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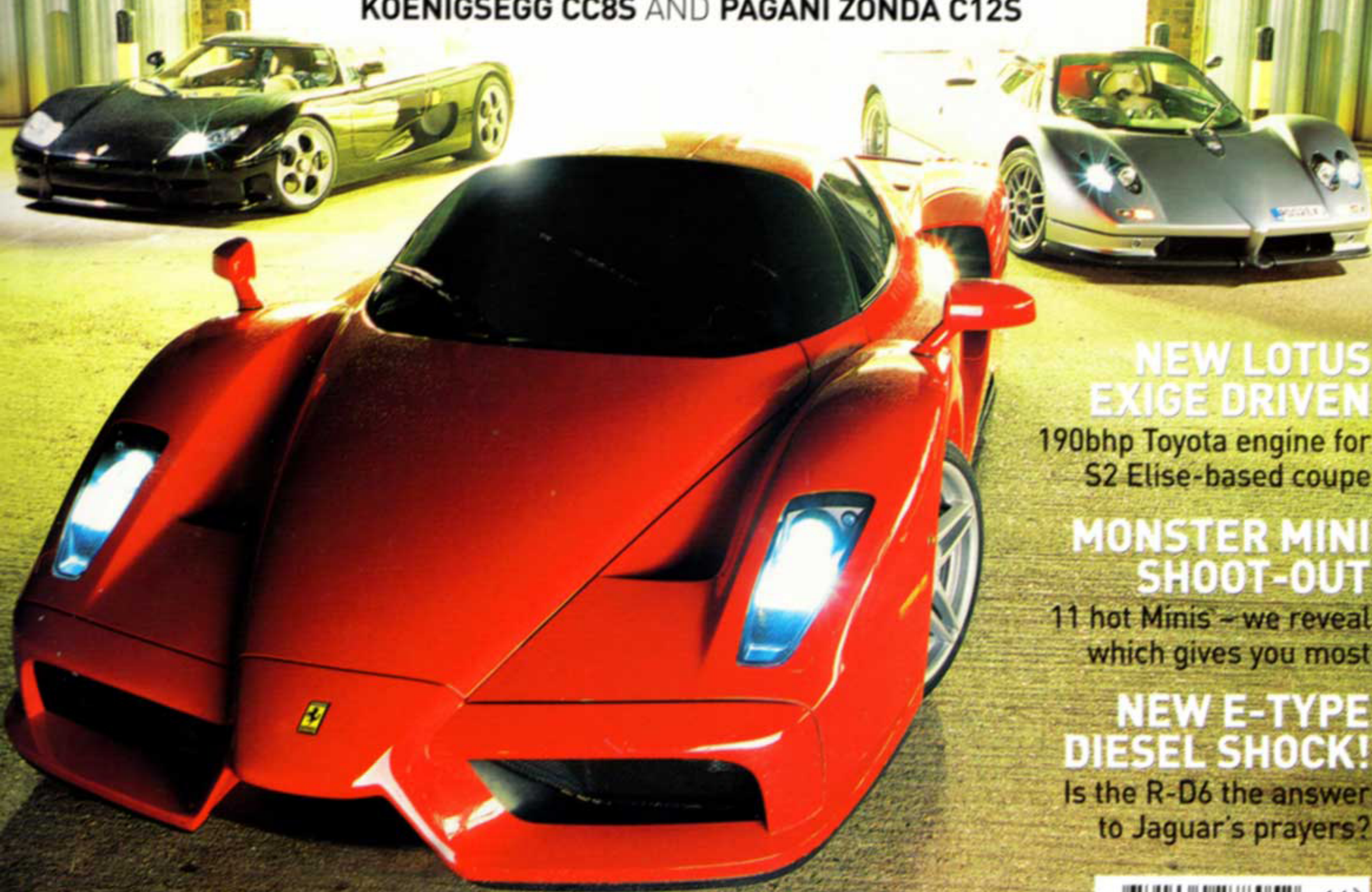
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[Lotus Exige S2]

T U R N I N G J A P A N E S E

A new Exige and, more significantly, a new engine: Toyota's 190bhp
1.8-litre VVTi, which will also power the American-spec Elise

Words: John Barker | **Pictures:** Andy Morgan





Exige S2 looks less 'motorsport', more 'Elise with a hardtop'. Front clamshell has different profile to Elise's, covering the wheels more from head-on

This rough and ready development car means a lot to Lotus. Six months from now, the production Series 2 Exige will be unveiled at the Geneva show. It will glint and gleam, its fastback-styling will attract

comment, but what everyone will be wondering is how it goes with the 190bhp Toyota 1.8-litre VVTLi under its engine cover. Since its launch in 1996, the Elise has been powered by many iterations of the Rover K-series, the most potent of them installed in the back of the S1 Exige, so this is a big change for Lotus. And it's bigger than the Exige, because the Toyota engine will also power the up-coming North American-spec Elise.

Our presence at Hethel to drive the first prototype so far ahead of the launch is mutually beneficial: we get to drive the new engine and tell you, potential Lotus customers, what we think of it, and Lotus gets early feedback on what is a significant engineering change.

Our opinion of the VVTLi engine in Toyotas is well documented and regular readers will know

that it isn't one of our favourites. In our first drive of the Celica 190 VVTLi (now T-Sport) we wrote 'to get the most from it you have to drive it like you're trying to blow the thing to pieces'. When we tried it in the heavier, soggy Corolla we were less kind. In short, it was dire – it seemed to have very little torque and even when you got it into the power band between 6000 and 8000rpm, the gear ratios made it infuriatingly hard to keep there.

'The Celica and Corolla are much heavier cars than the Exige and therefore the lack of torque isn't so apparent,' points out Exige S2 project engineer Geoff Grose. He says that pulling from low revs the Toyota-engined Exige is as fast as the Elise 111S with the 156bhp K-series VVC engine, with a real shove on top when the high-lift, long-duration valve timing kicks in. 'It's like having two engines in one,' he states.

We'll soon see for ourselves, but why change at all? The K-series is a very good little engine; compact, remarkably light and British too, all positive factors for a lightweight British sports car. 'It will continue to be used in European Elises for



Above: front air ducts and vents on upper body larger than on Elise; splitter integrated into new front clamshell. Engine cover mesh (left) good for cooling, not so great for rear vision



the foreseeable future,' says Grose, 'but it's expensive to make in 190bhp trim. For the US Elise we wanted exciting performance and the VVTLi engine gives us that with refinement when you're not stretching it. Also, Toyota has a very good reputation in the US.'

The hunt for the right engine has been going on for a few years. In its consultancy role, Lotus Engineering has designed 10 per cent of the engines that power all new cars sold in Europe, so it has a very good picture of what's out there. 'We certainly punch above our weight in engine expertise,' says Grose. The basic parameters set for the engine were that it must be four-cylinder, sub-2-litre and have an output of around 200bhp. 'Lots of hot hatches now offer 200bhp or more, so much less wouldn't do.'

A turbo unit was ruled out, partly because Lotus has an agreement with GM, for whom it produces the Vauxhall VX220 Turbo, not to have overlapping models, but also because the character of small Lotuses is better suited to normal aspiration. By a process of elimination that left two engines in the frame – the Honda VTEC and Toyota VVTLi – and Toyota and Lotus have historical links dating back to the early '80s when the Japanese company had a small shareholding in Lotus.

The Honda VTEC is better known but the Toyota engine is sophisticated in a similar manner, having variable valve timing (VVT) and lift (Li). Installed in the Corolla and Celica T-Sport it produces 189bhp at 7800rpm and 133lb ft at 6800rpm. It also comes with a six-speed manual.

'Toyota was a co-operative partner,' says Grose. 'It's not simply a case of bolting in the engine complete from air filter to tailpipe. We wanted to put in our expertise as well, to create our own management system to integrate the engine into our package, to fine-tune its responses to suit our lighter car.' There will be no drastic change in outputs but the character of the engine is said to be appreciably different.

It's not just an engine change that the new Exige ushers in, though. To satisfy the demands of the American market, Lotus has been developing features such as anti-lock brakes, airbags, electric windows and central locking. Not all markets will want them and Lotus plans to offer most as options, though it hopes their availability will broaden the appeal of its cars. The final spec of the Exige (which isn't going to the US) has not yet been decided but what is certain is that it will have anti-lock brakes as standard and probably electric



Chassis defined by great balance and excellent grip from Yokohama A048s, yet you can still fool around if you want. Wing [below] helps create downforce

windows (standard on next year's Elise) and air-conditioning, too.

The latter can only be a good thing. In a further effort to make the Exige more habitable and useable, the engine cover of the S2 is peppered with meshed grilles (in contrast to the S1's smoked perspex) to help vent heat. There's also a bigger boot that's more easily accessed because the rear wing is integral with the engine cover and so lifts out of the way. In combination with the rear diffuser and front splitter, the wing gives the Exige positive downforce front and rear, about 80kg in total at 100mph.

Styling is by Steve Crijns, who was responsible for the Elise S2. There's a new rear clamshell and Crijns has taken the opportunity to clean up the tail, deleting the crescent-shaped fake vents that edged the rear lights, losing a couple of shutlines and using tidier, centrally venting tailpipes. At the front there's a wider-mouthed grille and, as at the rear, the wheelarches surround the wheels more fully, giving it a hunkered-down appearance. It's

less muscular than the S1, 'more sinewy' suggests chief designer Russell Carr. More Elise-like than the last Exige, too: an Elise with optional hardtop looks quite similar.

Grose is coy about the kerb weight, saying it will be 'over 800kg but less than 900'. Let's do the sums ourselves, then. The Toyota engine and gearbox package weighs about 36kg more than the VVC K-series drivetrain, then there's the anti-lock hardware to add, and a chunk for air-conditioning and electric windows. Given that a VVC Elise S2 weighs 806kg, around 860kg would seem a good guess. Hefty for an Elise-based car, but that still makes the new Exige a significant 355kg lighter than the VVTLi-engined Celica.

The original, standard 177bhp Exige weighed just 780kg, yet ride and handling expert Matthew Becker says that the new car is 2.0sec per lap quicker around the Hethel test track. A significant amount given that a lap takes under 1.30min.

It's brave of Lotus to let us drive the S2 Exige so early, but I sense that it wants to prove that even at

this stage of development the decision to install the Toyota engine is vindicated, that its suitability will shine through.

The fit and finish of this hack show it's nowhere near the showroom item. The rear clamshell is ill-fitting and the side-scoops look like they've been gummed into place with toothpaste and sprayed over. Inside the dashboard is pocked with Velcro squares for temporary mounting of test gauges and the like, there's extra wiring drooping here and there, and the gearstick is a length of lightly corroded hexagonal bar.

Becker takes the wheel first. When the VVTLi engine fires up it sounds, well, ordinary; a bit buzzy, a bit coarse, just like you'd expect any four-cylinder to sound (except an Alfa's, perhaps) when it's bolted into an airy engine bay just over your shoulder. 'The ratios are right but the gearshift isn't as it will be,' says Becker, 'I've tried the production version and it will be the best we've ever produced. This is the interim chassis that we'll now spend another two months fine-tuning.'

After a lap tooling around, Becker steps on it. Until now the pace has been adequate, the engine note subdued and rather ordinary, the ride a little choppy on the poorly surfaced back straight. I don't notice this on the next lap because the engine note has hardened, Becker working it to the 8350rpm redline, and we're approaching the tyrewall chicane at the end of the straight at about 130mph. With what feels like only a slight lift we snick through it and brake hard for the long hairpin right that follows. It's the start of two exceptionally neat laps at full speed that have the Exige right at the edge but never over it, demonstrating its speed, chassis composure and



[Lotus Exige S2]



Left: roof vent and bigger side-scoops are unique to Exige. Sketch, below, shows what the car will look like when finished, including its bespoke alloy wheels

Specification

Layout	Transverse, mid-mounted engine, rwd
Engine	In-line 4-cyl, 1794cc, 16v, VVTi
Max power	189bhp @ 7800rpm (approx)
Max torque	133lb ft @ 6800rpm (approx)
Weight	860kg (estimated)
0-60mph	4.9sec (estimated)
Max speed	140mph+

traction. We don't understeer or oversteer anywhere and the Exige feels very fast. Clearly, Becker knows the track intimately and is showing the car's ultimate ability, but it's equally clear the S2 Exige has plenty of grunt and exceptional grip.

Like the original Exige, the S2 uses lightly-treaded 'trackday' Yokohamas that are road-legal but look like cut slicks. The A048 has replaced the A039 and according to Becker is worth a second a lap; the other second is down to the suspension. Lotus learned a lot developing the sophisticated dampers for the VX220 and the S2 Elise, and this knowledge is still paying dividends.

Impressive as Becker's laps were, they haven't told me all I need to know. I want to provoke and tease the chassis to see how it responds, hit the brakes hard in the 'wrong' place to check their ability, and upshift early to see what the engine is like when it has to dig deep.

From the off the Exige feels a quality item; the low-speed ride is supple and the steering smooth, quick and nicely weighty. I've driven to Hethel in

our long-term-test VX220 Turbo and while the Toyota engine is adequately gutsy in the mid-range, it's not until you get beyond 6000rpm that it's genuinely exciting. Brett Fraser arrived in our Elise 111S and reckons the Exige is every bit as quick even before the cam change. It's easy to keep it on the boil once it's up there, the note is encouragingly hard-edged, and the Exige *feels* fast. Test tracks and race circuits tend to lessen the impression of speed so it'll probably feel brisker still on road. There's scope for further tuning of the induction note but it'll never be as ear-splitting as the full-house 192bhp K-series of the S1 Exige.

Much as I want to try to catch the chassis out, it's hard not to drive the Exige precisely. The Yokos – 195/50s front, 225/45s astern – are sensationally grippy and offer terrific turn-in bite. Even getting

on the power early, the rear stays firmly hooked up so the Exige flicks through the track's S-bends with mind-blowing g-forces and exceptional composure. Mistakes at this pace feel like they ought to be punished harshly, but step off the throttle as the nose eventually pushes wide and the rear merely edges round a fraction with plenty of warning, requiring minimal steering correction.

This car is on the VX's slightly longer wheelbase; the production car will be 30mm shorter, which should make it even pointier and more flickable. Seems fine to me as it is. Back off as you throw the Exige into a tight, second-gear turn, get back on the power when the tail goes light, and you can power-slide for as long as you like.

If the Exige gets away from you there's always the option of jumping on the brake pedal. The brakes are wonderfully feelsome and progressive, and up to the point where the ABS triggers you'd never guess it was there, which is exactly as it should be in a sports car. The Exige will haul down hard enough to have you straining against the belts before you activate the ABS, and when it does intervene the modulation feels very rapid.

So the Exige S2 stacks up well. Most importantly, the Toyota engine hits the major targets; it offers decent performance mid-range, genuinely exciting pace at the top end, and it's pretty refined. The new anti-lock brake system is superb and certainly enhances the S2's appeal, and the same goes for the air-conditioning (said to be more effective than the S1's) and the more easily accessed luggage space.

Exige S2s go on sale next Spring and Lotus anticipates building 1000 at about £32K a pop, basic. The real action starts a few months later, though, when Lotus finds out if the fully-loaded, Toyota-engined Exige meets the approval of American sports car buyers. ■



MATTHEW BECKER DYNAMICS ENGINEER

Hethel's test track is Becker's second home. He estimates that in the last eight years as one of Lotus's principal vehicle dynamics engineers he's spent over 5000 hours pounding down its bumpy straight and around its demanding curves. That equates to a staggering quarter of a million laps. For the last two months he's been sharing the chassis tuning of the

Toyota-engined Exige with colleague Gavan Kershaw and this time, with anti-lock brakes to develop and refine, the project has been partially based at a more famous track, the Nürburgring.

'We consider that Porsche ABS sets the standard for feel and response, so we tried to match it. Essentially, what you do is delay its intervention, allow some slip (lock), so that the driver controls the car right up to the point where anti-lock is absolutely necessary. We spent a lot of time looking at the

threshold and tuned the system at the 'Ring – in one lap you've got every sort of corner imaginable.'

Becker is a genuine enthusiast and refreshingly honest as a result. He doesn't feel that adding a servo and anti-lock is a betrayal of Lotus's minimalist, purist approach. The Exige is a very quick car and, he says, 'the responsiveness of the brakes and their reassuring performance will simply give the driver more confidence to use its performance'.