a steel thrust washer that is keyed to the shaft by four short splines on the 1/4 in. dia. prop shaft. The shaft end is threaded 1/4-28 UNF and is fitted with a steel hex nut and serrated face prop washer.

FRONT HOUSING & BACKPLATE. The crankshaft runs in a bronze bushing that is fitted into the sand-cast front housing. The housing is secured to the crankcase in the usual way by four screws and incorporates a 1/2 in. i.d. intake boss into which the carburetor is inserted and held by two hex socket headless setscrews.

The backplate is also a sand casting, attached to the crankcase with four screws.

CYLINDER HEAD. This is a Fox machined bar-stock two-component type. It consists of a flanged insert or button that drops into the top of the bore, to form the roof of the combustion chamber, and a finned outer component that clamps the assembly to the cylinder with six screws. The underside of the insert is substantially flat except for a shallow conical depression surrounding the glowplug.

CARBURETOR. The carburetor is an adjustable automatic mixture control type of typical Fox design in which the throttle rotor, instead of having a choke hole, has milled flats, front and back, to form a butterfly type valve. It is drilled axially and threaded to take, from the left side, a conventional valve needle and, from the opposite side, a threaded tubular fuel inlet fitting. The fuel metered by the needle valve and released into the interior of the throttle rotor is then fed into the intake via two jet holes. One of these (the low-speed jet) is located in the front flat and the other, the high-speed jet, is positioned in the bottom of the throttle rotor and offset to one side. Below the rotor, the bore of the carb changes shape, and as a result of this, the offset high-speed jet hole is completely masked as the throttle is closed and the engine then runs on its low-speed jet only.

As in other, more orthodox carburetors, the correct mixture strength for full speed running is obtained by means of the needle valve. However, as already stated, this also feeds the low-speed jet and, to control the amount of fuel released to the low-speed jet, this has its own adjustment via the inlet fitting in the opposite end of the throttle rotor. This screws in to weaken the low-speed mixture and out to enrich it. The fitting itself acts as a needle valve here. Its tip, in addition to being drilled to accept the needle valve tip, is tapered externally and screws into the valve rotor to just beyond the position of the low-speed jet hole, thereby controlling the amount of fuel fed back to the low-speed jet.

The carburetor has the usual throttle stop screw and is provided with adjustable throttle arms on both sides.

MUFFLER. The muffler is a plain expansion box of fabricated construction, and has a volume of approximately 46 milliliters and a short outlet pipe of approximately 85 sq mm area. It fits firmly onto the engine's exhaust stack and is locked with a setscrew that is reached with a long Allen key through the outlet pipe in the bottom.

PERFORMANCE. As the 36RX is sold only as a complete engine/muffler package and is intended to be operated as such, all our tests were carried out with the muffler in place.

The engine is not critical to the type of fuel used: as the instruction leaflet says, any of Fox's own brands works well in the 36RX. However, a nitro blend is not essential and, where minimum operating cost is a factor, the engine can be run quite satisfactorily on a straight mixture of methanol and castor-oil. For our tests we compromised by using our standard RC engine test fuel which contains 5 percent nitromethane in a methanol/castor-oil base mix.

Our 36RX was given approximately two hours' break-in time prior to testing. Initially, the engine showed signs of a tight main bearing and we therefore used a little of Duke Fox's "Lustrox" to hasten the break-in. This worked well: at the end of the break-in, the front end was running noticeably cooler and the engine was holding steady leaned-out rpm.

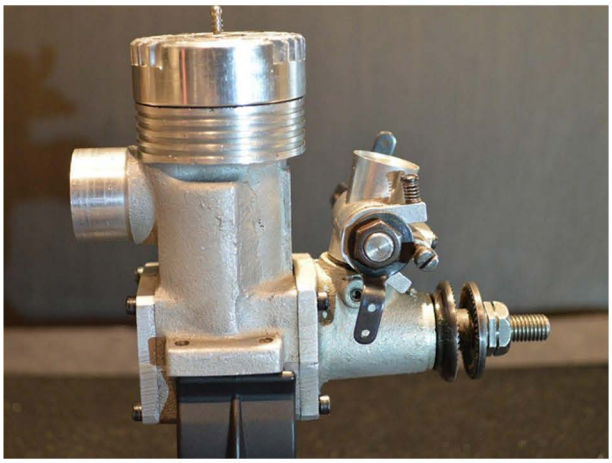
At this stage, we ran some prop rpm checks. Although an 11x5 is the largest size recommended in the manufacturer's instruction leaflet (rightly so, where one is looking for as much power as possible), we found that it would also cope quite happily with somewhat larger sizes. For example, it turned a 12x4 Zinger maple at 8,900 rpm; a 12x5 Top Flite maple at 8,000 rpm; and, still without any sign of laboring, a 12x6 Zinger maple at 7,700 rpm. Of course, these big sizes would only be required for very large, lightly loaded models. Moving toward more normal sizes, an 11x6 Power-Prop maple was turned at 9,500 rpm and a 10x7 Zinger at 9,700 rpm. Also, 9,750 rpm was recorded on an 11x4 Power-Prop maple; 10,200 on a 10x6 Power-Prop maple; 11,000 on a 10x5 Top Flite maple; and 11,100 on a 10x5 Zinger maple. Other figures included 11,200 on a 9x7 Zinger maple; 11,800 on a 9x6 Zinger maple; 12,400 on a 9x5 Zinger maple; 12,500 on a 10x4 Top Flite maple; 12,700 on a 10x4 Zinger maple; and 13,100 on a 9x5 Top Flite maple.

General running qualities were good. The engine ran smoothly except when loaded for speeds above 14,000 rpm, where there was some unevenness and an increase in vibration. This, however, is not important because, as the performance graph shows, such speeds are above the revolutions at which the 36RX delivers its maximum power. Allowing for some rpm build-up in the air, as the load on the prop is reduced with forward speed, it is probably best to prop the engine for static rpm of between 11,000 and 12,000. However, as the torque curve indicates, there is also plenty of pulling power at low speeds and consequently (as we have already seen) the 36RX also performs well on larger size props.

The peak power output, determined from our dynamometer tests, of just under 0.52 bhp at around 13,700 rpm is good for a .36 cu in. RC sport engine fitted with a muffler and running on mild fuel. It is also better than we recorded for the standard side-exhaust crossflow scavenged Fox 36RC *without* a muffler. Incidentally, with both engines fitted with the appropriate Fox mufflers, the 36RX is noticeably the quieter of the two and this, it would seem, can be attributed not only to its muffler but also to the shape of its exhaust ports which, by initially releasing the exhaust gases more gradually, give a less explosive crack to the exhaust note.

Handling qualities were generally good. After the break-in, the engine started easily and responded well to the carburetor controls, with a low idle (2,400 on a 10x6) and reliable transition between speeds. One thing to watch is the nearness of the carb controls to the prop. Needle-valve adjustments are best approached from behind the engine with the forefinger and thumb. Also, make sure that the back of the prop does not foul either of the throttle levers at the limits of their travel. This can happen if you are using a prop that has the back of the boss cut away, or if the throttle arm is incorrectly positioned—it can be readjusted by slackening the locknut on the throttle rotor.

Stripped down at the conclusion of testing, our Fox 36RX was found to be in good condition throughout. The original Fox long-reach idle-bar type plug, supplied with the engine, remained intact and, checked against another plug of the same type, had not deteriorated in performance. ■



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