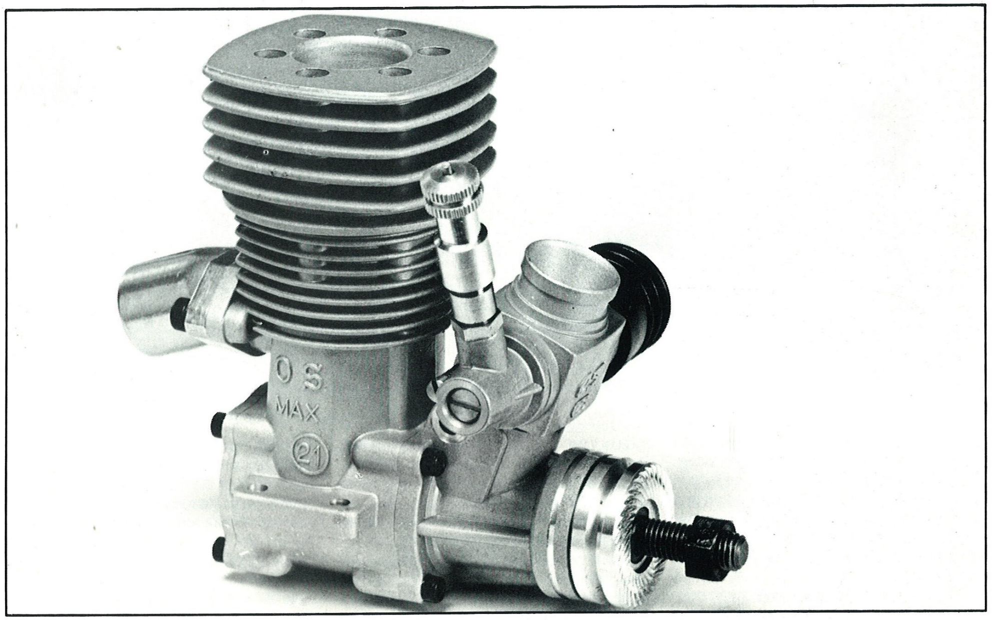
Review



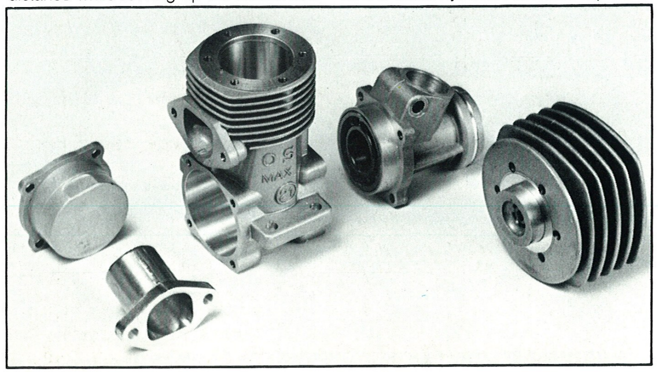
O.S. 21 VF-R

A WELL-MADE TWO-STROKE GLOW ENGINE

BY MIKE BILLINTON

First, apologies for the delay in this sequence of car engine tests, due mainly to a major relocating of the dynamometer facility at Santa Pod, U.K. (This writer can now watch full-size drag racing at discreet distance while revving up the Rossis and OPSs of the model world!)

The O.S. 21 VF-R is the model which placed second and tenth at the World Championships in Tokyo in July 1985, in the hands of J. Koma and K. Thukishi driving for the Team Kyosho. Favorable reports of the new Japanese engine followed these good results, achieved against a veritable deluge of OPS placings at that meeting. Not surprisingly, both this new engine and that successful OPS Pro-Comp model are, together with others, being persuaded along the same developmental route due to the advent of the now almost mandatory 4WD; i.e., that of increasing engine torque at the 16,000 rpm point onwards (roughly where the clutch starts to bite), mainly in order to cope with the dramatically increased traction offered by 4WD. Failure to do so leads to the motor being unable to get onto the rising power curve, or, more simply, bogging-down. The arrival of two-speed gearboxes could mitigate this problem enough to see some engines reverting to earlier high rpm/high and narrow peak power points (plus the usual "hole" in torque curve at lower rpm). However, the two-speeder strictly does not provide wide enough gearing (witness some 12-speeders used in full-size motorcycle piped two-stroke racing engines, albeit covering a much larger road speed envelope), and therefore there will be much reluctance to abandon the higher torque at lower rpm engines currently finding favor, particularly as engine handling and reliability appear to have been enhanced in part by the slight relative lowering of rpm maximum hp points.



Comparison of the earlier O.S. 21 VF-C with this latest VF-R shows this rpm shift, but more remarkable has been the large torque improvement. Clearly the O.S. engineers have been working on the problem of relatively low-level response to tuned pipe use of the earlier engine to such an effect that in torque terms at least the VF-R is now a very competitive engine.

This strong torque surge is not, however, maintained quite as far up the rpm band as has been found in some other competitor engines, and so results in a slightly restrained final hp maximum.

MECHANICAL POINTERS

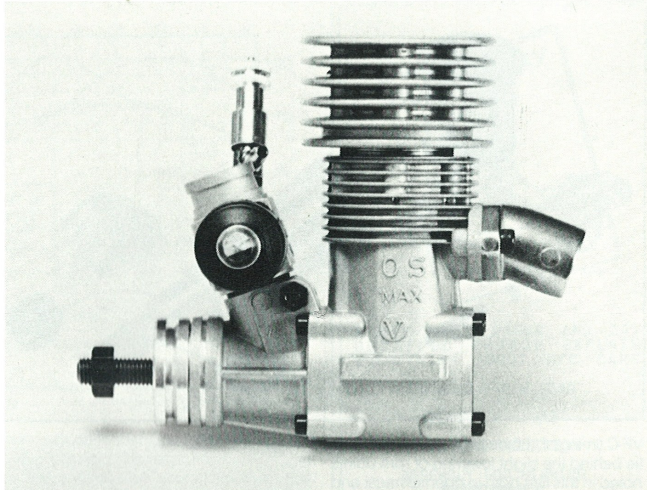
There being considerable similarity between the VF-C and VF-R engines, it seems preferable to comment mainly on the differences:

1. Externally distinguishing features of the new model are the new 9mm slide carburetor, the more solid diecast finish cylinder head having wider-spaced and squarish plan-form finning, and, on this test engine at least, a narrow turned "cosmetic" groove on the front housing/front bearing section.

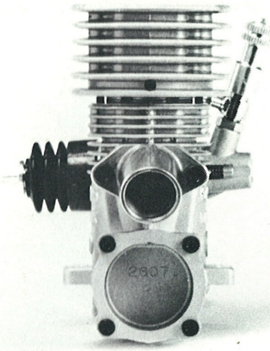
2. The cylinder head has a small "ventilation" hole near the plug position to keep its temperature at reasonable levels by air replacement.

3. Plug thread is the more reliable brass insert.

Paradoxically this area threatened problems during test, from a source which has potentially affected other previous tests, though not as in this case, almost to point of stoppage. The fine OPS 300 plugs are just that—fine. But they do have a detail fault in that occasionally the crimped coil ending intrudes out into the thread proper. Failure to file this down to below thread height allows this hard coil material to damage threads in the head. This should be noticeable when screwing the plug in, but sometimes is only manifest when removing the plug, following which matters rapidly get fraught! The brass insert of the O.S. head could almost be faulted for being too good in this context, for on one occasion a lengthy "to and fro-ing" of plug spanner and oil application only just enabled the plug to be finally freed. Usually the much softer alloy head material gets moved aside by this protruding piece of element material, but not so the brass insert. None of this is good practice, the plug needs preliminary trimming, using magnifying glass if necessary. The head itself is beyond blame.



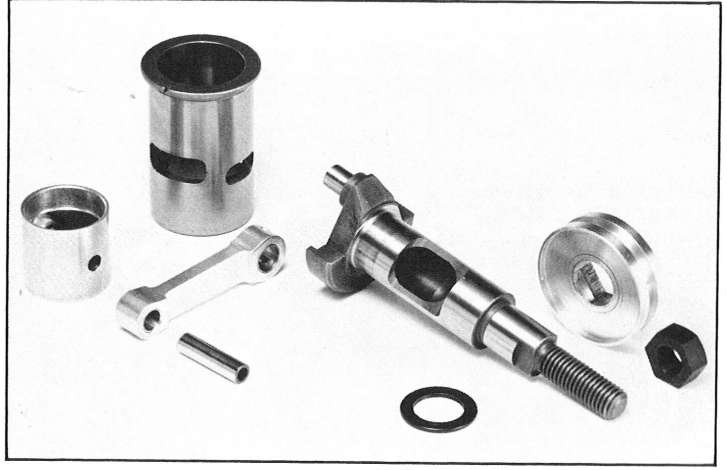
With many similarities between the VF-C and VF-R engines, the external differences should be noted, including the 9mm slide carb, and the solid diecast finish cylinder head.



This engine placed second and tenth in the World Championships in Japan in 1985.

4. O.S. has continued with the same separate front housing, so it is worth Loc-Titing those front four bolts. There is now an oil channel in the housing just aft of the front bearing. It connects in the usual way to the base of the carburetor via a small air slot.

5. Cylinder timing appears slightly reduced, though arguably only within measurement error. Certainly the exhaust port height is more shallow (.224 in. against .230 in.) and adds confirmation to the lower measured 164 degrees against the earlier

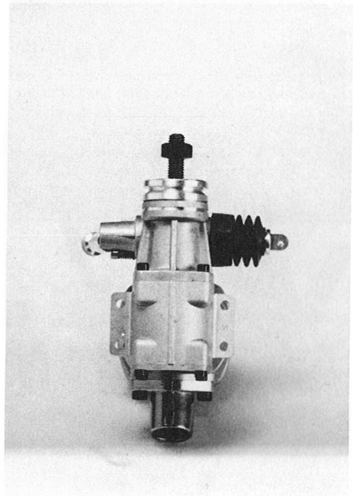


VF-C timing of 166 degrees, and which may lie behind the slight lowering of rpm points noted in this test both in open exhaust and tuned pipe formats.

6. In conjunction with a squish clearance increase (from .014 in. to .016 in.) the combustion chamber volume now results in a distinct lowering of effective compression ratio to 7.35/1 from the earlier 8.8/1.

In spite of these ameliorations the VF-R did not improve upon the OPS 300 plug-crunching ability at maximum pipe resonance and 50% nitro; if anything it was more hungry than the earlier VF-C engine.

7. The new O.S. 2S slide carburetor has an enlarged 9mm bore, and features the O.S. anodized aluminium barrel found in several of their other engines. The resultant light weight/low friction of this barrel style does appear to restrict wear, and at finish of test, very little play or wear was to be seen. The well-positioned and knurled "upright" needle control was very accurate in use, though it too suffered from O-ring swelling when using high nitro fuels to the point almost of immovability. Nice on the track? Nasty on the dyno!



The adjustable main jet gave firm control over acceleration, and throttle response was as good as can be reasonably assessed away from the track and on a test bench. (This aspect of accelerating performance is still under scrutiny and will form part of a future test.) Idling performance itself was equally acceptable and trouble-free.

POWER TESTS

Test 1. Open Exhaust. 5% Nitro/20% Castor O.S. No. 8 Plug

These torque tests covered rpm from 9,800 to 33,500, and immediately revealed the shift in performance emphasis. At 16,000 rpm maximum torque was up from 40 to 49 oz. in. compared with the earlier VF-C engine, while at 24,000 rpm it was up 4 oz. in. to 44 oz. in.

Around a third of this actual uplift in torque could be attributable to atmospheric differences on the respective test days (80 degrees F for the VF-C and 45 degrees F for the VF-R; with pressure similar). The actual hp figures (which are, as usual, corrected for atmospheric changes), show the real *engine* difference, and appears to amount to between 12% and 16% hp increase in the 12,000 to 24,000 rpm area. From 26,000 rpm, however, the new VF-R proved little different in torque terms.

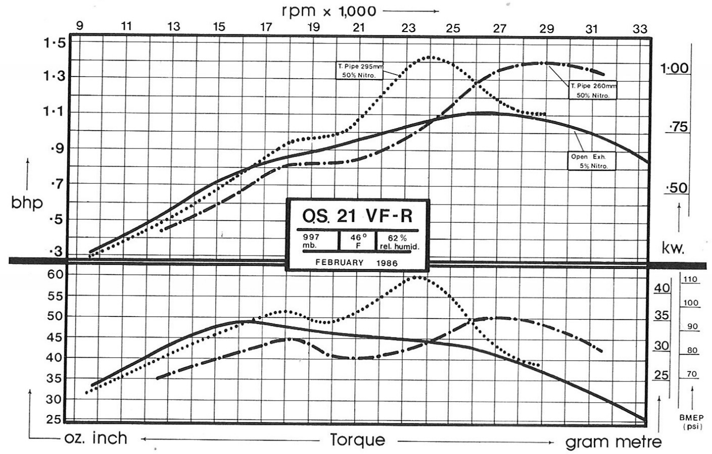
Interestingly the standard propeller rpm were not significantly changed between the two engines, seeming to prove that while thick air gives more power it happens also to hold back final propeller rpm. The precise values of these interactions have yet to be pinned down by this writer in the absence of a variable density air chamber in which to test the engines!

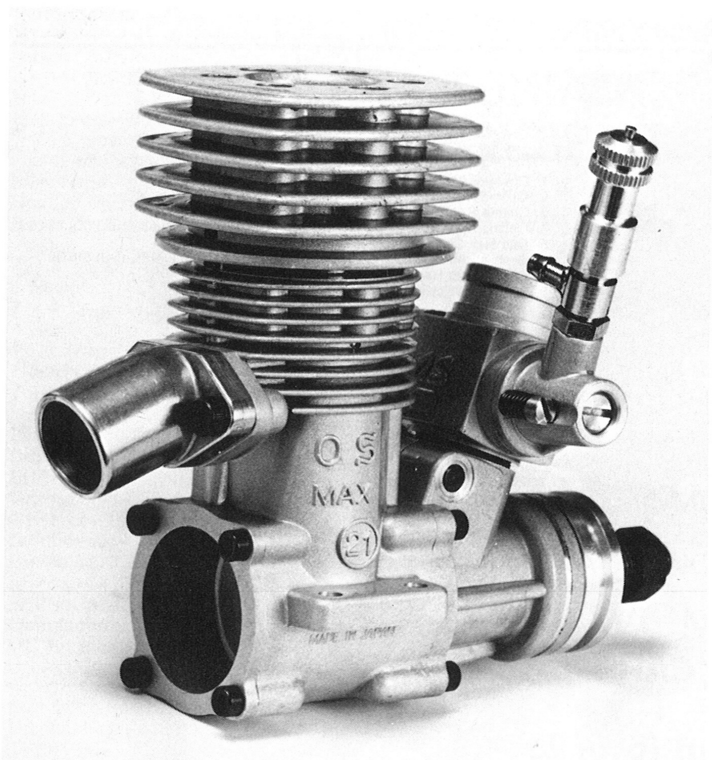
Test 2. OPS tuned pipe (rubber can end) set at 295mm plug to end. 50% Nitro/4% Castor/11% ML70 synthetic oil.

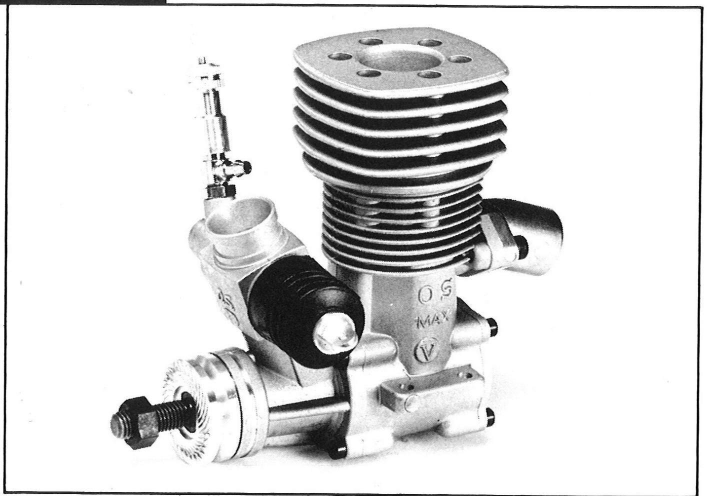
Would the shift in performance be reflected in the tuned-pipe layout? That was the interesting question. Answer: Yes, to a significant and useable degree. The No. 8 O.S. glow plug which had survived the open exhaust runs was immediately found wanting on these demanding tuned pipe and 50% nitro runs—so the more reliable OPS 300 plugs were substituted, though even these failed to survive maximum resonance hp. Compared with the earlier VF-C test using the same OPS tuned pipe, combustion appeared crisper and cleaner when at that maximum point around 24,000 rpm indicating that O.S. are now achieving more correct pipe response.

Test 3. OPS pipe now at 260mm. Fuel and plug as test 2.

As in previous tests, pipe length was now shortened to achieve correct resonance at a significantly high rpm point, nearer to 30,000 rpm. Again this resulted in a lowering of the hp maximum together with the frequently observed widening of the hp plateau, though this is felt to be, in part, a case of the high peak being chopped off as a result of exhaust timing no longer be-







ing a correct match for the higher rpm, even though pipe length itself is of right length for those rpm.

EXHAUST AND INLET RESTRICTORS

Time prevented any sensible look at the effects and/or problems resulting from the proposed new rulings designed to reduce noise. From a personal point it always seems odd to see the development of fine engines being stifled. (At both ends!) Admittedly they are already heavily restricted, if one accepts that the maximum carburetor bore should/could be the same as engine bore size! Also one must appreciate the problems posed by noise nuisance to national bodies and organizers. Provided the motives are open and unclouded by considerations of hp control per se—for commercial or other reasons, then the socially responsible would see the sense of such moves where locally sensitive noise situations exist. Equally it would be nice to see a degree of tolerance being extended by those who seem to be affected by noise nuisance only when it is generated by toys or units performing no visible useful economic function and when (apocryphally?) even a model glider was once the subject of a "noise" complaint. This is not to belittle the subject—the problem is real—the various freedoms involved are also real. The effect of fitting an exhaust restrictor of 5-1/2mm and at the same time an inlet one of 6mm (possible EFRA dimensions), was to reduce hp at the one load point measured giving the following set of figures:

	Unrestricted	Restricted
Rpm	23,550	21,000
Torque	60 oz. ins.	50 oz. ins.
Hp	1.42	1.05

Too much importance should not be placed on this loss because it will be necessary to undertake as normal a wide-ranging rpm set of torque figures to arrive at the real picture. What can be said though is that on a given load the effect of those restrictors is clearly to prevent the engine from reaching correct resonance as before and the load would need to be reduced in order to get back to that resonance rpm point. The writer intends to pursue this matter also in a future test, though it may be that EFRA developments in the meantime may make them of little interest.

In spite of a relatively delicate and refined structure (compared with, say, a Picco or NovaRossi), the O.S. VF-R proved almost unexpectedly reliable and survived the whole test regime quite unscathed. Quality of construction remains unsurpassed and at present is probably a major factor in keeping these engines "in touch" with the Italian hp producers.

O.S. Max—21 VF-R Glow-plug two-stroke single cylinder.

Dimensions & Weights:
Capacity—.2109 cu. in. (3.456cc)
Bore—.6532 in. (16.59mm)
Stroke—.6294 in. (15.986mm)
Stroke/Bore ratio—.963/1
Timing periods—Exhaust—164°
—Transfer—128°
—Boost—122°
—Front Induction—opens 36 ° ABDC
—closes 63° ATDC
—Total 207°
Exhaust port height—.224 in.
Combustion chamber volume—.35cc
Compression ratios—Geometric—10.87/1
—Effective—7.35/1
Cylinder head squish—.016 in. (.4mm)
Squish band width—.125 in. (3.15mm)
Squish band angle—2-1/2°
Crankshaft dia.—.4723 in. (12mm nominal)
Crankpin dia.—.1954 in. (4.96mm)
Crank nose thread—.2463 in. x 28 TPI (1/4 UNF)
Gudgeon pin dia.—.1574 in. (4mm nominal)
Connecting rod centers—29mm
Weight overall—10.45 ozs. (296 gms)
Mounting holes—15 x 38mm with 3mm holes
Width between bearers—1.21 in. (30.7mm)
Height—3.52 in. (89.4mm)
Width—1.78 in. (45.2mm)
Length—2.75 in. (69.85mm)
Frontal area—4.76 sq. in. (30.7 sq. cms)

Performance:
Max. BHP—1.42 @ 23,900 rpm (OPS pipe / 50% Nitro)
—1.11 @ 25,870 rpm (Open Ex. / 5% Nitro)
Max Torque—60 oz. ins. @ 23,550 rpm (OPS pipe / 50% Nitro)
—49 oz. ins. @ 16,100 rpm (Open Ex. / 5% Nitro)
Rpm on standard propellers:
8 x 6 Zinger—16,085 (Open Ex. / 5% Nitro)
7 x 6 Taipan—18,670 (Open Ex. / 5% Nitro)
7 x 4 Taipan—23,820 (Open Ex. / 5% Nitro)
7 x 6 Taipan—19,210 (Pipe @ 300mm / 50% Nitro)
7 x 4 Taipan—25,480 (Pipe @ 300mm / 50% Nitro)

Performance Equivalents:
BHP/cu. in.—6.73
BHP/cc—.41
Oz. In./cu. in.—284.5
Oz. in./cc—17.36
Gm meter/cc—12.3
BHP/lb.—2.17
BHP/kilo—4.79
BHP/sq. in. frontal area—.298

Manufacturer:
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