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Words Rupert Paul **Photography** PB archive

Why we need superchargers

Free power? Let us at it... If only if it was that simple. PB investigates the attraction – and the expense – of supercharging

If you see this unassuming Rocket III in your mirrors, do the honorable thing and let Richard Albans come by. It's packing as much power as a WSB bike.

BEFORE-AND-AFTER dyno charts are hardly a new thing. And of course, interesting as they are, they rarely tell you the whole story. But these ones do. Whatever your bike, just imagine what it would be like with 50 per cent more torque. No, imagine what it would be like with that grunt delivered in a surging torrent that just went up and up in a gravity-defying dead straight line.

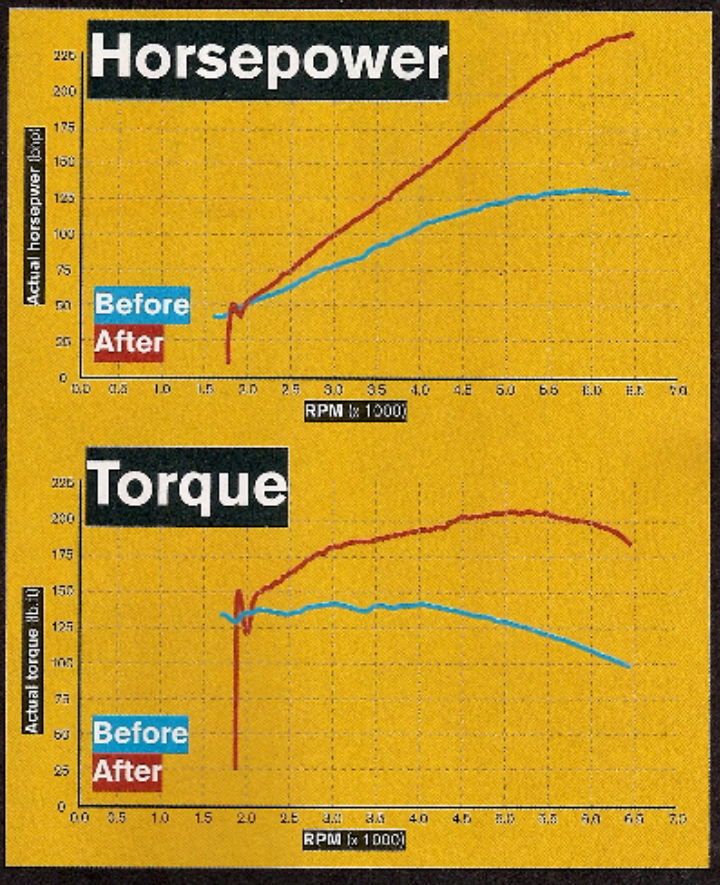
Welcome to the world of modern supercharging. It's proven, it's available in the UK and – if you can stump up the four-plus grand – it's even practical. Here's why.

Once you lift a standard engine out of the emission-control straitjacket and start tuning it, you quickly realise that anything you gain in one area you pay for in another. It's a law we've all come to accept, from GP crew chiefs to spotty youths tuning the nads off their Priller 125s. It fits with our British sense of fair play and worthy endeavour: you get out what you put in. Everyone stand in a queue. You can't have ice cream until you've finished your greens.

Forced induction flicks the vees at all that. You don't have to wait for a carefully tuned sweet spot high up the rev range, when the intake, exhaust and valve timing gel to achieve maximum cylinder filling efficiency. You can just turn the throttle and have it right now. In spades. As Richard Albans, builder of this supercharged Rocket III puts it: 'Supercharging makes your engine feel big.'

In a way a 2.3-litre Triumph is the worst engine you could use to demonstrate supercharging. It is already big and already has arguably the flattest, straightest torque curve of any bike. But in Richard's view you can never have too much of a good thing. Which is why his Hinckley cruiser now makes as much power as a WSB frontrunner.

How to describe what 240bhp feels like? Let's start with the bike on a shut throttle. It weighs more than a third of a tonne and when those tiller bars flop into low-speed corners, you know it. But straighten up, aim directly ahead and in a quarter-inch of wrist movement – about 0.1 seconds – the entire bike becomes weightless. Richard says he uses it to creep up behind R1s on motorways and annihilate them from 80-140mph. Experiencing this yourself is one of those things that makes no sense, like an elephant outrunning



a cheetah. The only other bike I've ridden with such storming, instant surge was Nicky Hayden's title-winning 990 V5 Honda. But that weighed 31 stone less.

There are side-effects to the supercharging. The Rocket III's standard rear suspension is crushed by the weight transfer, so unless you teeter along gingerly on country lanes, the entire bike weaves like an old V-Max.

Of course, what interests us is the prospect of fitting a supercharger to a better-handling bike. Over five years of developing Rotrex chargers with the factory in Denmark, Richard has done oddities such as GS BMWs, a Yamaha MT-01 and several Harley V-Rods. But he's also blown Blades, ZX Kawasakis, R1s, GSX-Rs and Busas using a smaller C15 supercharger. Perhaps maddest of all was a Lazer 600 that did at least 170mph.

THE RESULT ON AN R1 WOULD BE A GOOD 35 PER CENT POWER GAIN, TO MORE THAN 200BHP

In each case the trick is to take a drive off the end of the crank, support it with an outrigger bearing, then run a belt and pulley to drive the blower. On the Triumph the boost at tickover is already making more power than the supercharger uses. Richard says that's also true of the 1000cc inline fours he's supercharged. Any inefficiency from the convoluted intake manifold and absent airbox is swamped by the sheer quantity of mixture in the cylinders.

The result on something like an R1 is, Richard reckons, 'a good 35 per cent power gain, taking rear wheel power to more than 200bhp, with about 100lb.ft of torque.' But although the numbers are huge, the engine remains tractable and predictable low down. 'You can just go along on a whiff of throttle, getting good fuel economy – or open it up,' Richard says. He reports that several owners have done more than 15,000 miles with no problems, and the supercharger's traction-fluid changes (the stuff costs £60 a litre) aren't due until 40,000 miles.

Turbos came and went on production bikes a quarter of a century ago but today's lag-free superchargers are so small and effective, it's tempting to wonder if they might be the future. If you fancy stepping outside the limits of engines fed by mere atmospheric pressure, you'll need a Rotrex. We're planning to build a bike with one later this year.

The guts of a supercharger

1. Impeller housing
2. Impeller
3. Output shaft
4. Epicyclic rollers in drum
5. Roller holder
6. Main case
7. Main case cover
8. Input shaft
9. Oil pump (several items)
10. Input shaft bearings
11. Drive pulley

This is a Danish Rotrex supercharger suitable for bikes. The two bits to look at first are the rotor pulley (11), which is driven by a belt off the crankshaft, and the impeller/impeller housing (1) which actually stuffs the air into the engine under pressure.

The components in between act as a sort of compact gearbox, stepping up the speed of the rotor pulley by almost ten times to drive the impeller. Of course you will notice there aren't any gears. Instead, the Rotrex design uses a sun-and-planet roller design. You can visualise how this works if you imagine the drum rotating. The three rollers inside will then whizz round in a rather elegant fashion, driven by where they 'touch' the inner edge of the drum. (In fact they don't quite touch; the drum is full of traction fluid – a foul-smelling and rather special oil that becomes momentarily 'sticky' in the high pressure gap between roller and drum.)

Now add the output shaft to the small central gap in the middle of the three rollers. It should be easy to imagine that this skinny shaft (the 'sun'), driven by the three rollers (the 'planets'), will rotate much more quickly than the wide outer drum. The actual step-up is 9.49:1, and the impeller can achieve useful boost from 10,000 all the way up to 20,000rpm. Thus, even at tickover, the supercharger on the Rocket III motor is producing more boost than it consumes in power. No lag, just vast torque.

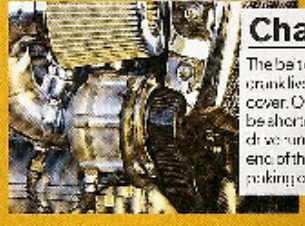
If you're thinking this kind of technology needs super accurate manufacturing tolerances, you're right. You can see an animation of the supercharger under 'Design and production' on rotrex.com.

COSTS AND CONTACTS

Rocket III Rotrex supercharger £3525 (£4000 fully fitted) www.tts-performance.co.uk
Tuneboy fuel and ignition modifier £280 www.tuneboy.com.au
Supercharger manufacturer www.rotrex.com

Drive system

A supercharger needs drive. On the Rocket III it comes off the end of the crank, via this spigot which effectively extends the crank enough to attach a pulley (the gear at the case drives the cams). An outrigger bearing added to the clutch cover supports the spigot. Its aluminium pulley, manufactured to create the right gearing for the engine's new range, uses a poly-V-belt to drive the charger's input pulley.

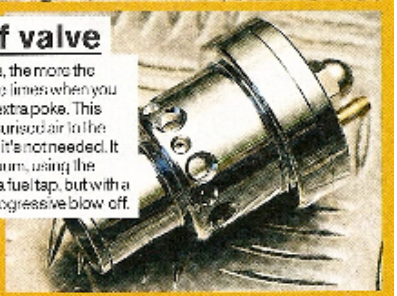


Charger

The belt drive off the end of the crank lives under that carbon cover. On a four the belt tends to be shorter and toothed, with the drive running off the right-hand end of the crank, and the charger poking out of the fairing close by.

Oil cooler

The traction drive system uses friction to transmit motion from the drum to the rollers to the spindle that drives the impeller, so the traction fluid gets pretty hot. It's cooled by this small rad, which comes with a temperature gauge you can keep an eye on. About 80°C is good.



Blow-off valve

The higher the revs, the more the boost, but there are times when you don't want all that extra poke. This valve bleeds pressurised air to the atmosphere when it's not needed. It works off inlet vacuum, using the same principle as a fuel tap, but with a spring to create progressive blow off.