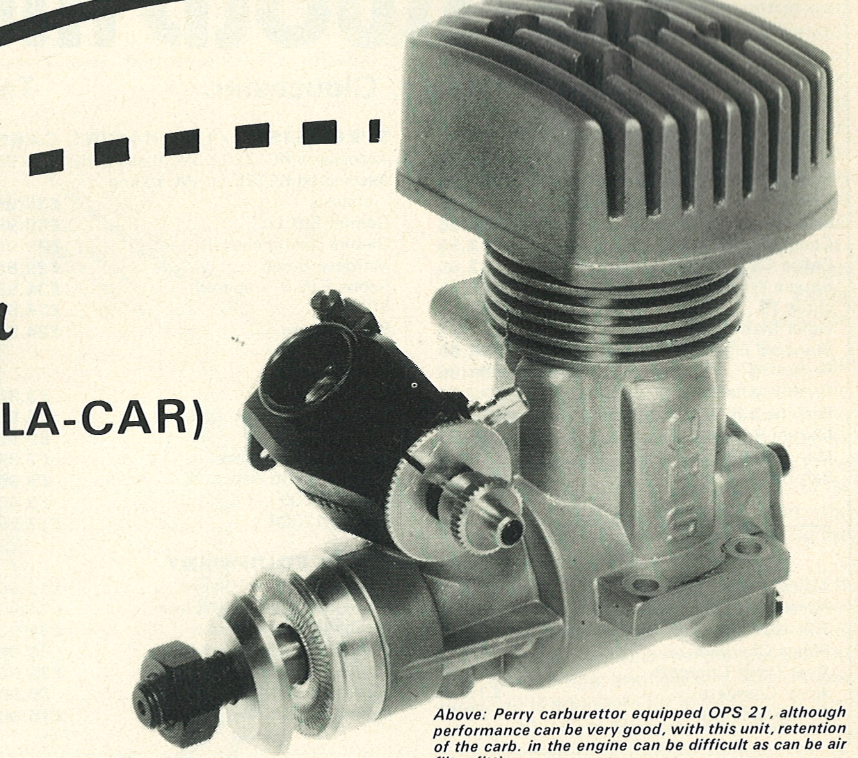
ENGINE TEST ②

by Mike Billinton

OPS 3.5 SPEED (SLA-CAR)



Above: Perry carburettor equipped OPS 21, although performance can be very good, with this unit, retention of the carb. in the engine can be difficult as can be air filter fitting.

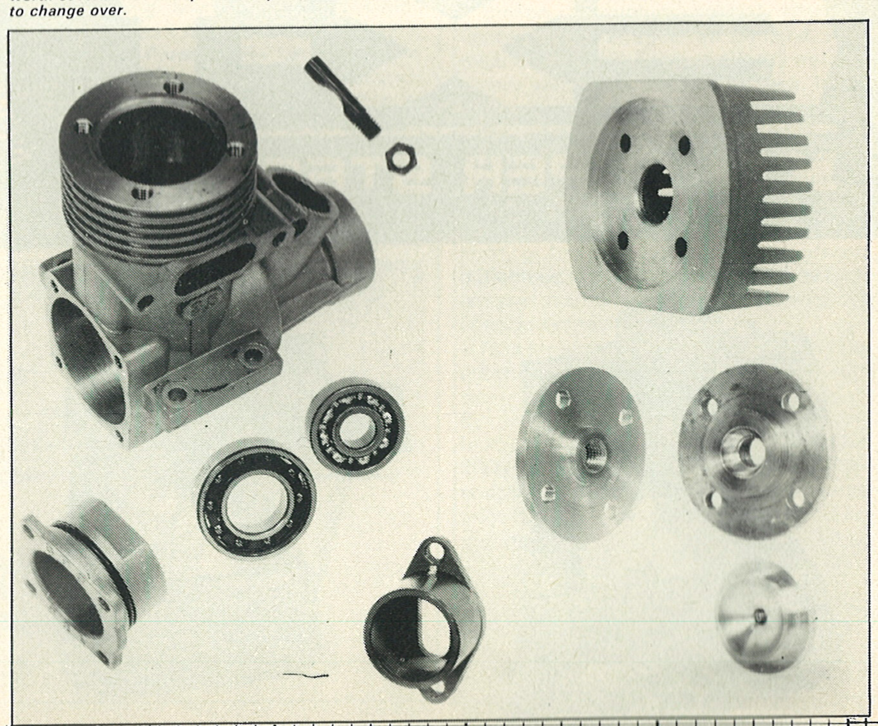
THE OPS NAME in model engines is synonymous with *speed* and in most of the racing classes it is recognised as the 'name to beat.' Their top CAR engine, tested here, was introduced in 1976, and has remained largely unchanged since — apart from minor modifications. These though, are often the essential points which separate out the winners, and OPS have one advantage here: the large range of Racing machinery they specialise in, allows for much cross-fertilisation of detail design between the various classes; with an end result of a likely high degree of dependability under racing conditions.

OPS have recognised the differing operational requirements of the Car and Marine worlds, by giving the Marine Version of this engine 170° Exhaust timing (for its certain tuned pipe use) and the Car version 160° (for its almost certain non-full-tuned pipe use). The tuned pipe (in its twin-cone style) has not found favour on the car circuits because the narrow 'peaky' band of power makes controllability a more difficult task than is the case with the more 'groovy' Boat and Aircraft Models. Basically the mediums through which the two latter travel, hold them more securely on their headings than happens with the car and so sudden increases of power are less easily controlled. The tuned-pipe's very low torque at low RPM is no help either to the car, with its relatively non-slip situation compared again with the Boat and Aircraft models.

All in all, it's no surprise that the practice is now established of 'no full tuned pipes in cars' but fine elsewhere. However the Marine liner itself with its higher timing *is* used cars on the reported grounds of a higher revving potential which can better suit some gear ratios and/or tracks. But OPS still recommend the car version as having slightly more consistent operating characteristics.

The OPS 3.5 is one of the very few Open car engines where the manufacturer makes available certain essential ancilliaries, such as large bore slide carburettors, air filters, high speed bearings etc. For other engines these have to be obtained from outside specialist sources.

OPS 21 parts - note the different head types - smallest is the integral element 'Trumpet' shape glow head, worth several hundred rpm but expensive and difficult to change over.

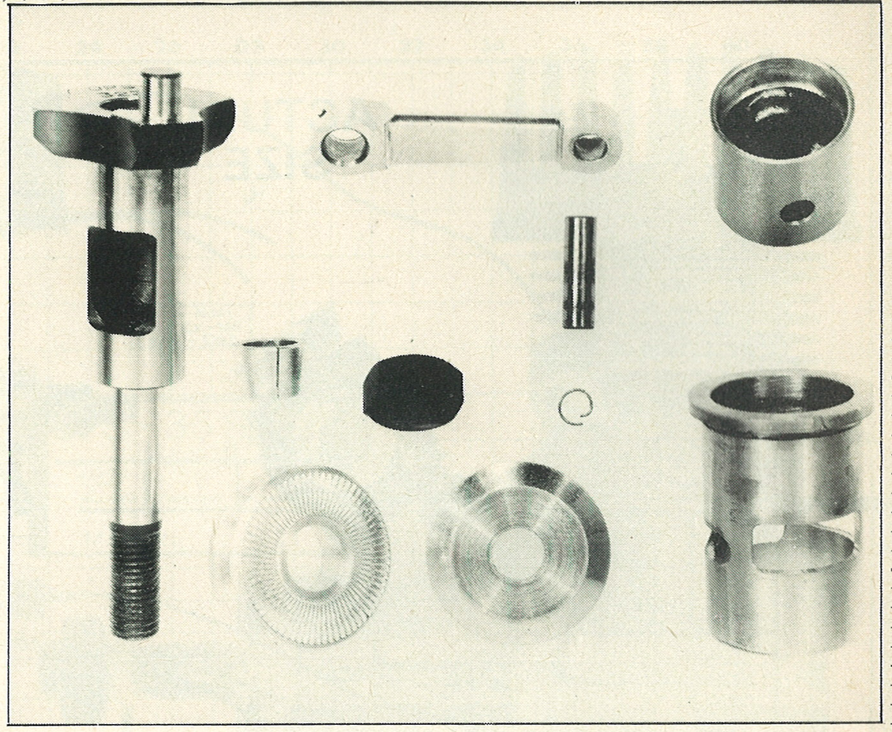


Mechanical Details

The letters 'SLA CAR' applied to this engine form one of the 28 different codings given to the current OPS range. The first three letters indicate the geometric layout, whilst the last three show what the unit is supposed to be used for. So, SLA is Italian for Side Exhaust, Front Induction . . . and Car is obvious.

Crankcase. In common with the majority of Class competitors, this is a solid one-piece aluminium alloy casting. The full side exhaust layout with the usual 4 Schnuerle ports means the gudgeon pin has to be circlipped to prevent intrusion of the pin into ports. A small drilled hole at the base of carburettor boss to front bearing allows carburettor depression to draw escaping fuel back from that bearing — a recurrent fuel economy feature in cars. The solid attractively finished case interestingly features transfer ports which are quite shallow by some standards.

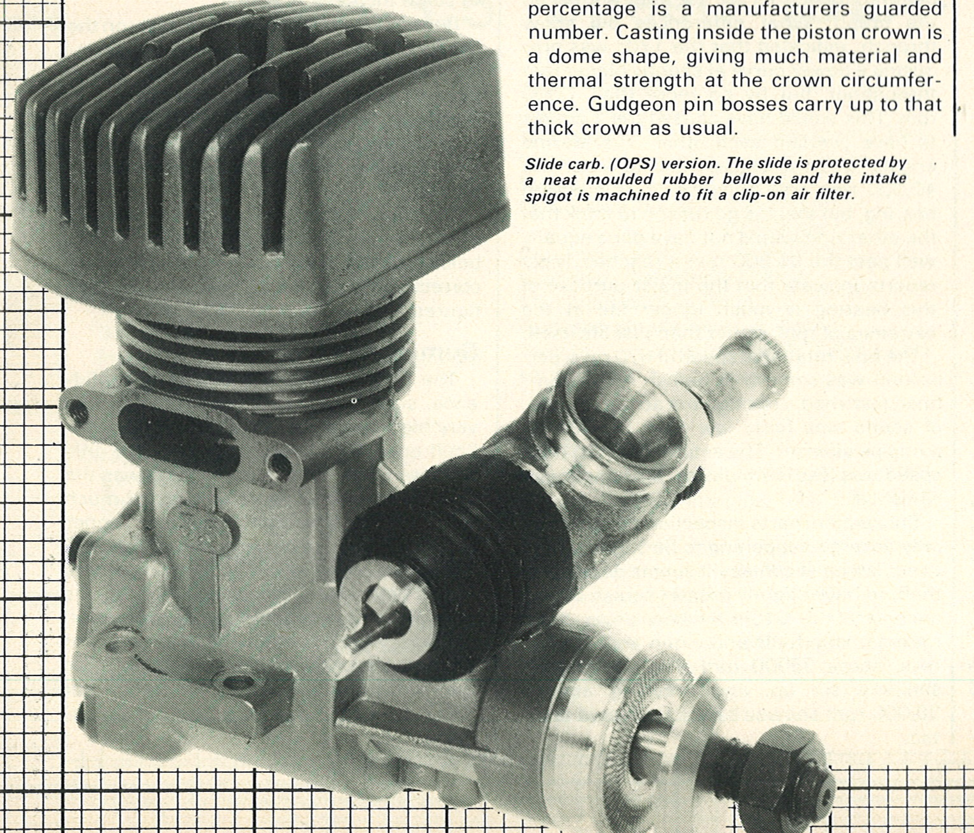
Cylinder Head: is in 2 pieces. A large 'heat-sink' casting clamps down with 4 bolts onto a combustion chamber insert. This can be either a double-angled squish band with deep combustion bowl, or — a 'trumpet' style insert. Head shims of .005in. and .009in. are available for different head clearances. As set up by the manufacturer the 3.5 Car engine has pure methanol in mind, and so has a tight squish clearance of around .005in. With the use of Hi-nitro fuels outside Italy though, it's advisable to raise the head insert by at least a further 5 thou. As set-up, it has an effective Compression ratio of 9.8/1. Using the Marine liner causes this ratio to drop to 9.2/1, and from a detonation point of view this extra shimming is less of a requirement. It *is* still necessary though, for squish clearance reasons, because these very small clearances reduce dangerously when using high heat fuels.



Above: reciprocating parts. Gudgeon pin is retained by two tiny wire circlips.

Liner: is the usual Brass chromed and 4-ported style, and OPS still retain the quite tapered and tight liner geometry i.e. .002in. small at TDC. The Car exhaust port is angled up 30°C but is straight cut in the Marine liner. Boost is at 54° in both, and transfers are also straight cut.

Piston: is high silicon content, but the percentage is a manufacturers guarded number. Casting inside the piston crown is a dome shape, giving much material and thermal strength at the crown circumference. Gudgeon pin bosses carry up to that thick crown as usual.



Slide carb. (OPS) version. The slide is protected by a neat moulded rubber bellows and the intake spigot is machined to fit a clip-on air filter.

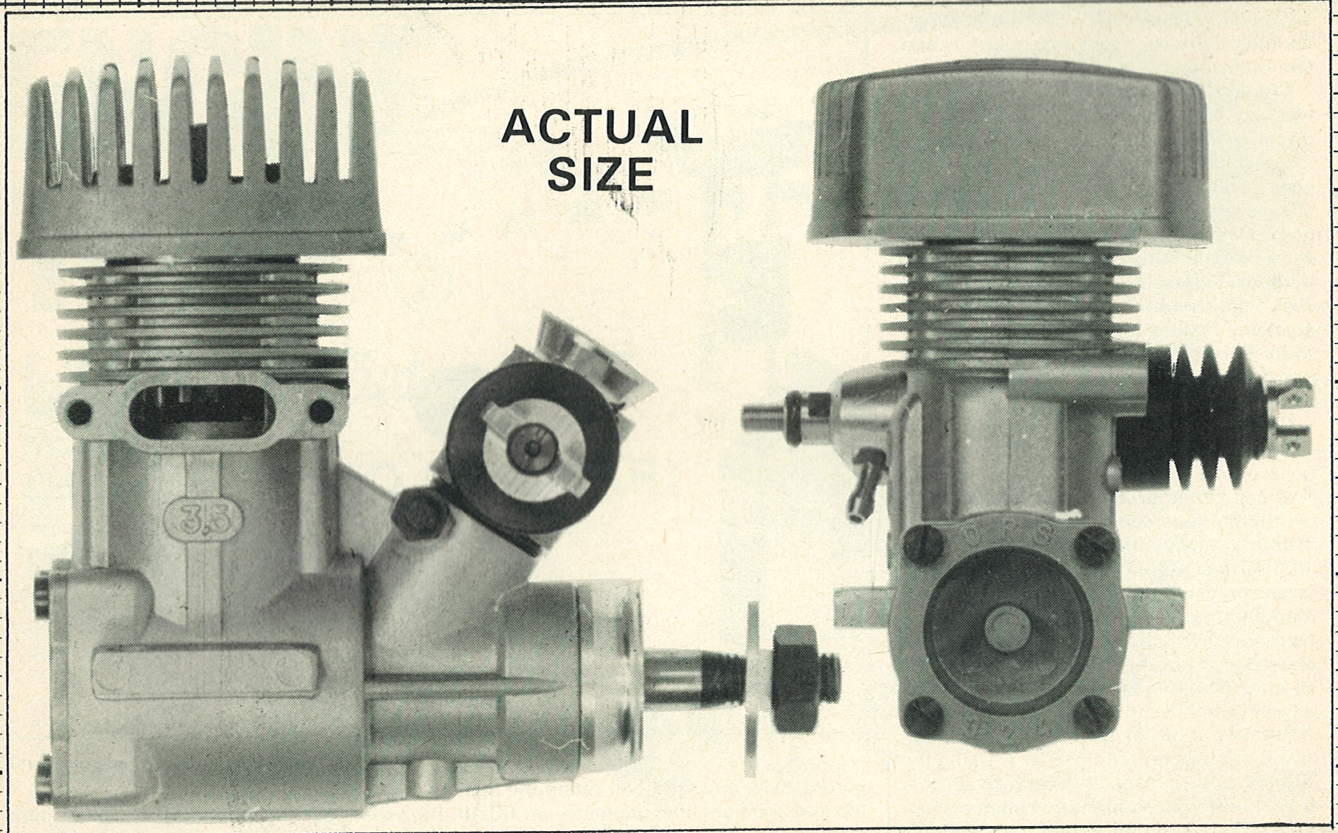
Con-rod: is milled from solid high-strength aluminium alloy, bushed at the big-end only with now only one lubrication hole.

Crankshaft: is in Nickel Chrome steel, with small crankpin of 5mm diameter: one of those awkward compromise areas where high rubbing velocities at 30,000 rpm plus, preclude larger diameter crank-pins.

Backplate: is unusual in that sealing is by 'O' ring round the circumference which plugs into the crankcase. This eliminates a fair amount of machining work, plus giving a good consistent seal.

Power Tests

Because of the use on Car circuits of the two differently timed liners, an attempt was made during this formal test to evaluate possible differing results. Best to say straight away that, (at least when running on 'full-house' equipment of AMPS mini-pipe/9mm OPS slide carburettor/50% nitromethane), there was not a marked enough difference to separate the results of the timing change from the fact of a different engine anyway. However on Open exhaust and 5% nitro with 7mm Perry carburettor a difference was noted as shown on the graph. A difference which has little value, as the engines would rarely be operated in this format. It is fair to add, that to obtain maximum benefit, either of actual power or of change in the position of the peak BHP points, would, probably require a different tuned length of the typical Mini-pipe silencer in keeping with the changed Exhaust timing. This was not done during this test, but no doubt on the circuits some



top drivers do experiment in this way. It seems unlikely though, given the fairly mild resonance effects of the minipipe, and the timing change of only 10° to the Exhaust, that large value changes to BHP or RPM points would follow from average adjustments to minipipe lengths.

Test 1

160° Car engine, 5% nitro Perry 7mm carburettor (suction feed) Head squish .005in. These can be considered as comparative parameters, though the typical car engine in practice will rarely use them. The result was 0.78 BHP at a quite high 25,000 rpm with little evidence of the relatively higher power at lower rpm reported by some drivers.

Test 3

Equipment as above; but using the 170° Marine linered engine. This particular engine started off with a tighter piston fit, and so required some running-in . . . more, that is, than the manufacturers instructions reading ". . . require no running-in."

Following a necessary freeing period, the tests then showed this unit to be down on torque and rpm from 14 to 22,000 rpm. But from that point on it proved to be slightly more powerful.

Tests 2 & 4

With 'Full-house' Power boosters of 50% nitro/9mm OPS slide carburettor/AMPS minipipe silencer. (Silencer pressure used). Heads were raised to .010in. total clearance. Because of the essentially similar results obtained in this format from both engines, and because the Marine engine had been fitted with the OPS hi-speed main bearing, its figures are the ones shown on the graph. What differences did show through, indicated that the 170° was producing a power curve at slightly higher rpm throughout; but by no more than 1,000 rpm. This would have caused the 2 curves to have overlain each other. The Marine engine was the chosen one to enter the 40,000 rpm area because of its hi-speed bearing, but there is no reason to think that the other unit would not have done equally well past the 35,800 rpm *it* reached. Most reports indicate that the major purpose of this bearing is much longer life at the extremes of rpm, rather than just life itself.

The final rotational speed of 670 revs. per second was somewhat hellish in the confined test shed, although the actual volume of sound was fairly low from the AMPS minipipe silencer. The actual torque at that speed was less intimidating, having almost vanished.

Subsequent parts inspection showed the only adverse happening to be slight piston to squish band contact. It seems necessary then, to have slightly greater squish clearance (around .015in.) when using high nitromethane fuels and when anticipating revs. above 35000 rpm. The Car engine similarly set up, and reaching almost 36,000 rpm showed no such signs of contact.

The maximum BHP reached was 1.07 at 25,500 rpm and it's as well to point out that the use of yet larger bore carburettors than the OPS 9mm used here, could well result in some increase of power.

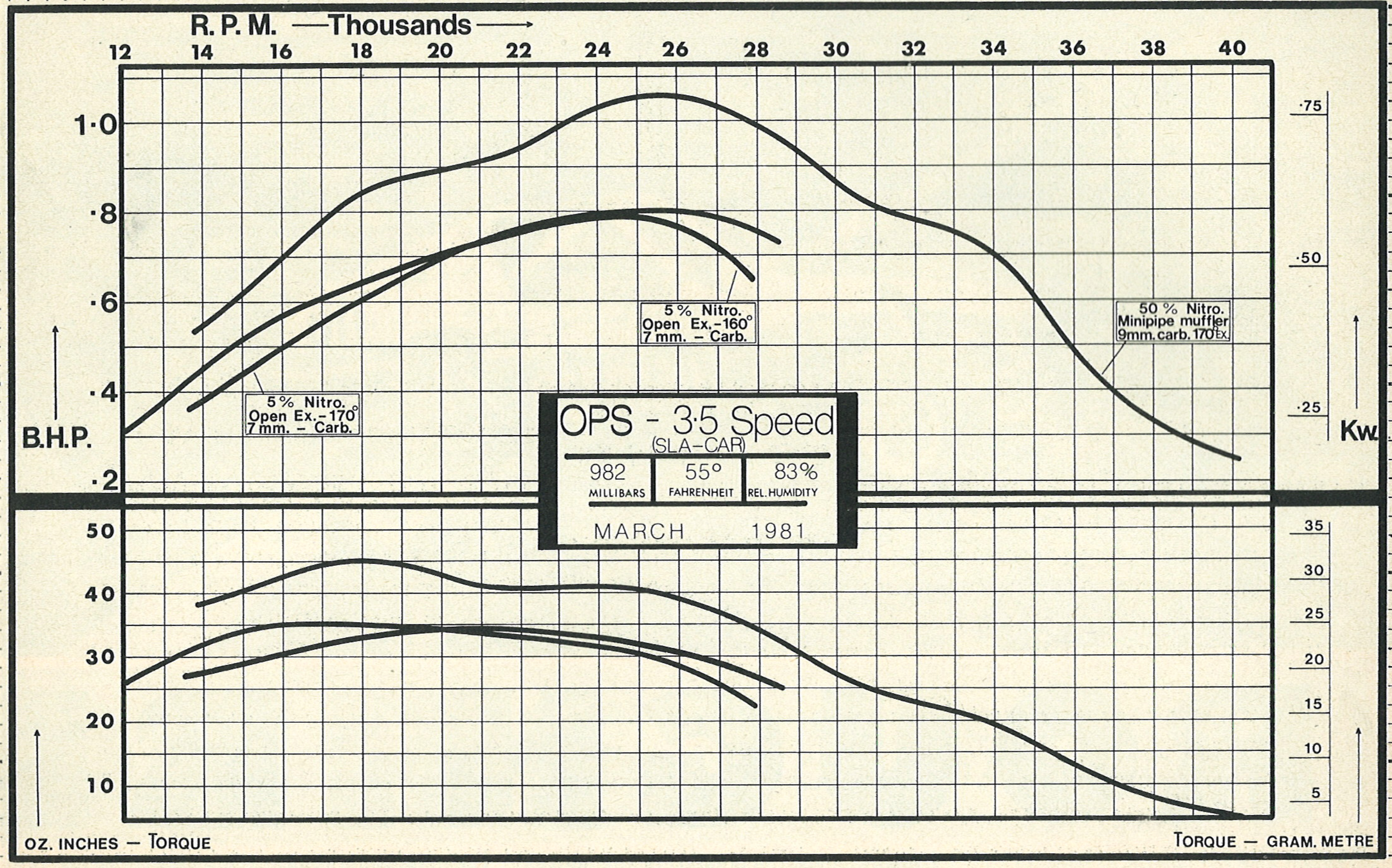
Beyond 25,000 rpm approximately on the hot fuel, plugs were consumed at an alarming rate. One cannot do worse than 1 plug per run, which was achieved in this mode. A change (through necessity) from the OPS 1½v Car plugs to Taylor 2 volt did not affect this problem, neither was performance altered.

Throughout all runs, 15% ML70 synthetic oil was used. Air Density a little below standard was compensated for, by a correction Factor of 1.03 applied to the BHP figures.

Summary

The OPS generated a degree of confidence, such that the decision to try for the very high rpm of 40,000 plus was not a difficult one. Other than that figure, the only surprise of the whole test session was the reluctance of both motors to reveal much trace of the frequently reported 'higher power at lower revs.' situation of the OPS 3.5 when compared with other competitors in this field. More information then, seems to be required in order to decide the matter.

There were no mechanical mishaps of any sort, the only problem was (on high nitro fuels only) swelling of the slide carburettor 'O' ring — causing very tight needle adjustment.



OPS 3.5 Speed (SLA- CAR)

Dimensions & Weights

Capacity — .2105 cu.in. (3.45cc)
Bore — .654in. (16.6mm)
Stroke — .627in. (16.0mm)
Stroke/Bore ratio — .96/1
Timing periods — Exhaust 160° (Car)
170° (Marine)
Transfer 123°
Boost 120°
Induction opens 38° ABDC closes 50° ATDC
Total — 192°
Combustion volume — .26cc
Compression ratios —
Geometric 14.2/1
Effective 9.75/1 (Car)
9.2/1 (Marine)
Exhaust port heights — .213in. (Car)
.236in. (Marine)
Cylinder head squish — .005in.
Squish band width — Inner band .10in.
Outer band .030in.
Squish band angle — Inner Band 5°
Outer band 0°
Overall height — 3.4ins.
Width — 1.7ins.
Length — 2.7ins.
Mounting — 16 × 37mm spacing with 3mm holes.
Frontal area — 4.74 sq.ins.
Carburettor bores — Perry 7mm
OPS 9mm
Crankpin diameter — 5mm
Mainshaft diameter — 12mm
Mainshaft bore — 9mm
Gudgeon pin diameter — 4mm
Weight — 9¾ozs. (with OPS slide carburettor)

Performance:

Maximum BHP: 1.07 at 25,500 rpm (170° engine/AMPS mini-pipe/50% nitro/OPS 9mm slide)
0.79 at 26,000 rpm (170° engine/Open exhaust/5% nitro/Perry 7mm carburettor)
Max Torque: 47oz.in. at 18,400 rpm (Full house equipment as above)
34oz.ins at 17,500 rpm (160° engine/Open exhaust/5% nitro/Perry 7mm)
RPM Standard Propellors:
Zinger 8 × 6 — 13,720 (160° engine/open exhaust/5% nitro/Perry 7mm)
Zinger 7 × 4 — 22,060 (160° engine/open exhaust/5% nitro/Perry 7mm carburettor)

Performance Equivalents:

BHP/cu.in. — 5.08
BHP/cc. — .31
Oz.in./cu.in. — 223
Oz.in./cc — 13.6
Gm. Metre/cc — 9.48
BHP/lb. — 1.75
BHP/Kilo — 3.87
BHP/sq.in. frontal area — .225

Manufacturer:

OPS Monza, Italy

U.K. Distributor:

OPS Distribution Ltd., 512 Berridge Road West, Hyson Green, Nottingham.