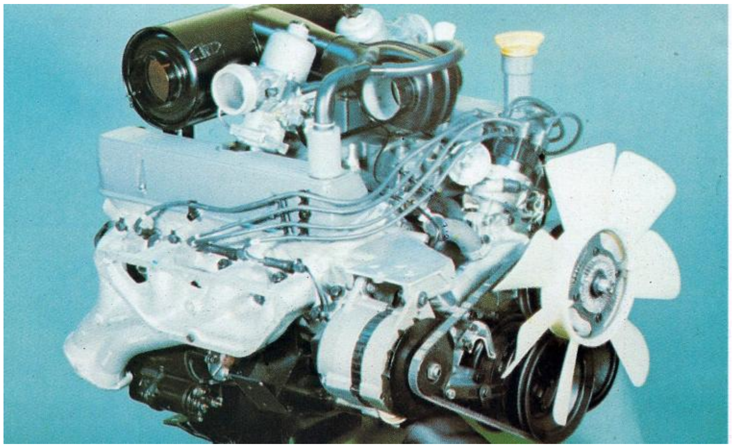


## The story of the Buick V8 engine which found its way across the Atlantic to power a generation of Rover and Leyland vehicles

This article by Chris Goffey was a feature in Autocar in November 1976. It's reproduced in the V8 Register Journal New Year 1980 by kind permission of Autocar issued to the V8 Register in 1979.

Autocar is often prophetic. But the author of a technical review of the then new Buick aluminium V8 engine, writing in the issue of 23rd September 1960, could have had little idea just how accurate he was being when he commented "we will wager that the most widely copied engine in the next 10 years will be the superb new aluminium V8 by Buick". In fact, it was only by a chance encounter with then engine by Rover managing director Bill Martin-Hurst that led to this particular prophesy being fulfilled in the UK. But fulfilled it has been with the highly successful Rover V8 engine powering a wide variety of Leyland vehicles over the past nine years.

Work started on the design of the Buick engine back in 1950, with the first experimental engine being a cast iron unit of 3.85 litres capacity. In the same year, a design for an aluminium unit was prepared with the displacement going up to 4.15 litres. By 1952 both these engines had been road tested under an overall GM plan to come up with a power unit that would be lighter than conventional cast iron engines, and would allow them to build a lighter, better handling car offering improved fuel consumption with little or no performance penalty. At this time aluminium looked to be the way for engine manufacturers to go in the search for weight saving, since the later, more sophisticated, thin wall iron casting techniques were then in their infancy. Work started soon the present unit at the GM design laboratories in 1957, with the first unit running in the summer of 1958 before being finally turned over to the Buick division for production engineering and design.

Buick managed to design an aluminium alloy with a high silicon content that gave wear characteristics on the engine test bed which were generally superior to cast iron, confounding the critics who said that they could not have an aluminium cylinder wall with an aluminium piston running in it in a mass production engine. However, one problem they simply could not overcome was the scuffing of the bores by the piston rings in a cold start. It was mainly for this reason that Buick elected to go for iron cylinder liners, cast in place in a block with a more modest silicon content in the aluminium alloy. Buick had ruled out any idea of using wet liners, because the American engineering techniques do not allow for the handwork precision of wet liners in European designs, and they were most concerned about the problems of water leakage from a poorly sealed liner.

In fact the feeling against wet liners was so strong that Buick later admitted they would rather have abandoned the aluminium alloy concept altogether, than go to wet liners. The liners in production were pre-heated to prevent chilling in the mould and held in place by mandrels as the block was cast. Buick used gravity castings in metal dies with sand cures for the water jackets. The problems of varying expansion rates in the metal between block, head and rockers were solved by using hydraulic lifters, already common practice in American engineering. The heads of the Buick unit were also cast in dies with intricate sand cores.

The engine was installed in a number of well-known American cars after the production troubles were ironed out, notably the Buick Special, Pontiac Tempest and also in the Oldsmobile F85 Cutlass, after Oldsmobile engineers had designed different pistons, heads and manifolding. The Buick Special engine gave 155bhp (gross) at 4,600rpm, and probably 220 lb ft of torque at 2,400rpm for an all up weight of 318lb.

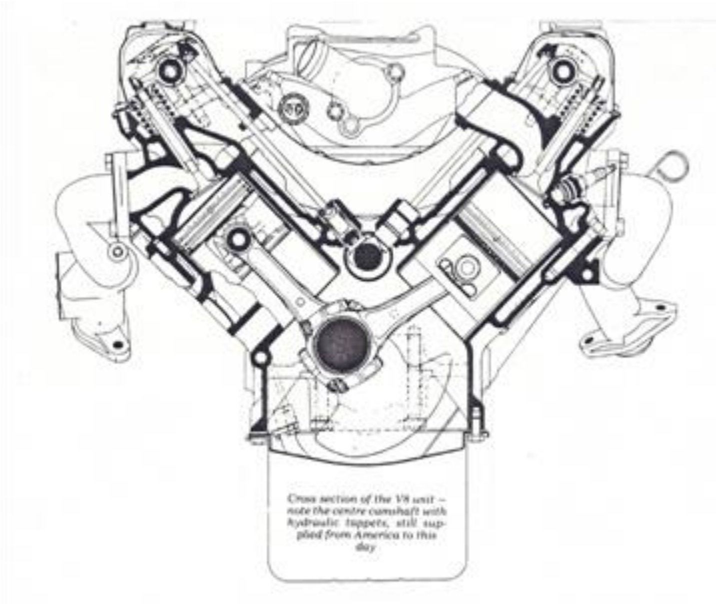
After all the investment and engineering time that went into the Buick engine, it seems sad its useful working life in production was so short. By 1964 the engine had been virtually abandoned with the more sophisticated thin wall iron casting techniques being perfected, and the American disenchantment with small engines and the compact car. In fact although 750,000 aluminium engines were produced in various forms, it was also successfully run as a 5 litre engine with the cylinder liners deleted and the block cast in iron instead of aluminium. A further 750,000 5 litre iron engine from the same tools were subsequently built.

### Historic stumble across an aluminium Buick V8 engine lying on the floor of an experimental shop at Mercury Marine

It was at this stage that Rover managing director, Bill Martin-Hurst, took his historic stumble across an aluminium Buick engine lying on the floor of an experimental shop in the Mercury Marine Company's base in Wisconsin. Martin-Hurst was in America talking to Mercury about gas turbine engines for outboard motors, at that time being most anxious to give his ailing gas turbine division a boost. In fact when he showed Mercury the drawings of the engine his company produced, they were more interested in the diesel version of the Land Rover engine than his turbines. They had a contract to supply diesels to Chinese fishing junks and they were having trouble with the Marine diesels they were using to fulfil the contract. The head of the Mercury concern, Carl Kiekhaefer told Martin-Hurst that the V8 lying on the shop floor was a Buick, an aluminium engine out of a Skylark that they had been playing around with for power boat racing purposes.

Martin-Hurst recalls that with a friend he had been taken out in a Skylark on a previous visit to America, and he had formed the opinion then that it had been "terribly nice". His thoughts went straight back England and the problems Rover were having with the six cylinder version of the Rover 2000 which marketing maintained they needed so badly. The prototypes had been built and Martin-Hurst had driven it. But he was worried about the weight of the big 3 litre six in the front of the 2000, which made the car extremely nose heavy. "Is this engine available?" he asked Kiekhaefer and was told that it had just gone out of production. The engine was measured and weighed against a Rover 2000 engine which Mercury had already received from Rover, and proved to be just 12lb heavier and within an inch of the overall length.

Kiefhaefer told him to go and see Ed Rollart at General Motors to ask if he could use the engine in a Rover car, and in the meantime the Buick V8 that Martin-Hurst had seen was crated up and dispatched to England. Martin-Hurst went to the New York Motor



Cross section of the V8 unit – note the centre camshaft with hydraulic tappets, still supplied from America to this day

Show and had breakfasted with Ed Rollart who was “jolly nice”, but who said he could not authorise licencing the engine. Rover would have to approach GM International. Martin-Hurst went there to see Copeland, the ex-head of Vauxhall, and told him of his interest in the unit. Copeland said he would look into the matter.

Back in England, the Buick engine was sitting in Rover’s experimental shop and creating not a little interest. Martin-Hurst tried to get Peter Wilks to put the V8 in a 2000 body but Wilks resisted telling him that everyone was too busy and that he wasn’t to waste everyone’s time. It was no good putting the engine in a car because they would never get permission to use it from GM anyway. But Martin-Hurst persisted and it was finally agreed that Ralph Nash in the competition department should do the job. The engine was duly installed with little modification and, apart from an over-long propshaft which tended to flex too much, it was a great success.

Martin-Hurst went down to a board meeting in London and without telling Spen King what it was, asked him to drive the car back. King climbed in, started up and then switched off again. “What have we here William?” he asked and Marti-Hurst told him about the V8. Spen drove it back to Rover and climbed out with the remark that it was the first Rover he had ever driven which was not underpowered. Martin-Hurst went back to Copeland and discovered that nothing had happened about his enquiry because GM could not believe they were serious. Martin-Hurst was soon able to convince them just how serious he was and with the help from “AB” they negotiated a licence with GM – a generous licence as it turned out which opened the flood gates of technical information. Up until this point, Rover had great trouble getting much information about the engine out of GM, but now they were able to acquire all the original service records, drawings, and 39 complete engines which the Buick factory still held. Rover purchased them for a negligible sum.

Then came the problems of taking an American manufactured engine and attempting to manufacture it in this country with British component suppliers and foundries. Martin-Hurst soon contacted Buick’s chief engine designer, Joe Turley, who was then within 18 months of retirement. He confided to Martin-Hurst that he was not doing much at Buick any more as he was close to retirement, so Martin-Hurst asked him to come to England to help in the conversion of the engine to British manufacture. Turley said he was worried about his pension, but Rover won GM agreement that his pension would not be affected. He and his wife were brought over to England and installed in a flat in Solihull on a salary of £20,000 a year.

When Turley arrived he was puzzled by the Rover engineers' insistence on more power and a higher rev range. The Buick ran out of revs at 4,700 rpm and was getting unhappy at that. Rover wanted at least 5,200 and possibly 5,500. “Why do you want all those revs?” asked Turley, “people just don’t drive like that”. So he was sat alongside a Rover test driver who proceeded to hurtle him across country and up the M6 at over 100mph in those pre-limit days to show him what sort of treatment the engine would have to withstand. After that experience he returned shattered with an insight into what Rover wanted.

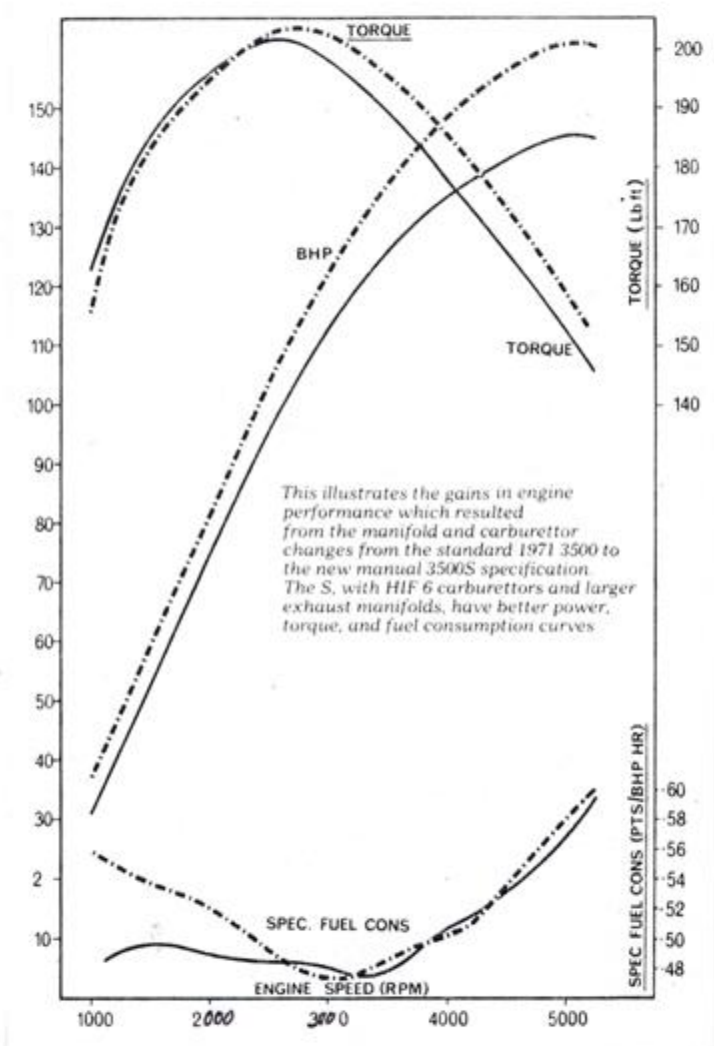
Turley was invaluable in interpreting the original drawings. Rover could not understand why the engines they had did not conform to the drawings. Turley was able to point out where things had been changed in production, the changes not being recorded on the original drawings. At one point he wandered into Martin-Hurst’s office and said that he was unhappy; he felt he was not earning his salary. “How many people have you talked to this week?” asked the Rover managing director kindly. “About half a dozen I suppose” replied Turley. “And what were the questions?” “Oh well they wanted to know why the crankshaft webs had a smaller radius than we showed on the drawings. I told them that after we made about 50,000 engines we started to get crankcase breakages and we discovered that by reducing the radius of the webs we got round the problem.” “What do you think that sort of information is worth to Rover? You can’t put a price on it” said Martin-Hurst.

Decisions were soon made about the production of the engine in England. In the first place the gravity die casting with liners in place was carried out in America on an old automatic transmission die casting machine, a transverse machine where the block was cast on its end. Enquiries about the drawings and the methods were met with the answer that the man who had set it all up had died long since.

Martin-Hurst asked Spen King to drive the car back to Solihull. King climbed in, started up and then switched off again. “What have we here William?”

British casters were unhappy about the technique and it was soon decided that the only feasible method of production in England was to sand-cast the block and then press fit and shrink the liners in. There were surprisingly few problems. Birmingham Aluminium got it right almost at their first attempt and with very few changes, the engine went into production. Rover altered the oil feed to the rocker shaft in an attempt to reduce the rocker shaft and rocker arm wear they were experiencing with test engines. They were very worried by the problem but Turley with his American engineering attitudes to engines was unable to see the need for concern. The problem was that the underside of the rocker arm was wearing away and at the same time cutting into the case-hardened rocker shaft until it had cut quite a groove. But Turley pointed out that the hydraulic pushrods took up the slack anyway and the engine stayed quiet, so what was all the excitement about? The engine would hold together despite the problem for well over 100,000 miles, so why worry? By that time no one would want the car!

Rover engineering were outraged by the suggestion and tried in turn to anodized rockers, the tin-plated rocker bearings and eventually settled on electro-plate nickel for the surfaces. They also changed from the American “Armasteel” specification for the crankshaft to a nodular steel, a feature about which Turley was very




dubious. With Birmingham Aluminium casting the heads and blocks in sand instead of die casting, the Rover engines were at once in better tune than the original Buicks. When a head is die cast it inevitably bows, and when it is then machined flat the combustion chambers at each end will be smaller in volumetric capacity than those in the centre. Rover did not have to contend with this problem.

The accessories for the engine would also have to be British. Rover looked at and tested a compound Rochester carburettor, but soon decided that with European cornering forces, it was unsuitable as the engine tended to cut as fuel centrifuged in the float chamber. Thus the decision was taken to go with twin Sus although this would mean introducing bulges in the bonnet – something the engineers had hoped to avoid.

Lucas were also approached about the ignition side. The Buick engine was fitted with an AC Delco single-contact breaker distributor. Lucas designed a V8 distributor – their first – and just developed it in time for final production. A feature of the distributor was the very long drive shaft, supported in the die cast timing chest on the front of the engine which also contains the water pump. The lower end of the distributor has to drive the oil pump, a Hobourn-Eaton unit. The only item of American manufacture in the entire unit remained the hydraulic tappets principally because the Diesel Equipment Co of Grand Rapids could churn them out at such a low price and at such good quality that it simply was not worth going to a British supplier. The hydraulic tappets are brought across to this day.

William Martin-Hurst was convinced that the engine he had bought for Rover was going to power many models for many years, and he was already eager to see it put to more sporting use. He asked Jack Brabham, then using the Buick engine in Repco form in his Formula 1 GP cars, for a scrap engine, but Brabham declined. At that time Brabham had won two World Championships with Repco, the engine being developed in its final form to a four camshaft unit. But the American engineering firm of Traco were more than happy to show Rover what they could do, and at one stage a “full house” 350bhp Traco unit was shipped to Rover for assessment. “I think we still have it”, says Martin-Hurst. The company made a collection of all the go-faster items available for the engine, from Iskenderian camshafts to Hallibrand manifolds, and they assured themselves that if the need arose they could be certain of having all the development work needed for raising the power of the engine ready to hand. Sadly that has never really happened at Rover, and it has been left to individuals to play with the Rover unit to gain the increase in power it is so obviously capable of delivering.

Notable among the development exercises was GKN. They took a standard Rover V8, installed it in the infamous GKN 47D Lotus, with a succession of modifications to manifolds, camshaft, careful attention to balancing, a longer throw crankshaft, bigger pistons and a lightweight flywheel. GKN eventually had the engine delivering a remarkable 296bhp at 6,500rpm. Later on, Bill Shaw entered a full race Rover 3500 in club racing in this country, with factory support.

There were any number of variations for the V8 in those early days. It was fitted to the revolutionary P6BS mid-engined sports car prototype designed by Spen King and Graham Blashford, and later killed off in the Leyland merger. This was a most interesting version of the engine. It ran facing the rear of the car with the final drive cast into the sump driven by a small prop shaft running from the gearbox at the front of the engine. Power was transmitted to the gearbox from the end of the crankshaft by Morse chain, and a modified Rover 2000 gearbox was used, lying on its side. Rover devised a new exhaust system for the car which gave pulses without the need for cross-over pipes. They also fitted 2” SU carburettors with none of the usual complicated silencing air cleaner trunking. The result was a very quick car indeed, topping 140mphand accelerating from 0-60mph in 7.0 seconds. The engine was mounted on one side, resulting in extra weight on the front and rear wheels on the righthand side. However with lefthand drive and the only the driver on board, the car would be perfectly balanced.

Another “one-off” using the V8 was a styling exercise made by David Bache, Rover styling director, which was a two-door fastback on the 3500 with a rather Chrysler Alpine-like style front grille and the nickname “Gladys”. This car was to have been marketed as the Alvis GTS but was another victim of the merger.

The original V8 installation in the Rover 3.5 saloon and coupe proved very successful. The lighter weight of the unit improved the handling of the big car enormously, and in no time the 3.5s were to be seen whistling around the country at great rates of knots. The conversion of the engine to 3500 form announced in April 1968 involved different manifolds with the downpipe being taken away from the centre of the exhaust manifold instead of from the rear end as in the original Buick and 3.5 installation. At first the car was available only with automatic transmission, but in 1971 the 3500S was introduced featuring a redesigned exhaust system with the downpipes joining into one pipe much further back down the system. In fact the two pipes from the manifolds are of larger diameter than the 3500 pipes and, combined with the extra length of downpipe, this meant the back pressure was thus much reduced over the standard 3500. The 3500S also introduced improved SU carburettors – HIF 6 (Horizontal Integral Float chamber) which were claimed to provide more stable carburation during conditions of hard acceleration, braking and cornering. At the time of the announcement of the 3500S (in October 1971) AUTOCAR commented that "relieved of the sobering influence of the torque converter, the engine has assumed a decidedly sporting character. Even so, it has lost none of its silky smoothness and delightful flexibility". The car developed 152bhp (DIN) at 5,000rpm and 203.5lb ft of torque at 2,750rpm.

One of the more major changes to the engine had come in June 1970 when Range Rover was announced. The introduction of the Range Rover unit had called for a new timing chest die to allow for the raising of the water pump to accommodate a starting handle dog and power take-off point. The compression ratio was reduced to a nominal 8.5 to 1 (the production engines varying under manufacturing tolerances between 0.25 0.75 anyway) from 10.5 in the car form. The reduction in compression ratio enabled the Range Rover to run on 2-star fuel fed to the engine through Zenith CD 2S carburettors on a special manifold, instead of the Sus of the car engine. The air cleaners were supposed to incorporate a one-way valve to allow any water which might find its way into the air cleaner to drain "harmlessly away", but on one Range Rover at least AUTOCAR discovered that it was possible to drown the engine in an especially deep water splash.  The metal fan was changed for a moulded plastic type (Rover had experienced fatigue failures with fan blades slicing into the bonnet on the cars) and the starter solenoid was moved further up the engine to keep it out of harm's way. The range Rover developed a gross maximum of 156bhp at 5,000rpm with a peak torque figure of 205lb ft at 3,000rpm.

Another major production change for the unit came with the ill-fated P76 saloon engine, first produced in June 1973. This was a fundamentally revised engine from the 3500 featuring an enlarged block to make a "square" engine of 3.5 in bore and stroke. This brought the capacity to 4,416CC and the engine developed 192bhp at 4,250rpm suggesting improvements above and beyond the capacity change to head design, breathing and exhaust. The Australians did much of the development of the unit themselves, no doubt in cooperation with Traco, and the exact details of what was done, why and how are not very clear. It is known that they went for a twin-choke Stromberg carburettor instead of the two Sus and the central manifold design was fundamentally revised.

## One of the most altered engines from the manifolding point of view was for the MGBV8

One of the most altered engines from the manifolding point of view was for the MGBV8. The design and development work for the unit was done at Abingdon and the most obvious difference was the new inlet manifold moving the carburettors to the back of the unit to permit the retention of the standard bonnet. The engine used for the MGBGTV8 (announced in August 1973) had more in common with the Range Rover unit than the Rover 3500. It shared the same dished pistons and 8.5 to 1 compression ratio, but with an AC-Delco alternator instead of a Lucas unit. The HIF6 twin carburettors have forward facing inlet tracts into a plenum chamber in the centre of the Vee, a system which MG claimed gave them increased low speed torque over the standard unit. The engine met ECE 15 regulations with bi-metallic strips controlling the temperature of the air flow into the carburettors. As installed the MG unit delivered 137bhp (DIN) and 193lb ft of torque at 2,900rpm.

Another famous application of the V8 in a sports car was of course the Morgan V8. The story of this car started in 1966 when Peter Wilks asked Peter Morgan to merge with Rover to produce a sports car fitted with the V8.Morgan said that he liked the engine but he didn't like the idea of a merger. Wilks agreed and negotiations for Morgan to use the engine went ahead smoothly until the Leyland takeover when there was a major hiccup. Leyland wanted permission from GM to use the engine in a Triumph sports car, so permission was sought for both the Morgan and the Triumph. GM replied that they had no objection to Morgan using the engine but would not commit themselves on the Triumph. In the meantime Peter Morgan had Maurice Owen shoehorn a Buick V8 into a modified Plus Four and a very successful car it proved to be. It is still owned by the factory.

After two years had gone by, still with no decision, Morgan approached Harry Webster with a view to getting a meeting with Donald Stokes to try and confirm the agreement. Harry tried to wean Morgan away from the Rover engine by showing him the range of new Triumph engines, but Morgan remained convinced that the Rover V8 was the unit he wanted. A couple of years later Webster came down to the Malvern factory with George Turnbull who was going to give the final approval. Turnbull went off for a blast around the hills in the car, came back most impressed with it and told Morgan "you can have the engine as long as you don't take too many of them". The car was exhibited at the 1968 Motor Show and was an immediate hit.

Morgan's use of the engine involves a fair amount of dismantling. The unit comes in a production line package and Morgan take off the power steering pump and alternator and dispense with the viscous coupled fan using an electric fan in its place. They alter the clutch operation, taking an arm through the top of the bell housing instead of the side, and they fit the original 3.5 manifold with a special exhaust system. Morgan of course, are still being supplied with V8s in the latest and most revised form from the SD1, the new Rover 3500, their latest model being the Plus 8-77 with the 5-speed gearbox.

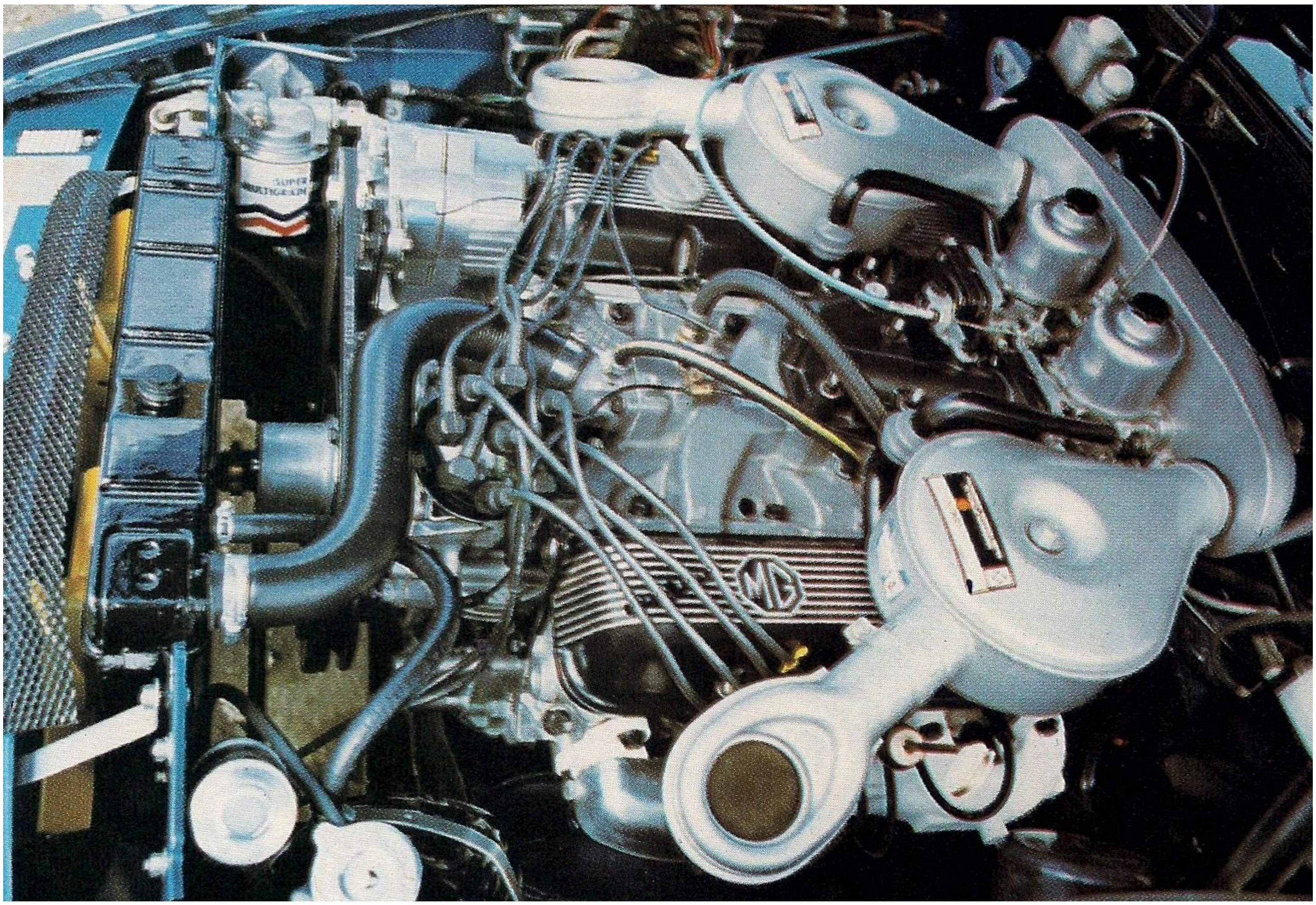
The use of the faithful V8 for the SD1, pride of Leyland's new marketing strategies, called for some fundamental rethinking. The engineering staff were faced with calls for more power, a higher rev limit and the eventual need to meet strict American emission standards.

## Remains one of the best engines we have ever seen in British cars

The first step was to alter the valving in the hydraulic tappets to delay the point at which they started to "pump up and after that to improve the breathing. Changes were made to the inlet and more especially the exhaust manifolds, with dual outlets per bank and much better extractor effect", and new single valve springs were introduced. To complete the change after exhaustive tests, Lucas electronic ignition was fitted. To test the system, Rover had it running for 6,000 miles of city driving followed by 6,000 miles around the "de-tox" route, followed by 6,000 miles at maximum speed around MIRA, all without attention to the ignition. To get the vehicle to work flat out without wearing out, a set of tyres on MIRA's banking every 10 laps, they erected a six foot high box on the roof of the Rover to drag down the maximum speed but still make the engine work on full throttle. After that they went back and did a further 6,000 miles in traffic. It seems amazing that all this testing the electronic ignition is still giving so much trouble in service.

Long nose Champion N12Y plugs were adopted to go with the electronic system. The oil pump design was improved with higher output especially at lower speeds, and the water pump housing and impeller were changed to reduce power loss at high speeds. The piston ring depth was reduced to cope with the higher revs and the temperature controlled air intake valve was introduced into the air trunking. The engine develops 155bhp at 5,250rpm and 198lb ft of torque at 2,500rpm.

Those then are the most of the major applications of the Rover engine. There have of course been countless other applications to specials and one-offs and many developments of the engine for competitive work. But the unit stands out for its reliability, its kindliness to different mounting brackets (nothing seems to vibrate and fall off in service) and its durability. The army made all sorts of demands on it for application to the new military V8 Land Rover, even demanding that soldiers must be able to stand on it to service it. It has taken all the abuse without complaint and, sadly for British engine designers, remains one of the best engines we have ever seen in British cars.



Photos:
Rover V8 engine (British Leyland Technical Publications)
Engine bay of John Dupont's MGBGTV8 (Tony Hilton)
Cross section of the V8 unit
Chart showing gains in engine performance from manifold and carburettor changes from standard in 1971

**Chris Goffey**
He is an English journalist and television personality, best known as a presenter of the BBC motoring television series Top Gear. He crossed over to Channel 4 in the mid-1980s and worked with two motoring programmes (The Motor Show and Wheeltracks) before returning to Top Gear. Goffey's demeanour on Top Gear was deliberately understated, calm, and practical when dealing with all road tests. His beard, formal attire, and common sense were a direct foil to the more in-your-face antics of his colleagues. He has worked on many different corporate, instructional, and motivational films for a variety of clients. Between 1972 and 1977 Goffey worked as a member of the editorial team of Britain's Autocar magazine, where for five years his responsibilities included the news pages. Recognition came in 1975 when he was designated News Editor. Leaving Autocar in 1977, he obtained his own editorship with the journal Motor Trader. He is a member of the Guild of Motoring. Chris has had a V8 Roadster and been a member of the V8 Register.