

"A very different kind of
TURBO



high performance" THE LITTLE SCREAMER

As soon as you hear that wail from the engine compartment you know the BMW 2002 Turbo is getting ready to catapult you forward with a rush quite out the class of your average sporty two-litre. MEL NICHOLS describes how it feels . . .

IT'S SMALL AND BOXY and the shape is thoroughly familiar all over the world. But it attracts as much attention as a Lamborghini — its deep chin spoiler, fat wheel arches and bright tri-color stripes really must scream out to passers-by that this BMW is something special. Or do so many of them really know the meaning of the word 'turbo' written on its sides?

Driving the thing, you sure as hell know what it means. You've been finding out the hard way that this chunky little car moves off the line. Just as though it's a standard BMW 2002 Tii; it gets going merely briskly but not shatteringly. You begin to think 'so what!' But then a peculiar whistling noise starts coming from under the bonnet, and the tachometer needle hits 4000 rpm and the car is catapulted forward as if a second engine has suddenly cut in. You think you've been shunted in the tail by a ton-up express train. And it's scary because your senses, lulled into false security by the modesty of the initial acceleration, can't cope with this sudden new pace. You're punched back into your seat and the scenery is pelting up at a rate that seems to multiply by its own square.

Your eyes widen, trying to take it all in. Your pulse quickens, your mouth opens and your heart pounds. The thrust keeps hurtling you forward with such strength it seems almost beyond control, like a race horse bolting. It's almost a relief when the gear runs out, at 6500 rpm, a moment later.

You do, of course, get used to this strange motoring phenomenon. After a day or two you're indulging in it to the full, loving every single exciting moment. But the fact that it takes days to get used to it is the significant one — a driver used to hopping from car to car, make to make, usually takes only minutes to adjust. Even in the most powerful ones it's normally not longer than a couple of hours. Why should this two-litre BMW be so different?

The answer lies in the way the turbocharger brings in the power suddenly, when the car is well under way and you've already accepted that it has a particular rate of acceleration. Such acceptance is the normal way of it, no matter how fast the car. They might rocket you forward at an incredible rate, but they do it from the moment you drop the clutch, maintaining a rate of progress that's fairly constant right through the rev range. You don't realise how much you come to depend on that simple fact until you drive the Turbo.

In the Turbo, it's a whole new ball game because



you have to deal with two acceleration rates within the one gear. And even when the second one has come, with its belt in the back and instant pulse-quickenings, you have to go on adjusting because the acceleration rate just seems to go on increasing. You need to tread warily when you're getting to know a schizophrenic.

The 2002 Turbo is the world's first turbocharged production car. BMW built it as a homologation special, rightly enough, but it is much more significant than that. It shows the possibilities of getting formidable performance from small and efficient engines, precisely what is needed now the spotlight is so strongly on fuel economy as well as low emissions.

Turbocharging is a system with considerable advantages, and not many drawbacks now. How else, for example, could BMW have extracted more power from a road-going 2002 without severely sacrificing flexibility? Turbocharging, in a way, is an answer to the adage 'there's no substitute for cubic inches'.

Although BMW hasn't quite as much current experience with turbos as Porsche, it's certainly no newcomer to them. For example, BMW won the European touring car championship in 1969 with a turboed 2002 giving a strong and very reliable 275 bhp. In the 1974 road-going 2002 turbo, the engineers have settled for a 'mere' 127 kW (170 DIN bhp) at 5800 rpm and 251 Nm (185 lb/ft) at 3600 rpm. While that's well within the ultimate potential of the engine, as that five-year-old race car proved, it's still a dramatic and instant step-up of 30 kW (40 bhp) over the 2002 Tii that previously was the hottest 2002 in the range.

To get the new power, BMW grabbed an off-the-shelf KKK turbocharger (they're used on truck engines), pulled off the Tii engine's Kugelfischer electronic fuel injection and replaced it with the mechanical Schafer injection. Mechanical injection works better with turbos, and any injection works better than carburetors with them because it compensates automatically for charge density to provide a near-perfect mixture right through the rev range. In most carb-fed turbocharged engines the mixture is overly rich when the turbo isn't working at full pressure. Internally, the only change was lowering of the compression ratio from 10:1 to 6.9:1 as

compensation for the volatility of the fuel-air mixture force-fed in by the turbo.

Because the BMW engine has a cross-flow head the turbocharger had to be mounted on the opposite side from the induction manifold. The blower has to be close to the exhaust gases which drive it. A long pipe takes the pressurised air up to the inlet manifold. Looking at the engine in the car, you can hardly see the turbo. It's compact and is tucked down under the exhaust manifold to fit in beside the right hand front side of the block. Because it is there and because the 2002 engine bay encloses the powerplant, BMW isn't sure if it will ever be able to build right hand drive Turbos — the blower uses up the space where the steering box would go on RHD cars.

When the Tii was introduced people said its 97 kW (130 bhp) pushed the ageing 2002 chassis to its limits. BMW didn't agree, but changes obviously had to be made to handle the fiery new bits of the Turbo. So apart from a strengthened gearbox and taller 3.36:1 slippery diff, the suspension has been thoroughly beefed-up. The spring and damper rates are stiffer (gas-oil shockers are available as an option) and adjustable anti-roll bars have been added in front and rear. The wheels have been widened to 140 mm (5.5 in.) and are shod with top-rating Michelin XWX 185VR70 radials. The front disc brakes are ventilated and their calipers now have four pistons to make sure the pads are pushed home firmly enough. The steering has been quickened up to three turns lock to lock.

The front bumper is ripped off and replaced by the deep air dam, CSL racer-style. A rectangular cap in the centre of the dam forces air through to the oil cooler, and a round hole just to the right of it takes in the air for the turbo. There's another spoiler made from soft rubber on the bootlid and big flares kick out from the mudguards to cover the wider wheels. They're held on by screws to allow owners to replace them with even bigger flares for racing tyres if the car is to be used on the track. Likewise, the front spoiler is easily removable for rallying.

BMW made sure no one would mistake the Turbo — as indeed they don't. The front air dam is painted with the familiar BMW red, dark blue and light blue racing colors and there are stripes made up of the same three shades running from just behind the front wheels right along the flanks to the rear bumper. Set into top part of the stripes on each side is the telltale word 'turbo'. A turbo badge is on the left side of the rear panel too.

Boot is very shallow because Turbo has extra tankage taking up all the space.



Steering wheel has a padded rim, and dash panel seen through the wheel is fire-engine red. Boost gauge is right of the clock and has no graduations at all. Its only real function is to indicate relief valve malfunction.

Fortunately or unfortunately, depending on your viewpoint, the production cars don't have 'turbo' written mirror image across the air dam. The idea was to give drivers in front of the Turbo the message in no uncertain terms when they read it, right-way 'round, in their mirrors. The West German government thought it all a bit much when they saw the prototypes and ordered BMW to remove it.

Inside the Turbo the very flat standard seats of the 2002 are ripped out and replaced by Rentrop rally buckets with big side bolsters to keep you firmly in place. There is a sports steering wheel, all black, the instrument panel surround is brick red and in a neat little surround added in beside the main instrument panel are two new gauges. One is simply a clock; the other is a round dial with the first half of its scale painted white, then a thin green section and then a big red section. This is the visual give-away to the turbocharger's presence, and when the needle comes up out of that tame white zone and into the green then — as you'll find out in no uncertain terms — it's all happening. And how!

But when you first fire up the Turbo you might just as well be starting an ordinary cooking 2002. The injection means there is no choke and absolutely no fuss about starting. Turn the key, press a little on the throttle and the engine catches.

It settles down immediately to a modest idle and revs without any hesitation. There is no sign whatever of the potential lurking beneath the bonnet, waiting only for the throttle to be opened right up.

But moving off for the first couple of times does require some concentration; the clutch is not heavy but it is very business-like and snappy and the throttle has to be pushed more than is usual to bring on enough revs to move off. Being a little uncertain of just what will happen if you press too hard, you tend not to give it enough and you stall. But after that introduction it is no problem, and you don't notice it again.

From then on the Turbo is driven normally, the engine feeling subdued and ordinary up to about 3500 rpm. It feels less potent low-down than a Tii. But the much tauter race car-like ride, the 'squat' feel that comes from the fatter low profile rubber, the more direct steering and the instant responsiveness of the chassis say there is something very different about this one. A few quiet miles are needed to get the feel of the chassis simply because it is so responsive, even twitchy if you're heavy-handed, before you're in any



Well bolstered seats hold occupants well and have plenty of fore/aft movement.

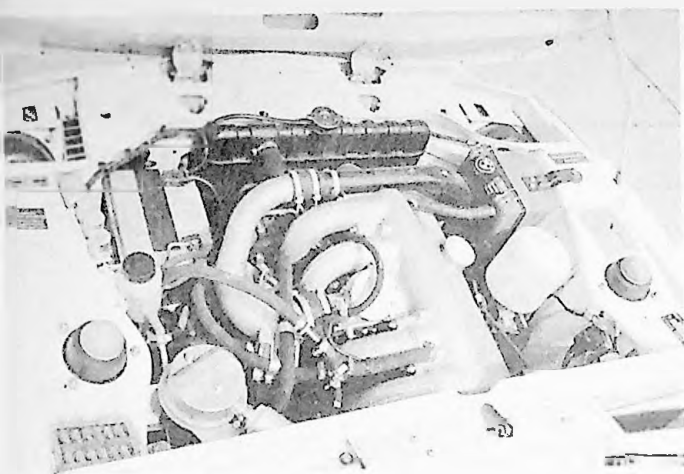
way ready to take the engine above its tame sector.

Then, when you are set to tread on it and see just what *does* happen, you get the message first from the noise. At 3000 rpm a faint whistling begins, and with every rev from then on it becomes more intense, almost an audio tachometer. At 3500 rpm it has risen to a turbine whine — the beast is beginning to stir. You feel it under foot too; the pull that had seemed almost sluggish is gaining some beef.

And then the tachometer hits 4000 rpm, the needle of the boost gauge leaps into the green . . . and the car rockets forward with almost unbelievable ferocity. It's as if a second engine has cut in!

You're thrust back in your seat and the car really is like a bolting horse, straining to get away from you. The car seems to be getting quicker and quicker, and while you're trying to adjust to the phenomenon of spearing into the future at such a suddenly rapid rate you're also watching the tacho because the needle is





BMW two-litre four looks like a fuel injected engine apart from the extra pipe running around the front of the engine. Turbocharger is mounted low and entirely hidden in this picture.

flying around it so fast now. What a change from the way it was below 4000 rpm! Then the needle hits 6500 rpm, before you know and nudges its electric cutout and it all dies. Whew!

Take second and do it all again.

It does indeed take time to adjust to this very different type of high-performance. Even when you know exactly where and how the sudden spurt will happen, and what occurs when it does, you have to drive the Turbo with a new and constant orientation to the conditions around you. It might be a bend coming up, or an approaching car, but you need to assess the speed with which you'll get there first in terms of the slow initial acceleration and then at the hot-stuff pace as the turbo cuts in at four. The normal methods of judging speed against distance just don't apply, and that's what makes the Turbo so demanding to get to know.

Of course, it's all tremendous fun. Once you've learned to use the throttle with due respect and caution you just can't resist giving it a prod at every opportunity and revelling in the searing, forward thrust. It's motoring mainlining that gives the same kind of kicks as the most beastly V8s and the hottest V12s.

We first drove the Turbo around some of the roads on the Monte Carlo rally route in the south of France. Even at the end of a day we weren't properly used to it and the driving was more point-and-squirt than anything else. The bends came up so quickly, or another car was in the way, that it seemed impossible to keep it working on the turbo all the time. There was also the supreme crispness of the chassis, a sharpness that required its own familiarity process simply because it is so much tauter than is normally available in road cars.

But the second time we drove the Turbo, when we picked it up for a week's road-testing, we found our initial lesson had been more valid than we imagined. All the car's idiosyncrasies were stored away well enough for them to be taken for granted, and we could begin enjoying the car almost immediately.

Whatever the reason for the stares the Turbo gets, you have to resist showing off — you behave like a good boy and just stick to the 3500 interim.

Sometimes it's different when a well-sorted Capri three-litre is alongside on the front row at the lights and he floors it as they change and rockets to a length's lead. Smiling with anticipation and keeping

your foot flat and you just wait for that familiar whistling and then the 4000 rpm whack in the back. It comes, and you catch him in an instant. He's just reaching for second, and you've passed him. Changing lightning fast to make sure the turbo stays full on, you keep the power up to it in second and you're scooting so far ahead he no longer need bother. Too bad; he thought he had it won to start with.

Before we took over the Turbo, a colleague had been driving it for a few days. Just when he thought he was properly familiar with it it rained. He still felt confident, because the grip is quite good (unless you bring on 4000 rpm or more on take-off the tail won't twitch off the line; if you do, it certainly does!). So, moving off gently as usual, he ran the car out quietly in first (you can go right up past 4000 and if you don't use full throttle you'll only get a proportion of the turbo's boost so that it is up to the driver to select how much power he wants). Then he went into second, went through the tame sector and decided to keep it flat, presuming there was now plenty of grip. But the turbo came in with such a demonstration of its power that it kicked the tail completely sideways with lightning speed, scaring the daylights out of him.

Knowing this, we took it pretty easy in the wet for the first few hours. But then we decided the grip was good enough to give it full power. But once we must have done it on a glazed patch of road and when it was pulling 80 km/h (50 mph) in second with 5000 rpm on the tach, we too got the sudden big side-step. Thank goodness the steering is super-quick: if it hadn't been, we couldn't have wrapped the opposite lock on smartly enough. A lesson learned, thank you.

But mostly, so long as you realise the turbo does need to be driven with respect for such situations, it is a thoroughly pleasant machine to drive. It is so quiet and smooth around town a woman could handle it with ease and so long as she didn't go past 4000 rpm she'd never know what potential it really had. Once the novelty has worn off, you tend to live with the Turbo like this, satisfied with knowing that the power's there when you want it.

And where you want it is on a drive into the country with a whole day to spare. Going down the motorway out of town it rained, but the stability of the Turbo is so good you can maintain a steady 160 km/h (100 mph) cruise. The wipers have anti-lift spoilers and at their fast speed they had no trouble clearing the screen. You feel supremely safe in this little car in such bad motoring conditions: it is so rock-steady. The spoilers and stiff suspension settings must do a terrific job, because the car is amazingly directionally stable.

When the rain stopped but with the motorway still wet, we opened the Turbo right up, able for the first time to see how much power there was under full boost in top. With 160 km/h (100 mph) already showing, the nose immediately lifted as my prod on the throttle flicked the boost needle into the green 'maximum' sector, and the car surged forward although it wasn't with the same kick in the back as in the lower three gears. The needle stayed solidly in the green and the car went on thrusting forward until, at 200 km/h (125 mph) we had to ease off because the back wheels were spinning! How real those 170 horses are!

Apart from the stability, the other really impressive thing about the Turbo at high speed is its quietness. When it's working full-out, the turbo's whine is lost in the slipstream so there's only the overall, fairly subdued sound of the engine, very little windnoise and no roadnoise. Talking is easy even with 6500 rpm showing on the tach in top.

Leaving the motorway, we headed for a series of

quiet country lanes. We were totally at home in the BMW by now, confident of running it at full boost for long periods and using all it had to offer. In the bends, it is a rather demanding car to drive, not through suspension deficiency but simply because you must keep changing rapidly up and down the box to keep the revs above 4000 and the turbo working hard. So, rushing up to a bend that you might normally take at mid-range revs in top you drop down to third and make sure you hold on as many revs as possible (either by heel and toeing or left foot braking) and then open up solidly again as soon as possible. In other words, it's all 'go' driving. If you don't keep the throttle opened up, the revs drop and the turbo cuts its boost. If you come through a bend like that you're out of it before the revs build up enough for the power to come on strong again. When that happens, it's like a mother pulling an icecream out of a little kid's mouth — disappointment.

Although we first thought the optional five-speed gearbox would be too much to handle — you'd be shifting furiously all the time — we now think it would be a better proposition than the standard four-speeder. The extra ratio would make it that much easier to keep the power on, although you definitely would be changing up and down dozens and dozens of times as you worked within the narrow 2500 rpm power band.

When the power is all on, when you can have no restrictions to make you lift off, how swift this car is along a bendy road! The steering is so sharp and the responses of the chassis so swift that you merely twitch the wheel and the car obeys. The LHD driving position helps because you can sight the car really tight into the banks and kerbs, adjusting the placement with millimetre movements of the wheel.

Although the steering isn't heavy, it does have a strong castor action to go with the precision so that you're very much aware of how far you're turning the wheel.

The handling is mostly neutral. The car simply answers the steering and flicks around the corner, staying very flat as it does so. Absence of body roll is always impressive, making you feel as if you're really on rails. But push too far and the limits of the 2002's ageing chassis show up: you get a quick touch of understeer as the inside comes close to lifting and you know to back off immediately. The very limits of adhesion have been reached.

While the ride is very firm, it is still comfortable because there is adequate suspension travel. So the bumps don't jar; the car just rides over them, sending back a constant stream of information to the driver — precisely the way it should in such a vehicle. In this area, the Turbo feels and is well bred. Of course, the seats complement the ride and the handling. Their big side bolsters are necessary to keep you in place during fast cornering; they let you relax and enjoy it as a passenger and keep you soundly behind the controls if you're the driver. But their backs are thick enough to reduce rear seat legroom to nothing more than poor 2+2 standards.

Although the speedo and tacho are fine gauges the overall instrumentation isn't good enough. Besides the main ones there's only the turbo boost, clock, fuel gauge and water temperature gauge. With such performance an oil pressure gauge seems essential, and an oil temperature gauge would be nice too. The boost gauge is barely more than gimmick value because once you've been driving the car for a while you know exactly when the power is coming in. It's real value is if the blow-off valve to release excess pressure from the turbo fails. The needle goes into the red then, and if you don't back off it's ka-pow.

All the controls have that BMW smoothness and efficiency about them, especially the clutch and gearshift. The blacked-out wipers do their job well,

and the vision in the well-known 2002 glasshouse is exceptionally good. The rear spoiler helps because you can easily see its edge when parking. Ventilation is terrible. There is a deal of body flexing over gutters taken obliquely too.

Going back to the motorway after our drive through the fun roads, we'd had enough excitement and we were just drifting along happily in top. We pulled out to pass slower cars on several occasions and felt the only real bugbear of BMW's turbocharged engine — at low speeds in a tall gear the acceleration seems painfully slow after what you've become used to. Just as you get past, after dawdling for the first part of the manoeuvre, the power comes in hard and you're overshooting by a mile. Damn, you should have changed down and got the power on before you started.

It does take a long time to get acquainted with the Turbo, but once you do it's a friendship you won't easily forget. *

SPECIFICATIONS

ENGINE:

Cylinders	Four
Cooling	Water
Valves	SOHC
Compression	6.9
Bore/stroke	89 mm x 80 mm
Capacity	1990 cm ³
Max power	127 kW at 5800 rpm (170 DIN)
Max torque	251 Nm at 3600 rpm (185 lb/ft)

TRANSMISSION:

First	3.35
Second	1.86
Third	1.28
Fourth	Direct
Final drive	3.36

SUSPENSION:

Front	MacPherson struts, lower wishbones, adjustable anti-roll bar.
Rear	Independent, oblique semi-trailing arms, coil springs, adjustable anti-roll bar.

Brakes	Disc front/drums rear
Steering	ZF worm and roller
Turns lock to lock	3.0

DIMENSIONS:

Length	4220 mm (13 ft 8 in.)
Wheelbase	2500 mm (98 in.)
Track front/rear	1360 mm (53.5 in.)
Width	1620 mm (64 in.)
Height	1410 mm (55.5 in.)
Weight	1035 kg (2282 lb)

PERFORMANCE

Top speed	211 km/h (131 mph)
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ACCELERATION:

0-30 mph	2.5 sec
0-40 mph	3.6 sec
0-50 mph	5.0 sec
0-60 mph	6.6 sec
0-70 mph	9.0 sec
0-80 mph	11.5 sec
0-90 mph	14.4 sec
0-100 mph	19.0 sec
Standing quarter mile (400 metres)	15.3 sec

OVERTAKING (third gear): 2002 Tii 2002 Turbo

20-40 mph	5.4 sec	6.8 sec
30-50 mph	5.4 sec	6.0 sec
40-60 mph	5.6 sec	5.0 sec
50-70 mph	5.7 sec	4.6 sec
60-80 mph	6.2 sec	4.7 sec
70-90 mph	8.1 sec	5.4 sec