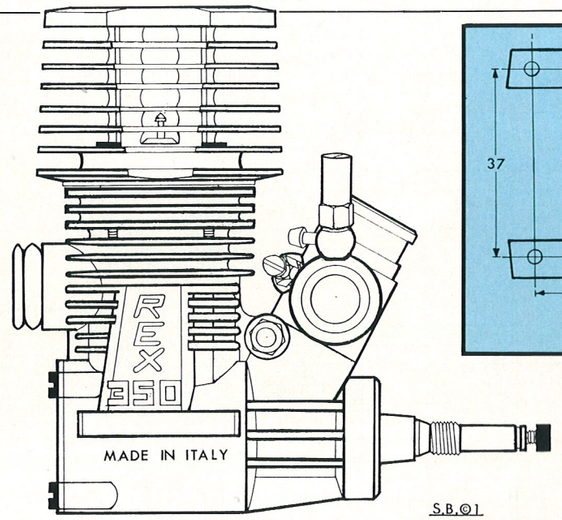

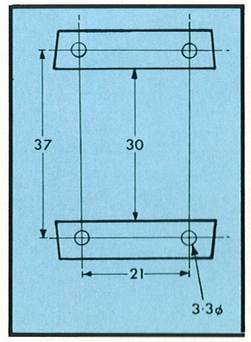

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Power Curve

NOVA ROSSI/REX (CAR 7/SCT)

Mike Billinton

The 'favoured engine' syndrome is probably a more marked feature of competition classes worldwide than of the less demanding sports modelling areas. Like them though, where it exists, it often reflects prevailing fashion; what the 'top' people are using and hopefully, in the saner world, a recognition of an observed balance of practical advantages.

An extreme manifestation of this tendency in recent times is the dominance of the very competitive International ⅛ Open Car class by the subject of this test report — the Rex 3.5cc car engine from the prestigious Italian manufacturer — Nova Rossi.

Still with the bit very firmly between his teeth, guiding light Cesare Rossi continues to produce his fabulous series of top line car engines of such performance that entry lists and result sheets rarely have room to show other engine makes at present.

Earlier Nova Rossi Car engines — Blackhead and Redhead of the mid-80s — were already at a high performance level, relative to their competitors' engines, so the approach to this test of Cesare's latest creation — Rex — was mixed; was it a fashion thing, or have all those competitors been obliged to accept track evidence of a superior balance of advantages?

First check over the test engine. (It's a Car 7/SCT — the top competition version claiming 2.2hp @ 31,500rpm, showing immediately really superb constructional standards and interesting points of design difference.)

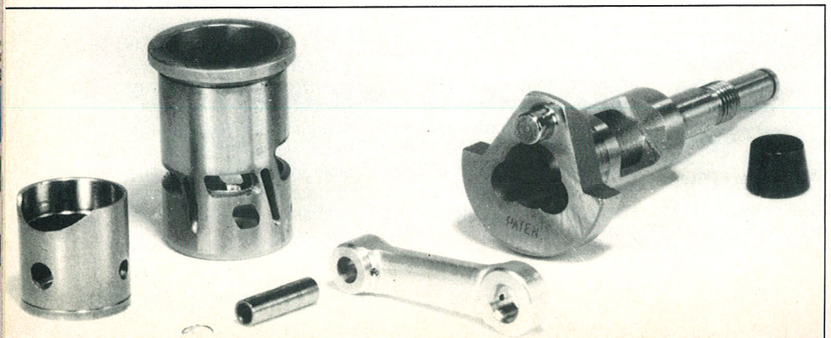
The basic design layout remains the proven one-piece crankcase with front induction, Schnuerle/ABC piston/liner with moderate exhaust timing to give a wide band performance on a tuned pipe.

Specific points are:

- ★ Cylinder liner is unique in having extra transfer port area in the form of slots.
- ★ Exhaust port has a raised point in the centre of the port giving 170° timing compared with the 164° average for most of the port.
- ★ 'Turbo' crankshaft has three milled grooves to reduce restrictions of gas glow and possibly assist mixing in the lower crankcase.
- ★ Connecting rod is profiled and finely machined from solid aluminium alloy. Bushed big-end is supported by considerable material thickness to obviate failure at high rpm.
- ★ Many things being subject to the 'turbo law' these days — even the glow-plug has been designated as such — and for good measure is available in eight versions (hot to cold) with advised ambient temperatures, nitro contents and squish clearances. No excuse here for incorrect running and burnt-out plugs, etc.

This plug style seats firmly against the taper at the bottom of the thread and thus right against the combustion chamber — and so benefits considerably from rapid heat transfer from the plug tip to the rest of the cylinder head. The normal glow plug tip is thermally much more isolated and, given its exposed position at the centre of the combustion process and the poor conductivity of the steel body itself, it's not surprising that plug failure and overheating to the point of luminosity has been an occasional problem. More importantly the

Note extra transfer ports 'squeezed in' between exhaust port at right and boost port at left of liner.



Nova Rossi — Rex (Car 7/SCT — Top Comp.)

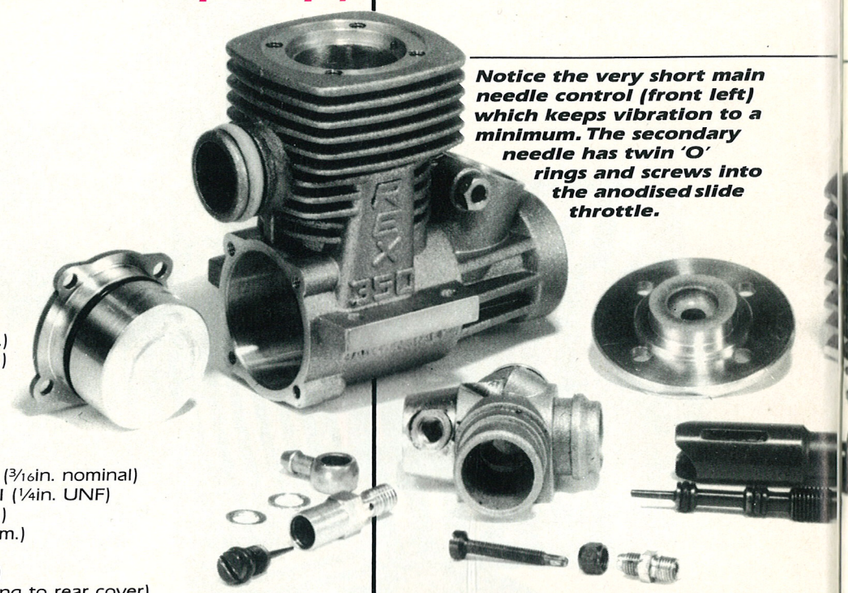
Dimensions and Weights:
Capacity — .2119cu.in. (3.472cc)
Bore — .646in. (16.40mm.)
Stroke — .6465in. (16.42mm.)
Stroke/bore ratio — 1.0008/1
Timing periods — Exhaust — 170°
Transfer — 120° (angled up 20°)
Boost — 106° (angled up 40°)
Front Induction —
— Opens 37° ABDC
— Closes 55° ATDC
— Total period 198°
— Blowdown 25°
Combustion volume — .36cc.
Compression ratios —
Geometric — 10.64/1
Effective — 7.11/1
Exhaust port height — .237in. (6.04mm.)
Cylinder head squish — .011in. (.28mm.)
Cylinder head squish angle — 5°
Squish band width — .14in. (3.6in.)
Carburettor bore — .351in. (8.93mm.)
Crankshaft diameter — .511in. (13mm.)
Crankshaft bore — .366in. (9.3mm.)
Crankpin diameter — .186in. (4.73mm.) (3/16in. nominal)
Crankshaft nose thread — .250 x 28 TPI (¼in. UNF)
Gudgeon pin diameter — .157in. (4mm.)
Connecting rod centres — 1.18in. (30mm.)
Engine Height —3.95in. (100.43mm.)
Width — 1.77in. (45.1mm.) (across lugs)
Length — 2.48in. (63.1mm.) (front bearing to rear cover)
Width between bearers — 1.2in. (30.5mm.)
Mounting hole dimensions — 21mm x 37.5mm x 3mm holes
Weight — 10.95oz. (310gm.)
Crankshaft weight — 1.35oz. (39gm.)
Piston weight — .10oz. (3gm.)

Performance:
Max. BHP: — 1.48 @ 27,852rpm (open exhaust/5% nitro)
— 1.68 @ 28,870rpm (tuned pipe @ 295mm/25% nitro)
— 1.99 @ 31,100rpm (tuned pip @ 275mm/50% nitro)
Max Torque: — 58oz.in. @ 19,725rpm (open exhaust/5% nitro)
— 59oz.in. @ 27,746rpm (tuned pipe @ 295mm/25% nitro)
— 64oz.in. @ 31,100rpm (tuned pipe @ 275mm/50% nitro)

rpm on standard fixed-wing props:	*open exhaust 5% nitro*	*tuned pipe @ 295mm 25% nitro*
7 x 6 Taipan	19,617	19,986
7 x 4 Taipan	25,600	27,800

Performance Equivalents:
BHP/cu.in. — 9.39 BHP/lb. — 2.91
BHP/cc. — 573 BHP/kilo — 6.42
Oz.in./cu.in. — 302
Oz.in./cc. — 18.4
Oz.in./lb. — 93.5
Gm metre/cc. — 13.17

Manufacturer
Cesare Rossi & Co.,
Rodengo Saiano, Italy.



Notice the very short main needle control (front left) which keeps vibration to a minimum. The secondary needle has twin 'O' rings and screws into the anodised slide throttle.

associated 'run-away' over-advancing of the ignition point, implicit in a rapid heating-up of the plug body itself, can cause engine performance to decline.

In large measures this new plug structure has eliminated the problem and quite incidentally has resulted in financial advantage when conducting wide-ranging tests with only one plug being actually used for the main part of the test!

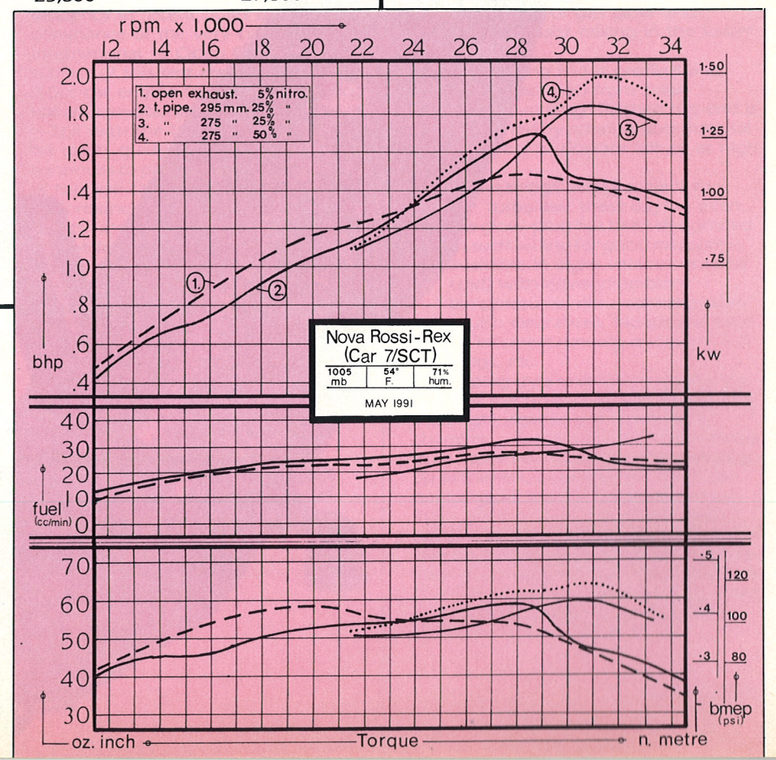
The large heatsink head (attractively anodised purple) and finned exhaust manifold, combined with the new thermally advantageous glow-plug, have all resulted here in noticeably cool engine running temperatures even when using a tuned pipe and 50% nitromethane fuel — a factor which itself must be enhancing engine reliability out on the tracks leading to more consistent fuel settings which are usually harmed by widely varying engine temperatures. In short, the 'turbo-plug' sets in train a sequence of important bonus points of much relevance where high power and high reliability are the absolute requirement.

The various carburettor fuel controls are effectively 'O' ringed against involuntary movement, even at a slight vibration period just before 30,000rpm. These all-important fixings proved rock-steady and tight under all dynamometer conditions. The context being that it is rare indeed to traverse the whole rpm range of these car engine tests without something needing an extra tightening-up, so the Rex was unusually solid in this area.

At almost 9mm bore, the carburettor is adequately sized for the envisaged high rpm. The aluminium slide barrel is hard anodized to prevent wear and remained a very close fit at the end of the test.

Thankfully, the Rex's virtually square stroke/bore ratio of 1.0008/1 lays to rest the idea that a short stroke is necessary for the high rpm of a two-stroke. In fact for a long time it has been considered, theoretically, that with stroke and bore being equal the maximum porting areas can be obtained.

Of maybe more importance is the reduction of reciprocating weight and here the low piston weight of .1oz must be a significant feature which resulted in easy, vibration-free running up to the maximum point of 35,536rpm.



Performance

The fanciful idea that "fashion" has been in any way responsible for the staggering competition success of the Rex 3.5cc engine received a fatal jolt because the early rpms on standard propellers indicated that, in open exhaust anyway, Cesare Rossi has created a storming engine with performance much above current norms, and appeared to indicate a potential open exhaust performance equal to some competitor engine's tuned pipe performance!

Test One: Open Exhaust

Fuel: 5% nitromethane, 15% castor oil, 80% methanol. Plug: medium cold turbo.

Nova Rossi specifically advise against synthetic oil — almost certainly because there are still some inferior or unsuitable types around and so they advise castor only. The argument rages on, with some competitors still prepared and happy to use 5% of a 'good' synthetic oil and others taking up the much less exposed posture of 'no less than 20% castor'.

The writer's experience of good synthetic oil (mostly in the admittedly controlled dyno situation) remains totally uneventful and satisfactory even where the most demanding performance levels have been reached.

Initial torque figures confirmed the exceptional propeller rpms and a maximum of 58oz.in. was as high a reading as some tuned pipe engines have reached when using high nitromethane fuels.

The 1.2hp plus is available over an rpm scale ranging from 21,000 to 35,000 and confirms the very wide ranging performance always on offer from the modern high-performance model two-stroke engine, whilst the final maximum of 1.48hp at 27,852rpm is by some margin the highest open exhaust figures in this series of 3.5cc car engine tests.

Test Two: Rex/ EFRA Tuned Pipe at 295mm

(from plug to end of pipe)
Plug as Test One. Fuel: 25% nitro, 10% castor, 65% methanol.

As the manufacturer appears to suggest an upper limit around 30% nitro and most track usage is around 25% it seemed an opportune time to make a sort of break with previous test procedures started some years ago where 50% nitro was the maximum fuel load used for comparative purposes. Plug life, engine reliability, operator's temper and financial state all improve as a result of reduction from 50% to 25% nitro, except for the occasional brief foray into 50% nitro (to reconfirm what looks here like almost 10% loss in power or some particular manufacturer claim), 25% nitro will be the preferred fuel for the bulk of top power runs with the 3.5cc car engines.

The manufacturer's tuned pipe and exhaust manifold were used in their "out-of-the-box" standard uncut lengths with an approximate ½in. sleeving overlap between them plus a length of silicon tubing as sealant.

Torque and hp results from this set-up confirmed yet again that manufacturers of racing engines are most reluctant to offer "out-of-the-box" specs which accord with their final maximum claims of hp and rpm levels, simply because the mere existence of such claims implies pushing hard and very close to the limits of engine reliability and thus it is not really appropriate for consistent "day-in/day-out" running performance. It is significant therefore that in common with so many other manufacturers the precise pipe length and nitro percentages are not specified by Nova Rossi when making their claim of 2.2hp at 31,500rpm.

Nevertheless, in this standard set-up a still high value of 1.68hp at 28,870rpm was reached and a reading of the parameters suggested that a customary shortening of the pipe would now be required to reach the 31,500 resonant peak implicit in the claim.

Test Three: Rex Pipe now at 275mm

Fuel/Plug as Test Two.

Removal of 2cms. of the convoluted exhaust manifold was as much as was practical and the resultant shorter length just served to push correct resonance to that 31,000rpm area where an enhanced hp of 1.84 resulted. The usual payment of a lesser torque at lower rpm had to be made however.

Test Four: Pipe still at 275mm

Fuel: 50% nitro. Plug now cold/cold.

With the manufacturer's claim of 2.2hp still beckoning (believed to be the highest claim worldwide for a commercial 3.5cc car engine) the final move to 50% nitro was made — with some trepidation because correct squish clearance to .4mm could not be arranged on the particular test day and so the slightly too tight .3mm had to be utilised. For engine survival's sake therefore these 50% nitro readings were more in the nature of "spot-readings" rather than longer term reliability proving runs. They serve to indicate, however, that the 2.2hp claim is far from fanciful — and, given more precise matching of plug type and squish clearance, would very likely be reached.

At 1.99hp, however (let's call it 2hp!), the Rex produced by some way the highest figure of this test series and has done so by maintenance of top torque figures above 60oz.in. well into the post 30,000rpm area. To achieve this both good engine design and good tuned pipe response are vital and clearly the Rex/pipe combo has both.

Summary

The dominant impression left behind after this test was of utmost reliability with a solid and almost strain-free performance. The final figures appear to confirm the worldwide reputation of this engine and whilst comparisons are invidious it probably has to be faced that this engine is the standard-setter at present.

Other than very precise matching of the engine set-up on the day, the quality of the Rex is such as to seemingly preclude any further "tuning", though the search for improvements apparently continues unabated.