Cylinder Head Oils & Filters V8 Engine Specifics

Cylinder Head

Note that inlet/exhaust manifold studs in the cylinder head are fine thread, but rocker pedestal and thermostat housing studs are both coarse. I can perhaps see reasoning for the thermostat housing as they are in coolant, less so for the rocker pedestal. Cylinder head studs in the block are also coarse thread.

Dating the head:

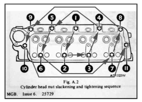
Cylinder heads can be dated from a casting number and (usually) a date code cast into the upper surface, so easily seen by removing the rocker cover. See also this information from Sean Brown's Flowspeed page.

Combustion chambers:

At least two changes in design, possibly 1970 and 1972, the earlier ones seem more prone to pinking.

Remove/Refit:

See here for a tip on removing a stuck capillary temp gauge bulb.



It's very important to get the cylinder head nut sequence right both for slackening and tightening if head warp is to be avoided. Looking at the drawing the order might seem random, but in fact it starts in the middle and spirals out anti-clockwise from there, finishing on the rear-most bolt. I hadn't realised the 'spiral' feature until I came across a drawing on a commercial site showing it, although whether I would rely on working that out as I go along instead of leaving the socket on the most recently slackened/tightened nut before looking at the drawing to see which is next is another matter.

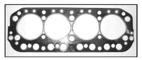
Equally important is how each nut is slackened and tightened. You must not go for everything in one go i.e. slackening the first nut right off before moving onto the second, neither must you apply full torque to the first nut before applying any torque to the second, and so on. They must all be slackened and tightened progressively no more than one turn at a time each between starting to undo and moving free of the head or rocker pedestal in the case of slackening, or starting to apply force to the head or rocker pedestal and reaching the final torque in the case of tightening. It's also very important to be aware that the manifold-side nuts and studs on each rocker pedestal also clamp the head, so you cannot remove the rocker pedestals without going through the full cylinder head slackening and tightening sequence, which means draining the coolant.

When slackening I'd advise doing it until they just start to come clear of the head. You may find that valve spring pressure pushes one end or other of the head up anyway, alternatively with them all fully loosened the head could be stuck fast. If the latter then with the spark plugs still in ... and power to the fuel pump disconnected or the carb feed hose blocked off if using the ignition key - crank the engine and compression pressure will hopefully loosen the head. If not you will have to resort to careful malleting and levering. With the head loosened it's probably best to remove the rocker shaft now - if nothing else it removes quite a bit of weight when you are leaning across to the middle of the car and trying to wiggle the head up off the studs. Lift it up carefully, making sure each push-rod comes free from its rocker. If stiction pulls a push-rod up, that can pull the cam-follower up, and it can drop off and lie tilted across the hole it should be sitting in, which will probably mean you will have to remove the engine side-covers to reseat it. Once the rocker shaft is off lift each push-rod in turn slightly - you will almost certainly feel the weight of the follower, so twiddle the push-rod and waggle it from side to side until the follower drops free and the lower end of the push-rod can flap from side to side. As you lift each out in turn have a piece of card to hand with numbered holes for the push-rods, to ensure they go

back in the same place. After that it's a case of grasping the head as best you can and wiggling it off the studs. If you have had head gasket failure then check for surface damage and flatness and examine carefully for any cracks - this Flowspeed page gives several examples.

When refitting a head the threads must be oiled and the nuts running freely or the torque figures will be reached before the correct clamping force is exerted. Also you need to be careful how many times you reuse the head studs. How many of us know if our engine has been apart, let alone how many times? I reused mine the first time I had the head off for a leaking exhaust valve as I tried undoing a couple with double-nuts and got nowhere. It's said that if running the nut down the stud encounters a tight spot then that implies the stud has stretched so should be replaced. But you would have to test that without the head in place as the stretch could have occurred anywhere down to block level - or even below it, so I wouldn't rely on that. And in any case typical MGB studs have a threaded section at either end and a plain section in the middle so you can't run the nut all the way down anyway. The second time I really didn't want to reuse them again, which meant the studs had to come out come what may. After much pondering and investigating shock forces on the end of a stud before trying to undoing it, with and without heat, and limited space for Stilson's, I decided to splash-out £21 on a Laser impact stud remover with my air gun and they all came out relatively easily. The next quandary is what to replace them with! There have been several reports that standard studs from the usual suspects are very poor quality with them snapping before they have got up to torque the first time. So far better to spend the money on a set of ARP, and for road use they are said to be good for the life of the average owner! Clean and dry the block face before reassembly.

Before fitting new studs I've seen it said that you should check the flatness of the block and if there is any raised area round the stud holes then it should be removed or it can prevent the head clamping the gasket correctly. Others say if the block shows that then it is scrap. The holes in the head have a clearance round the studs, and there is the thickness of the gasket to take into account, so if any raised portion IS holding the head up then the block is definitely scrap! When fitting the studs make sure the block holes are clear of any water or pooled oil as that can stop the studs going down as far as they should, which will reduce the number of threads engaged, and can hydraulically fracture (fracking!) the block. I checked the depth of the holes against the length of the threads and all were well over, and the lightly oiled studs went in with only light pressure for the whole length of the thread. If they don't then you should clean the block threads, although a full-blown tap may not be a good idea in case it takes metal away, use a bolt with a couple of hacksaw cuts along the length of the thread. DO NOT torque the studs into the block. Some say it will crack the block, but that will only happen if the stud is going to bottom of the hole, which with the partial threading that these studs should have can't happen, but you could still damage the threads at the top of the block making subsequent removal and replacement difficult.



Fit a new gasket - noting the TOP and FRONT marks. You can't get the long edges on the wrong sides as there are five studs in a row on the manifold side and only four on the plug side, but you can get it upside down. The original copper gaskets are quite easy as the copper side faces up and the 'steel' side down, and the TOP and FRONT marks are very clear. But the Payen gaskets are not so clear - not only are the sides very similar in appearance but the TOP and FRONT marks are small and not very distinct. A clearer indication is on the front and rear edges - the front edge has a distinct step but the rear edge is only a curve (same with the copper). However on the block both edges are stepped, and on the head both are curved, so why that particular feature exists I can't imagine!

Clean and dry the head face, and when picking up the head avoid wrapping your fingers round under the head onto the gasket surface. This is not so much to avoid you trapping your fingers between head and gasket as to prevent getting dirt and grease between the head and the gasket! It's easier to fit the head minus rocker shaft - not only for its reduced weight when leaning across to the middle of the car and trying to get all the studs in the holes in the underside of the head without damaging the face, but you can only get the push-rods back in with the head on. Drop the rocker shaft and pedestals onto their studs, and now you have to get all the push-rods into the recesses in their rockers. If you tighten the smaller pedestal nuts first that will lift the head off the gasket where valves are open, and the push-rods for closed valves will flop about. Fit the eleven larger head nuts first, and as you tighten them make sure the push-rods are seating as you go. Closed valves will have their push-rods down and won't seat into the rockers until the head nuts have pulled the head down almost all the way against open valve spring pressure. Alternatively you can slacken the adjusters right off - after-all they are going to need readjustment anyway. With all the head nuts tightened down you can fit the smaller pedestal-only stud nuts. After fully tightening, and refitting all the ancillaries, and maybe leaving overnight for things to settle and re-torque next day, set the valve clearances. At this point I started the engine with no coolant - for just long enough to make sure everything was working OK. If you don't get it too hot - or when cool enough, refill the cooling system with plain water and run to check for leaks. Then drain as much water as needed to get the required volume of neat anti-freeze (assuming you don't bother with any of the fancy dilute alternatives) back in. The carbs having been off you should probably check the air-flow and mixture balance.

To re-torque or not to re-torque, that is the question ... Next day after first fitting the head then set the valve clearances before any running, and again after about 500 miles with copper/sandwich gaskets (some recommend periodic re-torquing with these). Re-torquing after running should not be done with Payen gaskets (see this SC Parts page) because of the sealant coating these gaskets have that is activated by heat. It isn't necessary with the steel shim gasket on the V8 (use Wellseal as a sealant), and only initial torquing should be done on modern engines where after reaching the final torque figure the nuts are tightened a further number of degrees. Each nut has to be slackened slightly to break thread stiction before being tightened again with a torque wrench. If you start to slacken the nut with a ring-spanner you will almost certainly see the free end of the stud turning with the nut to begin with before it moves independently. This is normal and is just the elasticity of the stud plus the effect of thread stiction. Once the nut moves relative to the stud it is ready to re-torque back to the correct figure. If you use a socket to slacken you won't be able to see the stud, a quarter-turn of slackening should be enough. Work round them in the standard tightening sequence, DO NOT do what I've seen suggested and undo each nut completely, and slacken and re-torque each nut in turn i.e. do not slacken them all then re-torque them all.

Head Gasket Leak:

Bee's rad cap has always hissed when running (only audible when switched off of course) as pressure is escaping (seen by bubbles with the end of the overflow tube in water), which soon stops, then hisses differently as the system starts sucking air back in as the engine cools. I've never understood why, as surely in normal use the system should heat up, pressurise to something less than the cap pressure, then simply cool down and depressurise back to zero. But as it never caused any problems I left well alone.

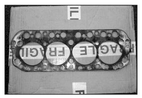
After many years a pal said his was hissing as well, so he was going to get a new rad cap, and I started thinking about it again. A pressure test showed the 10lb cap was only holding a few psi, and soon lost that after switch-off. So that explains why it was sucking air back in as it cools, but why was it constantly pushing air out? Nevertheless I bought a new rad cap, which now held 10psi, but was still pressurising up to that and hissing - sometimes. Again I put it to one side.

Then in May 2014 just before a run I noticed the temp gauge oscillating wildly just as the stat opened, and it lost a bit of coolant. "Stat sticking", I thought, so changed it. Despite testing the new stat was OK before fitting it there was no change. As this was very similar to the problem I'd had with the V8 some years ago which could well have been the pump, and I'd been carrying a spare pump round with me for 17 years, I decided to change the pump - but no different.

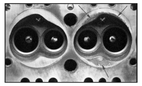
By this time I had put a pressure gauge on the cooling system utilising a Tee in the hose between the heater valve and the heater. What that showed was brisk acceleration causing a rise in pressure, that did not drop back! More gentle driving showed a similar rise in pressure, but slower.

Finally I did a combustion leak test of the air in the rad, which I probably should have done sooner if not years ago, and there is CO there so the head gasket is leaking. First decision is what type to fit? Originally copper, but first Americans started talking about Payen, now discussed here as well. Suppliers seem to have one or the other, so no point in asking which one they recommend. One acquaintance with connections talked about the usual problems of quality, small scale production, and competition on price rather than quality which didn't fill me with confidence for either. But Chris Betson of Octarine Services sells and fits Payen, and presumably if there were any problems with them he'd be getting cars coming back, so I think on balance that gives me more confidence.

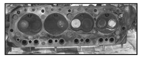
I've also done a compression test for the first time in very many years - never had reason to before now. 1, 3 and 4 were 160 to 173psi dry, 173 to 185psi wet. No 2 was 127psi dry and 138psi wet so significantly low. The dry to wet increase is pretty-much the same for all cylinders, so bores look OK, but I need to check the valves to see if that's the cause of 2 being low, or whether it is something else. I also did a sort-of leak-down test. I don't have the pukka kit so I just connected my compressor tyre inflater to an old spark plug with the centre drilled out, and a tyre valve soldered in. When in cylinder 2, with all the plugs out, I could hear hissing in cylinder 3. Consulting the valve sequence, No.3 exhaust valve is open with No.2 on TDC on the compression stroke, so the diagnosis was No.2 exhaust valve leaking.



Dismantling completely uneventful (however see the 'Gotcha!' that stopped Herb Adler lifting the head, also his further head gasket and cam follower problems). Draining the coolant first, as before I removed the bottom hose from the rad, but this time with a large padded envelope acting as a shoot and positioned such that virtually every drop went into the bucket. I disconnected the strap between the exhaust down-pipe and the bell-housing, and that was enough to pull the manifold off the studs and tie it to the bonnet prop. No horrors anywhere, although it looks like combustion gases have been seeping past the gasket towards the water passages for sometime, maybe a torque-down would have cured that, but the leaking exhaust valve on No.2 still needed attention. One interesting thing is that the block is stamped '+.040' i.e. 40 thou overbore, almost certainly part of the Gold Seal rebuilding. I removed the head complete with rocker shaft as the cam and push-rods are helpful in breaking the gasket seal, but it lifted right up. Carefully broke the stiction on the push-rods so they wouldn't lift the cam followers out of their sockets, which if they fell to one side would need removal of the tappet chest covers to rectify. I was taken aback by how heavy the head was - reaching across to the middle of the engine while trying to lift it off all the studs. Previous experience of heads has been on the V8 which are alloy hence lighter and angled towards the sides of the car hence a shorter reach. I wasn't sure if I would be able to lift the head back on, holding it up while trying to locate the studs in the holes.

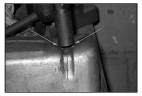


I said 'no horrors' but what was intriguing is that the flat parts of the head that are part of the combustion chamber were quite pitted on cylinders 1 and 2, and 2 even showed some erosion of the edges. By contrast 3 and 4 were perfectly clean and flat. I do run Bee on the verge of light pinking, although when faced with steeper hills on some runs she does tend to pink more. Maybe it's the effects of that and for whatever reason 1 and 2 are more prone than 3 and 4.



Waiting for the replacement head gasket kit (Payen) gave me time to clean everything up and investigate the valves. Nos.1 and 2 exhaust valves are white, but not 3 and 4, indicting the front carb was weaker than the rear carb, which could also contribute to pinking on those two cylinders. A little petrol poured into each combustion chamber shows 2 is leaking very slightly, as suspected. I remove all the valves to check the seats and lap them in, no obvious damage on No.2 exhaust, and quite easy to get a nice grey seat all the way round the valves. When removing them on No.1 the spring compressor pushed the spring retainer down easily to allow me to remove the collets, but most of the others were well stuck. When under tension from the spring compressor the spring retainer needed a sharp rap with a hammer to free them from the collets. An hour or so with coarse and fine grinding paste left them all with a nice, even, matt grey surface. Another test with petrol showed No.2 exhaust was fine, but a couple of the others had the tiniest weep. So removed the valves again, wiped the valve and seat sealing surfaces, replaced the valves, and gave them a twiddle with the lapping tool to fully seat them before refitting the spring retainers and collets. This time all were sealing perfectly.

I removed the thermostat housing and the new thermostat, to drill a 2mm hole in the outer part of the thermostat, to overcome the problem of this type of stat with no bleed hole trapping a vast amount of air under it until it gets hot enough to open - not good as it also means most of the engine has no coolant in it.



Bee has always been oily round the rocker cover, even though I have tried gluing the cork gasket into the cover, and using gasket seal onto the head. So some time was spent in cleaning the effects of that up from the rocker cover, head, carbs and such-like. I became aware some time ago that the cover had obviously been overtightened in the past, as the nuts were bottoming, and the sides had bulged out slightly. However the base where the gasket goes was flat and level, and even adding more packing under the fixing nut cups didn't keep it oil free. But when examining the cover closely I realised the holes in the top where the rubber seals fit, were bowed instead of flat. So the rubber seal rocked in them, and it was only sealing in the fore and aft position, and not at the sides - so that was where the oil had probably been coming from all these years, but wasn't visible until it had run down as far as the head. Pondered a while how to deal with that, and came up with squeezing the cover in a vice, with appropriately-sized sockets on both sides of the holes. First attempt at just clamping them up still left them slightly bowed, so I clamped them up again and rocked the cover top and bottom and side to side, which wiggled the holes nice and flat.

When the gasket kit arrived it included valve stem oil seals, which weren't on originally, so I left them out. Very carefully cleaned and smoothed the head and block surfaces. I tried to remove the studs but they seem stuck fast. Given the effort in lifting the head off, I pondered some kind of support along the engine bay I could rest my arms on while locating the head over the studs. I tried a couple of lengths of timber but nothing really suited, in the end I decided to lean my elbows on the heater casing and the rad diaphragm, and without the additional weight of the rocker shaft this time it wasn't too difficult. Torqued up the head bolts carefully (45-50 ft lb), refitted the push-rods and rocker shaft, torquing that up as well (25 ft lb). *November 2016: I wrote the preceding sentences, but they puzzle me. One of each of the rocker shaft pedestal bolts is also a head bolt, and there is no way you can torque up the head properly without the rocker pedestals - at least - fitted. I certainly didn't strip the rocker shaft, so must have torqued up the head with it fitted, even if I lifted the head on before fitting the shaft assembly.* Checked the torque several times over the next couple of hours, and twice I could add a little bit more, presumably as the gasket crushes into place.

The exhaust manifold lifted straight back on, but the carbs were a bit of a fiddle keeping both interconnecting shafts correctly located while lifting the carbs back onto the manifold studs, which needed a couple of goes, plus reattaching the cables. The carbs probably took half the time of the reassembly so far. Manifold nuts are torqued to 15-16 ft lb. I left the down-pipe to bell-housing strap disconnected for the time being.

I then had to leave it for a few days as I was away walking in the Lake District, and on my return adjusted the valve clearances. These have always been a bit of a pain, as some valves have their greatest clearance one side or the other of the strict 'rule of nine' point. The easiest way to adjust the valves is with the car on a flat and level surface. Put it in 4th, and with the plugs out you should be able to nudge the car forwards (and back) by pushing on the top of a front wheel. When you run out of space knock it out of gear, roll the car back to the starting point, put in back in 4th gear, and carry on.

Because I wanted to recheck the head bolt torque after a few hundred miles I didn't want to stick the rocker cover gasket down. The pressed steel cover is more convenient than the alloy, as it has retainers at each end and each side that hold the gasket in position while you fit it. From what I hear the alloy just has a flat base hence has to be glued to keep it in position, as between two flat surfaces (the head is flat) it would squirm out when tightened. Having corrected the bow of the holes in the top I was careful to torque these down as well - just 4 ft lb. Refitted the heater return pipe from heater to bottom hose.

Refitted the modified thermostat and cover with yet another new gasket, a smear of sealant on both sides, torquing down to 8 ft lb.

I'd removed the heater tap from the head before removing the head, so this went back on, with a smear of gasket sealant on both sides of the new gasket, remembering to put the support bracket for the temp gauge capillary on the lower stud.

Refitted the top hose - despite this being 'bellows' shaped it has to be slid onto the rad port as far as it can go before it can be fitted to the thermostat outlet, then slid back so that there is about an equal amount of each port covered.

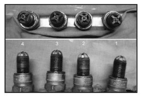
Refilled with the coolant saved from draining, and with the hole in the thermostat it took the whole amount. I spun the engine on the starter with the plugs out until I had oil pressure, then peered through the oil filler cap looking for oil around the rocker shaft. It takes a surprisingly long time for oil to get here, but appeared first in the cups of the push-rods, then from under the rockers on the shaft. Replaced the plugs and the plug leads.

Nothing for it now but to fire it up! Started straight off, and immediately peered over, under and round looking for problems like oil or water leaks. None found, so drove it out of the garage, turned it round and drove partially back in so that the exhaust was pointing out of the garage but any oil would land on the garage floor and not the drive! Warmed it up, and with the hole in the thermostat it was noticeable that the header tank on the rad started getting slightly warm - not surprising as now there is a small passage for coolant to flow all the time. Temp gauge rose steadily until about mid-way between C and N where it stopped - lower than before. Pressure gauge reading about 5 psi. I spent the next few minutes balancing the carbs for air-flow. Lifting them just off idle the rear carb was pulling very slightly less air, so I slackened the clamps - and spent the next half hour trying to get it back to as close as it was before! Checked the mixtures, but for some reason the change in idle when using the lifting pin is less than I remember - and these are HSs which previously I've found easier to use than HIFs. Settle for fastest idle, and refit the air-cleaners. Time for a tentative drive around the block. Accelerating up through first my heart sinks a bit when I notice the pressure rise, just as it did before ... but then when lifting off to change gear it dropped back again. Then I remembered someone saying many years ago that some engines can suck the bottom hose flat when they are revved. I was doubtful, but if it was true then the negative pressure on the suction side must be balanced by positive pressure on the outlet side. As the pressure gauge is on a Tee after the heater valve, I turned the valve off (it was open as per SOP for refilling with coolant), and Lo and Behold the pressure changes stopped. Back in the garage, very slight hissing and bubbling. The rad cap has always been difficult to remove, but is now really stiff, almost needing a smaller version of the eared wire-wheel spinner removal tool. So I clean round the rad neck - which feels sticky but the cap should be able to turn when the rubber seal and backing plate remain still, and smear it, the rubber seal, and the ears and locating slots on cap and rad neck with Vaseline. It certainly goes on much easier than before. That's enough for today.

Next day I remove the rad cap to check the coolant - easier than hithertofore - and add maybe half an inch. I've still got the catch bottle on the overflow so I can tell if I'm losing any that way. Time for a longer drive, from cold this time, which is when I got the oscillations and coolant loss. This time rises normally to mid-way between C and N, appears to stop, then gradually creeps up to the previous 'normal position' of this gauge of about an 'N's width below N. No oscillations - i.e. the same as on the V8 when I fixed that cooling problem. 20 miles of mixed driving - all seems well, 5psi on the pressure gauge unless stopped in traffic when it rises to about 8 or 9 with the temp gauge rising a bit, then drops again when back underway. No coolant in the catch bottle on my return, and no hissing or bubbling.

Subsequently a brisk 50-miler at speeds of 'Police 70', during which the pressure rises from it's otherwise rock-steady 5psi to about 8psi, together with a slight increase in temperature, again dropping back for more 'normal' speeds. Still no coolant in the catch bottle, or loss from the rad, or hissing or bubbling. More importantly perhaps no oil at all around the rocker cover! The big question now is, whether to risk Bee on a 4-day trip to North Devon in a week's time, and the thick end of 400 miles! I think I'll let the weather be the deciding factor.

In the event the forecast was good, so Bee it was. Some pretty challenging hills between Porlock and Lynton/Lynmouth - the steepest A-roads in the UK - but all was well. With the engine anyway, the release bearing started whining while we were away, so no doubt that will need attention at some time! On our return no coolant loss into the catch bottle, and just a tiniest amount of oil at the back of the head from the rocker gasket. Opinions are divided as to whether to recheck head nut torque or not, and when you do whether to back off a bit before retightening, or just to see if they can be tightened, i.e. three options at least! In the end I decided to recheck, but just to see if they could be tightened, not slacked off first. I was quite surprised to find that about four did move a fraction of a flat. Also rechecked the valve clearances, again a couple needed a tweak.



Part of that involves removing all the plugs, so I examined them for colour. They all look pretty good to me, perhaps the back pair are just a smidgen richer. I decided to weaken that carb a tad, and given that it's awkward to turn the HS nuts with the air cleaners on I made a box-spanner, which worked a treat.

December 2016:

A pal had similar pressurisation of the cooling system to Bee, but like Bee it had been evident for many years without causing any problems. Then he started to get a bit of coolant loss, and several tests culminating in a combustion leak detector in the radiator filler neck confirmed a leak, so head gasket replacement was called for. However he has a supercharger fitted, and after (not too much) pondering decided to have his head modified for the s/c by Peter Burgess as part of the job. Sent the head off, and almost immediately got a call back saying the head was scrap as it was cracked! I put him on to someone who could supply a bare head for just a tenner, which was delivered to Peter Burgess where it was tested, found to be OK, modified, and shipped back to my pal. However on refitting the rocker gear he suddenly realised this was the later head with the offset oil feed hole! See here for info on head types. Another call to Peter Burgess, and another wait for a compatible rocker pedestal to be sent back. After that refitting went OK, and the run-up in the garage to purge the coolant and check for any nasties, before the first test run. He doesn't know whether he had forgotten how fast it used to be over the several weeks the car was off the road, or whether the new head was that much better, but pronounced himself well impressed with the performance. He is planning on putting it on a rolling-road in the Spring, it's a pity he hadn't done it before to get a comparison and see how much he was getting for his several hundred pounds of modified head. As well as flowing the ports, the combustion chamber is also modified (as shown in the attached images). This does reduce the compression ratio slightly but hopefully is more than outweighed by the improved combustion.

Valve Leak:

Towards the end of 2017 Bee didn't seem to be pulling so well, and sounded a bit rough backing into the garage. Checking the carbs the rear was OK on the lifting pin but the front didn't give the usual response. Checking the plugs the front pair looked a bit weak, so enriched going for max idle when turning the nut, but the lifting pin still didn't do much. I'd deliberately left the Bosch 4-point plugs in well over 10k (40k!) just to see what happened, no mechanical wear, but decided the experiment had gone on long enough so fitted a new set of NGKs. Running noticeably better, some response from the front lifting-pin, but still not as good as the rear. Did a compression test, and No.2 was down - again, wet and dry. Did a compressed air test, and No.2 exhaust valve is leaking - again. So the head will have to come off - again, go away for testing, and if OK I'll have it converted to unleaded to take the old valves and seats out of the equation. If not, then a replacement head from somewhere. However, last time when torquing back up some of the studs weren't rising as I would have expected, and I wondered if some were on the point of failing. I'd tried to remove them using double-nuts - as much to make it easier to clean the block face as anything else, but couldn't shift the first few I tried, so gave up. I can't re-use them yet again, so will have to investigate more drastic ways of removal, which may end-up with some of them snapping off. If that happens, I'll have to try drilling and retapping, but that could well go wrong, meaning a replacement engine. So several things to research before I start.

- Heads 1: Peter Burgess is the obvious choice for testing, and conversion if sound, £282 plus ARP studs and sundries.
- Heads 2: If Bee's head no good one fairly well-known supplier has brand-new Ivor Searle heads of the correct casting available at £414 inc VAT, plus ARP studs and sundries, but see Engine 2.
- Engine 1: If replacing the studs goes wrong the same supplier has Ivor Searle engines on an exchange basis at £1550 inc VAT plus £420 surcharge, presumably if the old engine can't be reused. And logistically a bigger job to swap engines, meaning Vee will have to be outside in winter for a while.
- Engine 2: Studs ditto, a pal has a rebuilt engine available, only done 500 miles. £400, but will need some work, and the same logistical issues, plus those of getting the engine from Milton Keynes to Solihull.
- Stud removal: Several recommendations, including whacking the end of the stud first, Stilsons (not much room for wielding those in a forest of studs), and a Laser impact stud removal tool that cropped up more than once. Halfords have them for £21, and I have an air-gun, so that gets my vote. Also usable with a breaker bar, but when pulling hard it's going to be difficult not to apply a bending moment that may snap the stud.
- Replacement studs: Also several recommendations NOT to get standard studs from the usual suspects, as they are pretty useless, and to go for ARP instead. Probably talking about £160 instead of £30, but I can't afford the risk of problems refitting.

So one afternoon I start by slackening the bottom hose to rad clip, pushing a screwdriver up the gap, and letting it trickle down a large padded envelope to guide it into a bucket (rad cap removed) while I get on with things. I even spent time undoing the block drain plug (accessed with everything else round it still in-situ), which had wet gunge behind it but only let out a dribble for a couple of seconds. In the event not needed, as normal draining via the bottom hose had lowers the level to several inches below the block anyway. While down by the bottom of the rad I noticed the bottom of the front cover and that part of the sump are oily, so 'while I'm at it' a new front cover gasket and pulley seal. With the system drained it'll be easy to get the rad out and give me more space to work. With the cover off I'll also have to check the timing chain, gears and tensioner as I think the latter is getting slack and rattling a bit. But I'll only delve into that when I know I'm going to be keeping this engine. I also pondered fitting a drain tap to the bottom of the rad as I have a spare block tap. But as my method is easy and clean, and it's not something I plan on doing on a regular basis, I decided against it.

As it's been less than four years since everything came off last time it all came undone without any problems - air-cleaners, carbs, inlet manifold (left attached to the servo hose and servo), exhaust manifold on its pipes wedged away from the head studs with a block of wood without undoing any of the clamps, heater hoses and return pipe, heater tap left on its cable, temp gauge sender, plug leads but plugs left in case I need to crank it to break head-gasket stiction, rocker cover, and start slackening head nuts in sequence. A couple of the rear valves were open, and that end of the head started lifting straight away. With all the nuts off I removed the rocker shaft to lessen the weight - break the stiction to the push-rods as you go, removed the push-rods being careful to leave the cam followers behind and store them in order, and with a bit of wiggling lifted the head straight off. I was surprised the head and block surfaces were clean and the gasket not stuck at all. I was expecting it to be the same as the composite gaskets I last used on the Scimitar, and which are sometime used on the V8s, which bind to the surfaces and need a coolant-less running period to bond them. I did that last time, obviously needn't have bothered!


So, head off, studs sticking up. Fit the removal tool to the first long stud, hand-tighten, attach air-gun tighten-chatter-chatter-chatter ... and out it screws! Clamped tight onto the stud, so I took it over to the vice to get a Stilsons on the outer part to undo it, hardly a mark on the stud. I could have used the Stilsons to hold the outer part while I reversed the air-gun, but didn't think of that at the time. On to the next stud, and the next, and the next, and so on. Some needed quite a bit more chattering than others, but they all came out - phew! What's more it's taken less than 2 1/2 hours to get them all out from first starting to drain the coolant!!

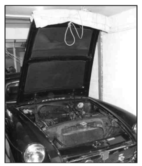
So next step is to discuss with Peter Burgess options for testing and modifying. He does standard unleaded at £282 inc VAT or Econotune (a bit more poke) at £432, but after pondering I decide on standard as I've never been into performance upgrades - having driven an F1 on track nothing else will ever come close. Booked a day to take it up, Peter checked it over and declared it sound, ditto the rocker gear, so will proceed with a standard unleaded conversion. In the meantime, I removed the front cover to replace the gasket and pulley oil seal, and investigate the timing gear and tensioner.

A warning: Ted Prouten writes on the MGOC forum:

> "COUNTY Cylinder Head
> "I have just sent my 12H4736LF COUNTY cylinder head to Peter Burgess for inspection
> "For those of you who like me were unaware.
> "This is a relatively new cylinder head casting which, because of the tiny ports and the combustion chamber roof which features the seats sunk 1 to 1.5 mm. means it is not suitable for anything but standard leadfree use."


Late Feb I collect the modified head ... painted a nice shiny black which I'll have to repaint for the Gold Seal engine. He's replaced the rocker shaft for me as it the old one is showing a bit of wear, and supplied a set of good head studs (When I replaced the head gasket I felt some of them were stretching, so wasn't going to use the same ones again). Then we get the snow on top of the below zero temps, so I don't even get it out of the car for a few days until it starts to warm up a bit.

Investigating gold paint at Halfords most seemed to be too coppery compared to the rocker cover I took with me, and settled for a Frord colour as that seemed closest. But when spraying the rocker cover, which was already gold, it was nothing like the colour band on the tin! Realising I could go through two or three tins trying to get a match, it occurred to me (belatedly!) to check the usual suspects. Only Moss has it ... at £17 per can ... gulp, and £10 delivery ... double-gulp! But along the way I decided to replace the manky heat shield as well, which lessened the pain somewhat. Waiting for that I cleaned up the block face, and checked the replacement studs would go into the block as far as the end of the threads. I also masked off the valve area and thermostat housing, plug holes, heater tap location, and manifold face, so was ready to paint by the time it turned up. Impatient as ever, annoyingly the second coat started to go like a crackle finish. I thought it was reacting with the black and it was going back to bare metal, but it was only the second coat. So I left that to dry right off before giving it some more light coats, which has covered it up fairly well. It'll have to do. In the meantime I did the rocker cover again, but I'm not sure it's a terribly good match, its more like a browny-buff colour than gold.


I wake up on the morning I'm planning to refit the head ... and suddenly realised there are no manifold studs! As they didn't come out easily with double nuts I left them in, but Peter obviously had to remove them to do his stuff. I can't believe I didn't notice it especially when prepping the head for paint when I masked off the ports in one straight strip as there were no studs in the way! More P&P. But despite that the head can go back on - Payen gasket again, and the alternator-side ancillaries, thermostat, housing, cooling and heater hoses. When the studs arrived I was annoyed to discover that after checking manuals and web sites carefully for how many of each length were required I seem to have got them the wrong way round on the order! Should be four long (FHS2515) and two short (FHS2313). Still, the four short ones are just long enough for the long brass nuts. The longer ones are a bit too long for the outer pair in that the plain shank extends just past the face of the flange, but with some thick water pump bolt spacers left over from Vee's engine rebuild plus lock-washers they are fine. Why I didn't think to use the two long in the middle so releasing two of the shorts for the outers I don't know.

With the head on and torqued up I did a quick check/adjust of the rocker clearances to make sure the valves were closing fully - just enough to have a bit of free play. I then did a compression test to check everything was OK before going further - and was taken aback to discover how low and variable they were: 104 136 110 132. But thinking about it if any of the gaps were small especially the inlet it would impact on compression by closing even later in the compression stroke. So I did the gaps again this time setting them correctly at the Rule-Of-Nine point. Compression now noticeably better and even at 125 135 122 150, but as I know I have a 'funny' cam I did them again looking for the point of maximum gap and adjusting there. Another improvement - 138, 150, 124 145, although the one that was highest before was now slightly lower, probably a factor of the gap now being slightly lower at the start/finish of the lobe. All these were done cold of course.


So then it was a case of plodding through the fittings i.e. temp sender, heater valve, heater hoses, manifolds, heat-shield and spacers, carbs and their plumbing and cables. Then a dry run (no coolant) just to check oil was getting to the rockers. Then fit the rocker cover, fill with coolant, and run up to temperature. Looking all round, over and under and all looks good. But peeing down so a road test will have to wait for another day. A couple of days later dry enough for a short run, then next day a longer one of over an hour and all looks well so far. Did a hot compression test - dry was 157 157 152 162 and wet 170 170 156 165. 1 & 2 good showing a good rise, less so 3 and 4 when the dry figures are pretty close. However Willy Revit points out that even on the HC pistons there is a small dish so you have to be sure to squirt the oil at the bore with a can rather than just dribbling it in to lie in the middle.

Valves

Originally valves were used with double-springs, a shroud to locate the inner spring, and a spring-clip round the top of the collets but in 1969 part-way through 18GD production (Clausager) or the start of the 18V (Parts Catalogue) single springs were used with no shroud or spring-clip. The cap, collets and 'packing-ring' (oil seal) are shown as being the same throughout production.


Double-spring valves have a recess the length of the collet and from drawings the packing-ring sits at the bottom of that. Single-spring valves only have a narrow groove for a projection at the top of the collets, so the packing ring is on a larger diameter part of the stem than previously. Other than that the valves remained the same except for 1972 to the start of rubber bumpers when a larger diameter inlet was used. Double-spring valves are 12H435 inlet and 12H436 exhaust, single spring valves are 12H4211 small inlet, 12H2520 large inlet and CAM1717 exhaust.

Valve Stem Oil Seals *June 2023*

One of those areas that seems to generate a lot of different opinions, a lot of which can be boiled down to things like partial knowledge, incorrect assumptions, guesswork and downright scaremongering.

I've had an email from someone who wrote:

> "Never have I seen so much debate in forums for the valve stem oil seal lubrication issue. I understand that the exhaust valve requires lubrication to help transfer the heat from the stem to the guide.
>
> "In the case of the inlet valve stem do they also require an oil film for normal operation? I see people fitting additional top hat seals on the guides to reduce oil being sucked down by the inlet vacuum pressure over time. Would this reduction in oil flow not cause additional guide wear? Also the seals sold by the usual vendors look really poor quality as compared to Viton Seals used in the USA. I believe there is an Elring seal which will fit.
>
> "I am also confused as to how the lead in original leaded fuel acted as a guide lubricant.
>
> "I am just about to put the head back together. Should I lubricate all of the valve stems or just the exhaust or assemble it dry? The Leyland workshop manual does not mention lubrication during assembly."

I'm no expert on the subject but I will say that I don't see how leaded fuel had any effect on valve **stems**, it was the seats that the lead protected by cushioning the impact as the valves closed. The rest is based on my thoughts from a common-sense point of view.

When people say the MGB needs something that the factory never provided the first thing I say is "What problem is it solving?". Valve stem/guide wear and high oil consumption/smoking from it can't really be an issue or our cars would be trailing clouds of smoke, never mind the millions of other BL models that used A and B-series from way back before the MGB. They rarely do based on my experience of more than 30 years of running with groups of other MGB owners never mind my own rear-view mirror. Having said that all engines wear over time, valve stems and guides are no different to anything else that moves in the engine, and when they **are** worn you will get puffs of smoke after running downhill with the throttle closed then opening it, or idling for a period then blipping the throttle, or simply changing gear and reopening the throttle in more severe cases.

The WSM calls the O-rings 'packing rings' not 'oil seals' as suppliers do. The WSM does say that when reassembling a head "new packing rings should be used or oil sealing may suffer" and head gasket kits do seem to include them. Looking at the drawings the packing ring would need to be sandwiched between the bottom of the collets and the top of the cap to do any good, such that in general oil from the rockers runs off the cap and down the coils of the spring instead of running down the stem to the guide. Given the contact surface area between stem and guide and the small clearance I don't think the oil does much to aid cooling, but of course it will reduce wear from sliding friction so some must be needed, and sucked down from above. There has to be some clearance - I understand some early unleaded conversions had problems because they didn't allow enough for the materials being used and how they reacted to heat and you could get sticking valves. As said above it's the depression in the cylinder as the piston goes down drawing in mixture that will suck oil down, and the top of the head should be swimming in it. There will always be people that swear by alternatives, and in my opinion whilst the top-hat type may well reduce oil consumption with worn stems and guides, by keeping oil away from the top of unworn guides they may well be accelerating wear.

It's always been said that some upper cylinder lubrication is a good thing, which is why in days of yore people used a shot of Redex with each gallon of fuel purchased. It's also been said that lower piston rings should not be too effective at scraping the oil off the cylinder walls as the top ring won't get any and will wear more quickly, and the bore.

I wouldn't use anything other than the standard packing ring (WSM advises soaking it in oil before use). I would put some oil on all the valve stems prior to fitting to act as initial lubrication, it makes sense as with any other part moving against something else, and it can take some time for oil to get all the way through the rocker gear. As said the WSM makes no mention of oiling them, but then it doesn't say anything about lubricating the big-ends and mains on assembly either.

Valve Clearances

'Rule of Nine'
'Rocking', or 'On the rock' method

January 23:

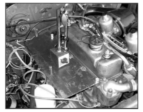
My WSM gives the clearances for early engines as .015 cold. Part way through that changes to .015 cold .013 hot, then goes back to .015 cold so effectively all the same. But for 18V846/847 ECE15 it says .013 cold and .015 hot which is obviously an error, and for 18V847 ECE15 1976 on just says .013 cold. If it wasn't for the 846/847 it would look like it had been reduced for later engines, but I suspect ECE15 1976 is also an error. Leyland Repair Manual AKM4070 for 1978 states .013 'warm' so the earlier manuals are definitely in error. My Haynes has .015 cold .013 hot except for 18V797/798 where it says '.013 warm', so basically consistent depending on one's interpretation of 'warm'.

These are best adjusted cold for consistency (even though you might be tempted to adjust hot in the winter for comfort's sake!) to .015" for both intake and exhaust on all 4-cylinder engines. If you **do** decide to adjust hot it is .013", but bear in mind the engine will be cooling all the time you are doing it. Adjusting them with the engine running is very slap-dash and can damage the feelers. One potential problem using feeler gauges is that the valve stem that contacts the rocker is much narrower than the rocker pad, which are narrower than the steel shim feeler gauges. On older engines the valve stem can wear a shallow groove in the rocker pad, the steel shim feeler gauges bridge this, so you end up with a gap that is .015" **plus** the amount of wear in the rocker pad which will lead to reduced valve opening and noisy tappets. One way to eliminate this is to use wire feeler gauges if you can get them, another is to use the Gunson's ClikAdjust (prices vary!), but see these opinions which seem to fall on the side of "it isn't worth it" (I've never used one, did try a Colortune many years ago but found it much more difficult to judge mixture than with the lifting pins, have got an EeziBleed which is useful for a full fluid change but not good enough for bleeding a system after work - either brake or clutch, and have got a GasTester which seemed OK to begin with but has now gone way out of calibration range and the reading varies wildly with slight changes in orientation, and did have a digital MultiTester (?) which was fine but packed up after a few years use (but then so did a Draper and much sooner)).

For many years getting consistent results on my 4-cylinder roadster had seemed impossible - I would adjust them all using the 'Rule of Nine' then go through them again to recheck and some of them would be incorrect. So I

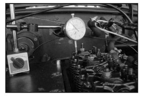
would adjust them again, rotate again, and they would be out again! It took me some years to realise that at the strict 'Rule-of-Nine' (RON) point some of the gaps were still changing. And unless I stopped the crank at the exact same point for each valve each time they could vary significantly between tests. So instead of using the strict RON point I just used it as a starting point, and looked for the point of greatest gap on each valve either side of that. On valves 6 and 8 this proved to be significantly **after** RON and on valve 7 significantly before. What this says about my cam and cam bearings I am not sure, but the tappets are noticeably quieter, and 5000 miles on the gaps are still the same indicating that I am not getting recession or burning.

March 2017



When a pal got a dial gauge and a magnetic base, I decided to see what that showed as far as the clearances varying as the engine was turned over. I had a chunk of 1/10" steel plate that was as long as the head and several inches wide, and drilled five holes in one long edge to fit over the exposed head studs and nuts on the alternator side of the engine. Note that the middle three studs are spaced back a little compared to the other two. Even with the thickness of this plate there were enough head stud threads showing to get additional nuts on, and hold the plate firmly.

With the rocker cover removed and the magnetic base arms articulated to press the dial gauge plunger down onto the valve-end of a rocker, I was ready to go. I know the rear three valves are the odd ones, the front ones less so, so concentrated on those. The crank pulley nut is only really accessible from under the car, but I don't fancy continually getting up and down for each small movement of the engine. Normally I put the gearbox into 4th, then by pushing the top of the off-side tyre backwards or forwards I can nudge the engine round. But with the V8 dismantled and many parts in the garage, behind Bee, and the full-length ramps positioned half-way down the garage, Bee's rear wheels are only just on the ramps. To use the tyre nudge method Bee would have to be outside, but with the changeable weather at the moment I didn't want to be caught having to drive her back into the garage and get the rear wheels up on the ramps with the rocker cover off. Plugs out, I can easily turn the engine backwards by pressing down on the fan belt between water pump and alternator, but can't turn it forwards. However a spanner on the alternator pulley nut will turn the engine forwards ... but not backwards! So have to keep switching between the two methods when comparing clearances with only small movements of the engine.

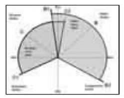


It's quite fiddly, turning the engine bit by bit, pressing the rocker down onto the push-rod each time, taking pictures, and making notes - easy to get confused as to what goes with what. It would be much easier with two, but there we are. It would also be easier if I could rig something up like a strong spring or heavy weight that would continually press down on the push-rod end of the rocker as it went up and down, that's a future 'enhancement'. The upshot is that the dial gauge confirms that the clearance is greater several engine degrees away from the strict rule-of-nine point, but even more interesting is that it suddenly gets a couple of thou greater still immediately before it starts going down. So maybe I need to check in a lot more places between just fully up and just starting to go down, and not simply a little way either side of the rule-of-nine point. However I would need to be sure that didn't mean the gap closed up during the expansion and exhaust phases, which could burn the valves and seats.

Update January 2011:

Whilst researching valve timing I came across a John Twist video on adjusting valve clearances where he states that the partner valve doesn't have to be fully open, any position where it is partially open should be OK because the partner lobe is always diametrically opposite the one being adjusted. This turns out to be the 'rocking' method, but he didn't say that, and I hadn't seen any use of the term 'rocking' which explained that it was when the partner valve was partially open! This may be the case for cams that have a consistent base circle i.e. back of the lobe, but as I (and others) have found that can't be guaranteed. So finding the position of largest gap while the partner valve is open remains the way to go.

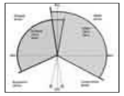
'Rule of Nine' method



The Rule of Nine simply provides a clear visual pointer from another valve to adjust its partner valve without knowing what angle the crankshaft or camshaft are at. For example adjusting 1 when 8 is fully down (which is the usual way this method is described), 6 when 3 is fully down, and so on. Each of these partners is the same type of valve i.e. both 1 and 9 are exhausts, and both 3 and 6 are inlets. They are always on the partner cylinder, so all the Rule of Nine is doing is picking an adjustment point for each valve in turn when its partner valve is fully down or 'rocked', it's just a different arbitrary point on the back of the cam to the other method. In fact anywhere the partner valve has opened the valve would be a suitable point, so perhaps the definition of Rule Of Nine should be 'anywhere the partner valve is down', instead of 'when the partner valve is fully down'. Also as you turn the engine if you look for **any** valve going down and adjust its partner, rather than trying to work through the engine from front to back sequentially, it will still only take two full turns of the crank.

But in theory a valve can be adjusted anywhere on the back of the lobe, and for a portion more either side of that, as each lobe on the standard cam has a duration of 252 crankshaft degrees. This is 126 camshaft degrees which leaves nearly 234 degrees of camshaft rotation, or 117 degrees of crankshaft rotation, where a particular valve could be adjusted. Both valves are fully closed for 253 crankshaft degrees, so you can adjust both of them at the same time with the crank **anywhere** from 51 degrees before bottom dead centre to 56 degrees after bottom dead centre, with an allowance each side for the valve to be fully off the slope of the lobe and hence the clearance at its maximum. And this leads on to the 'rocking' method.

'Rocking', or 'On the rock' method: *March 2020*
I've seen references to this method for a long time - usually from Americans, never explaining what it was, and I'd never bothered to find out. Then someone wrote to me suggesting this method would address the 'largest gap' problem, but it doesn't.



'Rocking' refers to the rockers, but it doesn't mean when they are able to 'rock' back and fore through the valve clearance, quite the opposite. It means when they are depressing a valve so NOT rocking! You turn the engine until both valves on a particular cylinder are partially open, which puts that piston close to TDC on its **exhaust** stroke, where its inlet valve has just opened while at the same time its exhaust valve hasn't yet closed. On a 4-cylinder 4-stroke engine there will be another piston - the partner piston - at the top of its **compression** stroke, which will have both valves fully closed and so can be adjusted. On the MGB cylinders 1 and 4 are partners, and cylinders 2 and 3. So with both valves partly open on, say, cylinder 1, you can adjust both valves on cylinder 4, and so on i.e. Rule of Five!

So on the face of it this is easier as you can adjust two valves at a time, with only four movements of the engine through two full turns of the crank, instead of one valve at a time and hence a lot more movements. That is true, but both valves are only partially open for 37 degrees of crank movement, so when turning the engine to find this point one has to look for when two valves on one cylinder are partially open - one having just started to open and the other just short of closing - and stop within that band. If you have the plugs out to make turning the engine easier then just look in the plug holes for two pistons at the top and adjust the one with its rockers clear of the valves.

December 2021 And because of the way the valves work at bottom dead-centre you can adjust two more valves at that point making four altogether in one go, only needing one full turn between adjustment points.

If you have a straightforward cam where the clearances are constant throughout the back of each lobe then all three methods will give exactly the same results. But if you have a 'funny' cam where the clearances are changing when in theory they shouldn't be, then none of them will find the point of maximum gap except by coincidence. For example only one of mine is at the strict i.e. fully down Rule of Nine point, so I spent some time going through each of mine with a dial gauge looking for the point of greatest gap, noted where other valves were at that point as a reference, and now I can go straight to that point for routine checking using this chart. Since doing that they are consistent, needing no adjustment from one years end to the next, and in 2023 checking them for the first time in probably four years and they only needed closing up by a tiny amount.

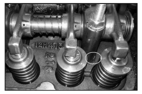
Rockers *December 2017*

Rocker oil-feed: *December 2021:* The oil feed for the rockers comes up through the rear-most pedestal, and an important thing to note is that the oil feed hole changed position in both the head and the pedestal on rubber bumper cars.

Rocker-valve alignment: Andrew Robinson emailed to ask my opinion on his rocker to valve alignment, as No.2 seemed particularly out and the rocker pad didn't fully cover the end of the valve stem. He was concerned that this was resulting in unbalanced forces which would cause rapid wear at various places in the valve train. The engine has only done 2k since a professional rebuild and wanted to avoid such wear if at all possible.

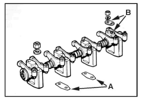
Googling this seems to be a not uncommon problem, especially with replacement pedestals. Several said theirs was the same and hadn't caused a problem, and one suggestion was to remove the rocker assembly and machine the pedestals one side and shim the other to get the rockers exactly in line with the valves. But this is quite a big job,

and would need all the head nuts to be slackened in the usual order as if one were removing the head, and probably to remove the head and replace the gasket.

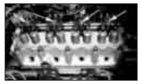


Looking at his picture there was a sliver of machined head visible in front of the pedestal, but not behind, and the nuts and washers also seemed to be more to the forward face that the rear, as if the holes in the pedestal were larger than they needed to be giving some scope for fore and aft positioning of the pedestal on the head. I suggested that he could slacken the rocker cover stud nut first, then the head nut at the rear of the pedestal, then he might be able to quickly move the pedestal forwards a bit and retighten the head nut without compromising the head or gasket. He did, and got just enough movement for the rocker pad to completely cover the valve stem. Still offset to some extent, but the rocker web does now seem to be in line with the stem, so the forces should be balanced even if the positioning isn't exact.

Subsequently it occurred to me that if one were to slacken all the adjusters right off, and remove the split-pin at one end of the shaft, one might be able to push the shaft back (or forwards depending on which rockers needed adjustment), catching all the bits and keeping them in order for reassembly, to remove No.2 rocker and machine the appropriate amount off the front face to bring it fully into line. His No.1 rockers also seems a bit off, but not as much as No.2, and that could be shimmed on its rear face.



Later engines have a shim under each of the middle two pedestals to move their shaft holes fractionally out of line with the outer two. This means that when all are bolted down the shaft is gripped firmly and prevents the shaft from fidgeting in the pedestals and causing wear there, and noise. That deliberate misalignment may be enough to prevent you sliding the shaft out of the rockers while the pedestals are bolted down - or back in once out, as suggested above. There is no date for the provision of the pedestal shims (12H 3960, 2 off), the Parts Catalogue lists them for five-main engines but not for three-main, and the WSM has section A.32 'Rocker Assembly (Later engines)' that states they should be fitted to early engines on reassembly. However some with later engines say theirs doesn't have them, so they may well have been lost on reassembly. There is also some debate about what they are for and even whether they are needed at all. So as well as people wanting to provide things the factory didn't e.g. valve stem seals they also say things the factory did provide are not needed.



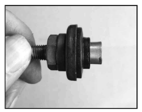
Note that of the two studs in each rocker pedestal the ones nearest the valves - two of which are used to secure the rocker cover - can have the nuts removed (perhaps for stud replacement) without affecting the head gasket. But the four between the pushrods, together with the other round the head outside the rocker cover, should only be slackened and retightened using the correct sequence.

Running out of adjustment? *June 2022*

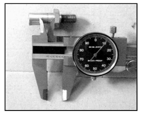
Jonathan Bawden posted on the MGOC forum that he seemed to be running out of adjustment on one of his rockers, which could indicate all sorts of problems. However John Pinna spotted that they were two different rockers!

Rocker Cover *Added September 2007:*

Lots of discussion on rocker cover oil leaks in the various fora. One frequent observation is that if the original covers are overtightened, then they will distort and leak, and further tightening makes them leak even more. Fair enough, but the later 18GD etc. and 18V engines have a different rocker cover nut which is much deeper than it needs to be which seems as if it was originally intended to prevent over-tightening, by tightening down onto the top of the rocker pedestal nut. However with the correct cork gasket and rubber grommet (between cup washer and top of the rocker cover, 12A1358) the bottom of the special nut is well clear of the pedestal stud nut so overtightening can still occur.



The later rocker cover nuts, as well as having the stud on top of the nut for the heater return pipe, has a deeper cylindrical portion below the hexagonal section. This passes through a 1/8" spacer, cup washer, rubber grommet 12A1358 and rocker cover onto the long rocker pedestal studs. The grommet performs two functions - it seals the fixing holes in the cover to prevent leaks, and also applies pressure to the cover and from there to the cover gasket and head. Old grommets compress and harden with age and so reduce the pressure applied to the cover gasket. Old cork gaskets similarly compress, and can rarely be reused successfully once disturbed, even if it was oil-tight before.

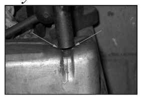


On my engine once the cover nut has taken up all the free play between it and the top of the spacer, it can only be tightened one more turn before the bottom of the cover nut contacts the top of the rocker gear nut. This is with new rubber washers and new cork gaskets. Even gluing the cork gasket into the cover, and using Hermetite Red as the seal to the head, I still get weeping from the rear of the cover. Although this results in only an occasional drop of oil on the floor I still don't like it, and I have had to put 2 or 3 thicknesses of gasket card between the cup washers and rubber washers to get a seal.

In discussions some have avowed that this is because it has been overtightened in the past and buckled the cover, the cover nuts should never contact the rocker gear nuts. But my cover is perfectly square and symmetrical. One poster stated that, with the exception of the oil filler, you should be able to lay a straight-edge across the top of the cover and have no gaps. Now straight away this is incorrect as the cup and rubber washers sit in recesses, that extend as grooves down the side of the cover. I can't for the life of me see why the cylindrical portion of the cover nut should be made so much deeper than the cup and rubber washers, unless it was **designed** to bolt down to the rocker gear nut and so **prevent** overtightening. I've no experience of the 3-bearing and 18GD engines but they have a different rocker cover nut which doesn't seem so deep and with those I **can** imagine they could be tightened so much they distort the cover. I also don't see how on the one hand overtightening the nuts overcomes the natural springiness of the pressed steel cover enough to cause distortion, but in my case at least adding more packing to apply more pressure stops the leaks. The only way the cover could have been distorted so much that there is now only one turn of the nut available before it 'bottoms' is if a lot of extra packing i.e. several thick washers had been fitted in the past. But there weren't any when I got the car, it didn't start leaking until I replaced the rubber washers and cork gasket, and the old ones weren't bonded. But then I only have a sample of one.

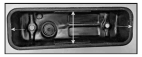
The upshot is that for the moment I'm leaving things as they are. I'm not going to try and 'uncrush' the cover as that almost certainly **will** distort the cover beyond sealing, and at the moment nipping the nuts down as far as they will go gives me a decent seal without any further risk of overtightening and distortion. I'd still be interested to see how much the stud does or doesn't protrude on other engines, though, and get the measurement from the face of the flange the cork gasket sits against to the recess the rubber washer sits in.

July 2014:



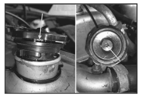
I've just had to replace the head gasket, and whilst cleaning the rocker cover I suddenly realised the holes in the top where the rubber seals fit were bowed instead of flat. So the rubber seal rocked in them, and it was only sealing in the fore and aft position, and not at the sides. So that was where the oil had probably been coming from all these years, but wasn't visible until it had run down as far as the head. Pondered a while how to deal with that, and came up with squeezing the cover in a vice, with appropriately-sized sockets on both sides of the holes. First attempt at just clamping them up still left them slightly bowed, so I clamped them up again and rocked the cover top and bottom and side to side, which wiggled the holes nice and flat.

Gasket:



Cork is the standard material, in May 2024 one owner said the one received from the MGOC was too big and a chunk would have to be cut out of a corner to get it all in on his standard cover, which has tabs on each side and each end to position the gasket correctly. The supplier claimed they had not received any other complaints. Silicone rubber are available from various sources, but at several times the price of cork.

Oil Filler Cap: *January 2022* 18G engines had a metal oil filler cap that was not ventilated.



On 18GA and later engines positive crankcase ventilation was used with a plastic oil filler cap that was ventilated and filtered on RHD cars for the remainder of production, and LHD cars up to 1970. From 1970 North American cars, and from 1977 all LHD, had an evaporative loss control system that used a plastic non-vented oil filler cap. V8s always had a sealed oil filler cap. For more information see Crankcase Breathing.

July 2024: Not sure if it had been like it a while or I had been ham-fisted refitting it after an oil and filter change but one of the tabs that should go under a peg in the rocker cover neck had been pushed up so the cap wasn't pulled down onto the rubber seal both sides. Rather than try and straighten out plastic I splashed out £3 on a new cap! However once correctly located it was a beggar to turn fully, the next removal and refit was slightly easier, but nowhere near as easy as the previous cap that I had previously replaced in 2006 as the one that came with the car was warped and hadn't been sealing properly and led to oil escaping slightly.

Alloy Rocker Cover: *January 2022* Alloy rocker covers are quite popular - for 'bling' mainly, they are claimed to reduce tappet noise but others claim they don't - and probably will have a shiny oil filler cap. These may or may not be ventilated - with a visible hole on the top, but they may also be unventilated, or ventilated with a concealed

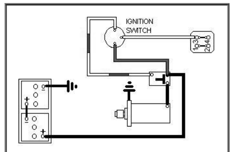
hole. Some of these with a visible hole are advertised as for 62 to 64 cars i.e. the 18G engine but would not be 'correct' although probably won't do any harm. Shiny caps probably don't have a filter as they are much closer to the cover than ventilated and filtered, which may not be ideal with the later positive crankcase ventilation systems that are pulling air through the cap all the time. Alloy rocker covers do not seem to have the gasket retainers that the pressed metal do which means the gasket has to be glued to the cover to ensure it stays in place as the cover is fitted, needing to be scraped off when the gasket is replaced.

With alloy covers the gaskets (either type) normally have to be glued in position as there are no location tabs. In theory alloy covers won't distort as easily as steel so - without going mad - it should be possible to tighten those covers down onto a cork gasket and get a good seal all the way round. But some say theirs still leaks.

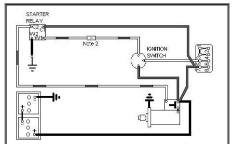
Starters

Help! My starter is cranking all the time! On 76 and later models this can be caused by the 'brake test' diode having gone short-circuit. On all models it can also be caused by failure of the ignition switch, a sticking starter relay (1970-on), sticking solenoid, or chafed wiring.

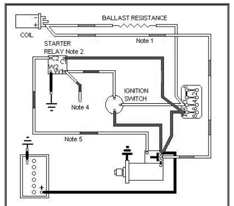
Schematics Note: Automatic cars have the White/Red wired via the combined reverse light switch and automatic transmission safety switch on the gearbox. While the automatic gearbox was an option, **all** MK2 CB cars had a bullet connector in the white/red starter wire to the solenoid (68 and 69 models) or starter relay relay (70 and later) in the tail leading down to the starter.



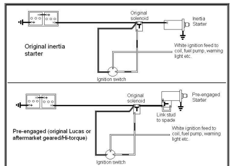
Inertia Starter (remote solenoid to 67)



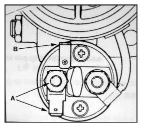
Pre-engaged starter (attached solenoid) 12v Coil (chrome bumper 68-74, not V8)



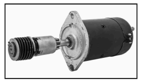
Pre-engaged starter (attached solenoid) 6v Coil (rubber bumper and all V8s)


Pre-engaged Starter Replaces Inertia

Model Variations:



An M418G inertia starter 13H4561 and a remote solenoid on the inner wing was fitted to MkI cars. MkII and later had a 2M100 pre-engaged starter with attached solenoid 13H6130. Originally the ignition switch operated the solenoid directly on both types, but probably because of the higher current requirement of the pre-engaged starter a starter relay was eventually (1970 models) fitted which has the effect of reducing the load on the switch and its connections. 18V engines had the later 2M100 starter 13H7844. The solenoid on this starter has a 'boost' contact for ballasted ignition systems to aid starting (it connects full battery voltage to the 6v coil) but this wasn't used on 4-cylinder CB cars, only RB. All V8s had the 2M100 starter with the coil boost system - albeit to a different part number BHA5223. V8s also have an additional connection under the right-hand toe-board where the battery cable joins a short tail from the starter.



December 2023: The inertia starter is significantly longer and heavier than the later pre-engaged starter, even more so than the modern replacements which are also 1/3rd the price of a rebuilt exchange original. Simon Sjenitzer needed to remove his and was having trouble getting it out, asked on the forum how it should be done but didn't get any useful response. The Workshop Manual makes no reference to it as they advise removing the engine and gearbox together. Haynes does cover removing engine only and says "... Undo the two bolts which hold the starter motor in place. It will not be possible to remove the starter **until the engine has been drawn forwards a few inches** *my emphasis*, unless the distributor is removed. They say 'all models', but show a circular gear lever gaiter so that must be a 4-synch with the pre-engaged starter, and I removed mine just by removing the distributor i.e. without pulling the engine forwards. Not having done an inertia starter (on an MGB, I have on a Mini) I did advise that once he did get it off to replace it with a modern - smaller and lighter - type even if

there was nothing actually wrong with the starter. He had to puzzle it out for himself and came back with (paraphrased) the following:

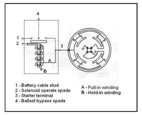
> "The only way to remove the original inertia jobbie is to (1) remove the distributor, (2) remove alternator (to be able to get at the off-side engine mount), (3) disconnect the engine mounts. Then lift the engine just enough to allow the old unit to be taken out. What a palaver!!!"

He did replace it with a modern type.

The 1977 LHD Workshop Manual AKM3524 gives the 'lock torque' current (stalled?) as 463 amps, the current at 1000rpm (cranking?) as 300 amps, and the 'light running' (spinning not cranking?) as 40 amps.

Clausager and the Parts Catalogue say that a rubber boot BHH790 was fitted over the 4-cylinder (but not V8) starter, solenoid and connections from chassis number 284721-on in May 72. It is no longer shown in the 77 and later catalogue, but some say their 77 and later models have it. It's said to be a right pain to remove and refit, my 73 hasn't had one in my 30-year ownership and hasn't suffered as a result.

Pre-engaged solenoid: *August 2013*



The Workshop Manual including early models makes no mention of it but the pre-engaged solenoid has two windings - a pull-in of 0.25 to 0.27 ohms as well as a hold-in of 0.76 to 0.8 ohms. Current flows through both windings in parallel initially - the hold-in direct to earth and the pull-in in series with the motor to earth. This additional current turns the motor as the solenoid is moving the pinion towards the flywheel which aids engagement with the flywheel. As soon as the solenoid has moved far enough a copper bar bridges two large contacts and that connects full battery power to the motor for cranking. That effectively short-circuits the pull-in winding i.e. connects battery voltage to both sides, so pull-in current no longer flows, only hold-in current.

Haynes lists both windings in the sectioned drawing of the pre-engaged M418G starter, but doesn't mention it for the later 2M100 for 18V engines, however it will be the same. This results in an initial current of about 30 amps when power is first applied to the solenoid, dropping to about 10 amps when it has operated. In fact it is closer to 8 amps once the cranking load has been applied to the battery when its voltage has fallen to the normal cranking level of about 10v. Brian Shaw reported that the solenoid plunger didn't move when he applied 12v to the larger operate spade and earth to the starter body, even though he could see it was sparking, and he measured 11 amps on it. It was only when he connected 12v to the battery cable stud as well as the operate spade that the solenoid operated (and the motor spun). Bob Davis pointed out these two windings and posted a Bosch circuit diagram of a typical starter and ignition system, click the thumbnail for a simplified diagram of the solenoid and motor and an explanation how the system works. However that doesn't explain Brian Shaw's problem. Regardless of whether 12v is connected to the battery cable stud or not, current will still flow from the solenoid operate spade to the starter body through both hold-in winding **and** the pull-in winding and the motor - as long as the solenoid is connected to the motor. By not having 12v on the battery cable stud the opposite problem occurs, i.e. the pull-in current isn't reduced to the hold-in value when the solenoid operates, so it could overheat. Brian's problem is more an indication that insufficient current was flowing to pull the solenoid in. The solenoid only operating when 12v was applied to the battery cable stud as well is not logical as until the solenoid operates the battery cable stud isn't connected to anything.

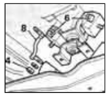
Fixing bolts: *August 2016*

Incidentally the two starter bolts are different on engines attached to 4-synch gearboxes. The upper one goes through the engine back-plate and into the bell-housing, so is longer. The lower goes into the back-plate only so is shorter. If a long bolt is fitted here it can foul the flywheel. However there is confusion over the thread type. The Parts Catalogue indicates they are both UNC thread; Brown & Gammons indicates they are both UNF; Moss Europe indicates the longer upper is UNC and the shorter lower is UNF. Moss makes the most sense - bolts that go into alloy castings are usually UNC, and those that go into steel are UNF.

Earth Straps: *January 2020*

Earth straps should be braided to cope with engine/gearbox movement, stranded cable (as used at the battery) will eventually fracture if used at the engine or gearbox.

Chrome bumper cars have the earth strap round the right-hand (as you look into the engine compartment from the front) engine mount with one end under an engine front-plate nut (one of two) and the other under a chassis bracket nut.



Rubber bumper cars have it at the gearbox end as the engine mounting arrangement is completely different. One end under a bolt through the rubber mount plate into the gearbox casting, and the other end under the nut that secures the mount stud to the crossmember, and as such much less accessible.

Very late models got a new engine earth strap from the heater shelf to the engine back-plate, it would be easy to add that to any RB and forget about the inaccessible gearbox strap.

See below for how to check the condition of battery and earth connections. A bad engine/gearbox strap can result in smoking/damaged accelerator, heater and choke cables as well as slow cranking and difficult starting, and I have heard of one case where a braided clutch hose (why?) burst.

Mechanical Problems:

The original inertia starter relies on the pinion being 'thrown' into engagement with the flywheel as the motor starts to spin, and it can stick and fail to engage, also only just engage where it can 'jump out' again just as it starts to take the load of the engine, resulting in a whining motor and no cranking. The books say the spiral gear and fine spring should be scrupulously clean and not oiled, but in my experience this causes them to stick as much as over-oiling. Just a drop of light oil on the spiral gear, distributed by working the gear, and any excess wiped off, seems best. The pinion can also jam in mesh with the flywheel after a failed start, and this can prevent any further cranking. This can usually be cleared by putting the car into 4th gear (not 1st!) and rocking it back and fore until it 'clonks' out of engagement. Sometimes the motor has a square shaft sticking out of the back-plate and this can be turned with a spanner to 'wind it out of engagement' and clear the jam.

By contrast the pre-engaged starter uses the solenoid to move the pinion into engagement with the flywheel before full power is applied to the motor (see here

Electrical Problems:

Probably the most common is slow cranking, or there is a chattering noise when you turn the key, but there can be others where the starter doesn't turn at all. With Mk1 cars you turn the key which operates a solenoid on the inner wing and that connects power to the inertia starter motor. For about three years of the Mk2 the ignition key switch operates the solenoid on the pre-engaged starter directly, but 1970 models on had a starter relay on the inner wing by the fusebox operated by the key and that powers the solenoid on the motor which powers the motor proper.

On Mk1 cars if you hear a 'click' when turning the key that is probably the solenoid on the inner wing operating, so if the motor doesn't turn either the solenoid is failing to extend power to the motor or the motor is not responding to it.

On Mk2 if you hear a 'clonk' when turning the key that is probably the solenoid on the starter you can hear, so if the motor doesn't turn either the solenoid is failing to extend power to the motor or the motor is not responding to it.

From 1970 if you only hear a 'click' that is probably the starter relay you can hear, so if you don't hear a 'clonk' or the motor either the relay is failing to extend power to the solenoid or the solenoid is failing to respond.

If you don't hear anything at all when you turn the key either the key switch is failing to extend power to the solenoid (up to 1970), or to the relay (1970 on), or the solenoid/relay is failing to respond.

July 2024: Filled up a couple of days prior to a trip to Norfolk I went to start the engine and just got a 'clonk' - odd, but I'd already put it in gear and was starting to lift the clutch so it could have been something to do with that. 2nd turn was fine. Morning of the journey the same thing happened, but again the 2nd turn was fine - slightly concerning at the start of a 3-day 360 mile trip! Lunch stop was fine, as was starting the engine twice when we were there. Could be the solenoid failing to power the motor, or the motor not responding. Unlikely to be a dead segment on the motor as the armature would need to be turned to another segment before it would work. Could also be a bad connection feeding the solenoid, so far I hadn't looked at the ignition warning light to see if that went out, but having got the clonk and again when I released I doubt it is that. Could also be a bad engine earth strap, but that would make the accelerator, choke and heater cables smoke, and I should be able to use my lithium jump pack connected to the remote starter terminal on the inner wing and the engine block to get round that. Looking at pictures of Bee's solenoid and motor there is a bolted connection both sides of the solenoid, with the 2nd one being the connection to the motor, so if it is the solenoid contact I would be able to bridge the two to power the motor independently - once I had got the car high enough ... and safe enough! But if it is the motor itself then no chance. The hotel car park was down a slight slope and had a hardcore surface so bump-starting it there was out, as was

pushing Bee out onto the road, she would have to be towed out. Start of the journey home the same thing happened, but fortunately again the 2nd try was fine, as was a restart at a filling station and our lunch stop then home with no further problems.

Pondering next day if I can connect two voltmeters one to the battery cable stud on the solenoid and the other to the link between the solenoid and the motor I should be able to see exactly where voltage is and isn't getting to. Jacked up with axle stands under the spring pans that's easy enough, but Sod's Law dictates that she fires up first time and several times immediately after! Can't leave her like that as she is just forward enough to prevent the garage door closing, so really I need something a bit more 'permanent' that I can see in the cabin, like a bulb connected to the solenoid output, with the ignition warning light being used for the input. The wiring needs to be fairly robust to cope with engine movement, and connected firmly enough so it doesn't fall off, so I opt for length of twin-core sheathed mains cable with a through-hole terminal on the end as the connection between the solenoid and the motor is also a threaded stud and nut just like the input. I go to undo that nut ... and whilst not loose as such it needed very little pressure to start moving it, and many years ago I did have a bad connection develop where the battery cable attached to the solenoid input stud! In the normal run of events that nut shouldn't have been moved since the starter was built, and it is quite likely to be the original as it came with the car to me in 1990, so no complaints about quality of the starter as a whole!

For the bulb I root through the old harness I kept from a 1980 and find a holder one with a small bulb with long enough wiring tails both sides which is perfect. Connect the tail to my solenoid output wire which has been fed though the harness grommet, the earth goes to the fuel gauge clamp bracket under the knurled nut. Bulb taped to the top of the steering column just down from the cowl. Turn the key and it lights up and the starter turns the engine - several times, so worth the effort as it's may take a few start attempts over a week or more ... and I may have fixed it anyway by tightening that solenoid output nut more than it was before. Next morning still working, and again in the afternoon, plus twice next day and succeeding days. After a few weeks and several starts no further occurrence so took the test bulb off, and nothing in the remainder of the year.

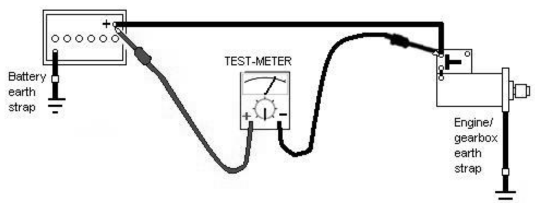
Electrical Problems - slow cranking:

As well as a weak battery this can be caused by bad connections in the cranking circuit. The Lucas Fault Diagnosis Service Manual states:

> "The acceptable volt-drop figure for most circuits is 10% of system voltage (1-2v on a 12v system) but there are exceptions to this rule as in the case of the starter circuit where the maximum voltage drop is 0.5v."

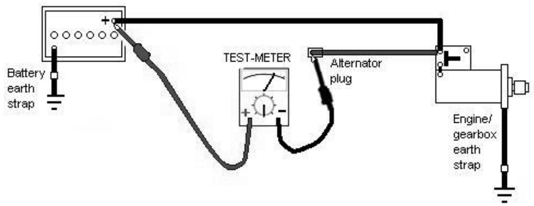
The first thing to do is measure the voltage on the battery **posts** (not the clamps or connectors) while cranking - each battery in turn and adding them together for twin 6v batteries. If you see much below 10v then the batteries are weak, otherwise check for bad connections as follows (assumes negative earth, for positive earth cars change each reference of positive to negative and vice-versa). What you are going to do here is measure how much voltage is being 'lost' at bad connections in a circuit, which reduces cranking speed but more importantly reduces voltage to the ignition system, rather than measure the absolute voltage between a terminal and earth.

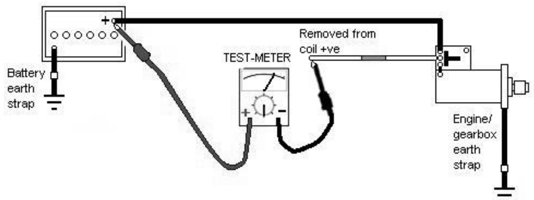
Note that V8s have an additional connection under the right-hand toe-board where the battery cable attaches to a short tail coming from the motor.



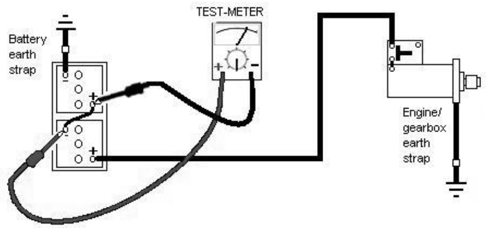
Ideally we want to test the 12v circuit between the battery post and the and the solenoid stud - meter positive on the 12v post and negative on the solenoid stud for negative earth cars, reverse for positive earth cars. Again these voltage measurements are taken while cranking, but instead of a meter with manual range selection being set to its 12v scale, it should be switched to a low voltage scale.

However the solenoid stud is not easy to get to, particularly on the V8 where it is covered with a heat-shield. But by unplugging the alternator plug and using the brown wire in that, you are effectively measuring the voltage at the solenoid stud. Except on the V8 - where the browns go to a battery cable stud under the toe-board, and a short length of battery cable goes from there to the starter. This will give the true voltage at the toe-board stud, which still leaves the potential (ho ho) for losses between there and the solenoid stud.

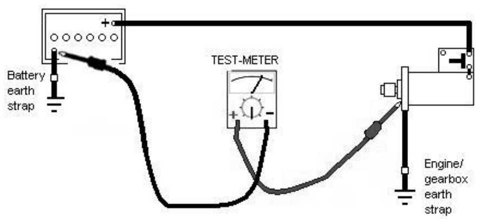




But! There is another dodge, and that is that when V8 and rubber-bumper 4-cylinder solenoids are operated and powering the starter, they are also connecting solenoid stud voltage to the ignition ballast bypass wire that goes up to the coil +ve. So removing this from the coil and connecting your meter to that tests the voltage **inside** the solenoid, and includes any voltage being lost in the battery stud half of the solenoid contact. There could be more voltage lost in the starter half of the solenoid contact, but unless you can get at the link that goes between the solenoid and the starter motor itself you won't be able to test that.



For twin 6v batteries also measure between the two link cable posts and add that to the losses measured in the 12v and earth circuits to get the total losses. Note that the meter polarity shown is correct for the negative earth system depicted.



The earth circuit is tested with the positive probe on the starter body and the negative on the battery earth post (for negative earth cars, reverse for positive earth), and checks the engine/gearbox strap as well as the battery earth strap. You will obviously need a long wire for one of these connections on an MGB.

The individual readings will tell you which of the two (or three) parts of the circuit are giving you the greatest losses. An analogue voltmeter is preferable for these tests as a digital meter may give wildly fluctuating readings while cranking. Disconnect the coil to prevent the engine from starting.

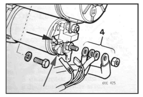
In a perfect world you would see 0v while cranking on both tests. But even with cables and straps of this size and good connections there will be some resistance, and hence some volt drop, but ideally it should not exceed 0.5v in either path. With freshly cleaned connections you should be able to get it down to a couple of tenths of a volt in each direction. If you get significantly more than 0.5v you have one or more bad connections, and by using the same technique of looking for lost voltage at various connections in a circuit you will be able to determine those that are causing the biggest volt-drops. These can typically be the battery post connectors, with the older cup-style battery connectors in particular, the earth strap where it bolts to the battery box, and either end of the engine/gearbox earthing strap. In any of them you could also get bad connections where the cables and straps attach to their connectors. Incidentally make sure you do have an earthing strap either around the left-hand front engine mount (CB cars) or round the gearbox mounts (RB cars) or your starter current will be returning to earth via the heater and accelerator cables, heating them up and possibly damaging them in the process.

Also test the link cable between twin-6v batteries in the same way, i.e. between the two posts, and the cable from the remote solenoid on the inner wing and the starter motor for the earlier inertia starters. You can also test the remote solenoid by putting the meter between the two studs. However this will show 12v immediately, dropping to the 'lost' voltage in the contacts when you turn the key to crank. If your pre-engaged starter with the attached solenoid has an exposed link between the solenoid and the motor as some do, you can check that solenoid as well.

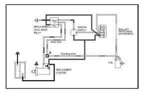
Rubber Bumper 'Coil Boost' System: *August 2014*

Rubber bumper cars and all V8s have a 6v ignition system for running, but the coil voltage is boosted to full battery voltage during starting. This makes starting easier and can make the difference between starting and not starting under certain conditions.

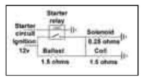
The system works in normal running by feeding ignition voltage to the coil through a ballast resistance concealed in the wiring harness, such that half the voltage is dropped across the ballast resistance and half across the coil. The coils on this system have half the primary resistance of 12v ignition systems - about 1.5 ohms as opposed to about 3 ohms, and are known as 6v coils.



For starting there is an additional contact on the starter solenoid which is connected direct to the coil +ve. When the solenoid operates as well as powering the starter, it also feeds battery voltage out on this additional contact. With a decent battery you should get 10v while cranking, which boost the coil voltage from the normal 6v running level to 10v during cranking, which gives a much fatter spark. This boost voltage is disconnected as soon as you release the key and stop cranking, if you ran with this voltage on a 6v coil you would overheat it and rapidly burn out the points.



It seems many geared and 'hi-torque' starters supplied for the MGB still don't have the extra contact on the solenoid which boosts coil voltage during cranking, meaning you either have to dispense with the coil boost feature or replicate it with an alternative or additional relay, or possible a diode if you know what you are doing! Click the thumbnail for three options.



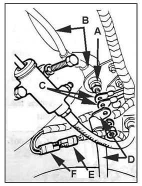
A couple of people have asked why the bypass circuit doesn't come from the existing contact on the starter relay and the answer is that Messers Ohm, Volt and Amp won't allow it! With the coil +ve wired to the solenoid contact on the relay you create a network of resistances instead of two simple series circuits and they interact with each other to affect the voltage that is available to the coil, reducing it from 6v to about 1.5v which isn't enough for ignition. A secondary effect is that the current through the ballast resistance would increase from about 4 amps to 7 amps almost doubling the heat that it would have to dissipate, and a tertiary effect is that the solenoid would have some current passing through it all the time.

I recently started getting hot-starting problems on the V8, first wondering if it was a batch of dodgy fuel, but when it happened again two or three tankfuls later I wondered whether the coil boost circuit was operating. I connected an earth to the coil -ve effectively shorting out the points, and connected a volt-meter between the coil +ve and earth. When turning on the ignition I saw 6v which was what I expected. However when turning the key to crank, instead of seeing about 10v, the voltage dropped to 5v i.e. half the cranking voltage, so the coil boost circuit wasn't working.

I got under the car and found the coil boost wire was broken between where it came out of the harness and where it went to the spade on the solenoid. This wiring was damaged when I got the car, there is supposed to be a short sub-harness on the starter and a 2-way connector joining it to the main harness, but this was missing and a dodgy join made instead. I'm not sure why it needs this as both solenoid spades are accessible even with the heat-shield in place. When I replaced the starter in 1999 I repaired it as best I could - I had to change the spade as originally it was a small spade to distinguish it from the standardised solenoid operate spade, but it seems that rebuilt starters have two standard spades. However since then the insulation had hardened and cracked in a couple of places and allowed engine movement to flex the conductors which fractured them.

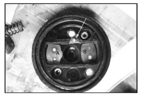
I made a better repair, removing the heat-shield and convoluted sheathing that covered the battery cable plus the two wires. I sleeved all the wire that came out of the harness with two layers of heat-shrink for strength, and soldering the end of that to the tail from the starter, putting two layers of heat-shrink over the join as well. Tested before refitting the convoluted sheathing ... and still no boost! This time I put the meter right on the solenoid spade with the wiring removed, and still no boost, so there is a problem with the solenoid. The question then was, whether to remove the starter and investigate it, or use one of my alternatives until the engine comes out for a replacement clutch or whatever. Having replaced the starter previously I know I could get at everything relatively easily, so opted to take the starter out, which only took a few minutes.

The V8 has a curious arrangement of a stud under the toe-board with the battery cable attached on the top, then a few inches of battery cable from the bottom of the stud to the starter. This together with the sub-harness containing the solenoid operate and boost wires means the starter can be removed and refitted with these three still attached to



it - why, I don't know. Maybe it is so you can fit the heat-shield before the starter, which **is** a bit of a fiddle, although I have been able to remove and replace it with the starter in-situ.

With the starter on the bench a couple of Allen screws removed and a nut terminating the starter feed to the second stud slackened the solenoid comes away. There are two Phillips screws holding the 'plastic' end-cap that carries the two studs and the two spades to the end of the solenoid, but there are wires from the solenoid that come through the cap and have to be unsoldered from the operate terminal and the starter stud, and fortunately my iron is up to the job. Flicking molten solder off, then levering up the ends of the wires, allows the end-cap to be removed.



I can immediately see what the problem is! There is a large copper bar that bridges the two studs when the solenoid operates, and the boost terminal has a small copper contact that sits between the two studs and should be contacted by the copper bar at the same time. However, the contact is bent back, so the copper bar will never touch it. This lies under the copper bar, so it is impossible that my dismantling has damaged it in any way, it must have been like that from the beginning. It obviously was never tested, and although I tested the starter before fitting I only checked that the pinion moved forward and spun. I didn't check the boost contact - "Of course that will work ..." yeah right.

So I straightened the boost contact, and adjusted it such that the copper bar touched that before it reached the two studs. Refitted the end-cap but didn't solder the wires yet, and with a continuity meter checked that when the copper bar was moved manually by pushing a bar down the middle of the solenoid the boost contact and the two studs were all connected together. Re-soldered the wires, and fitted the solenoid to the motor. Another test this time with 12v between the battery cable stud and the solenoid body, then bridge the battery cable stud to the operate spade, first to check the pinion comes forward and spins, and secondly to check that voltage appears at the boost contact - all good.

Refit the starter to the engine, attach the battery cable and the two wires but leave the sheathing and the heat-shield for the time being, and redo the original test i.e. monitoring the coil voltage before and during cranking - success! Refit the sheathing and the heat-shield, test again - still good.

So the question is, will this overcome the hot-starting problem, which in any case is still down to unknown causes, as there obviously has been no coil boost function for 14 years. But the hot starting has only been an issue for two or three months, and seems to be associated with hot weather.

October 2018: It seems to have gone as suddenly as it came, nothing since the summer of 2014, including in the very hot weather we have experienced this year. There have been several complaints of 'vaporisation' or 'vapour lock' in various fora and Enjoying MG, with those reporting it claiming it is common. Not only has it not happened to me, but on various runs in hot weather this year I've not come across any stranded MGBs - including organised runs with dozens of MGBs and Midgets taking part! If you get the problem, then there is a fault on your car that can be fixed without resorting to modifications. The one possibility I will acknowledge is that excessive fuel height in float chambers can expand when turning off a hot engine, and rise enough to run out of the jet into the inlet manifold, resulting in a rich mixture which DOES affect hot starts. That can be caused by incorrect float height, and for those that experience it during a long idle it may even be the float valves are not fully closing off when they should, and letting in more fuel that is being used at idle (<u>see this test</u>). That will gradually raise the fuel level in the jet, with liquid fuel eventually running in to the inlet.

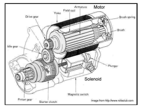
'Hi-Torque' Starters:

Be careful with these! I've seen some and they sit between the original and the geared starters. They have a different internal construction that gives more torque in a smaller and lighter unit than the original starters, but they are not as efficient as the geared starters. However these days geared starters are also described as 'high torque', so you need to be careful what you are buying. In general non-geared starters seem to have the motor in line with the pinion, and the solenoid attached to the side. Most geared starters have the solenoid in line with the pinion and the motor to one side (but not always, see the 'Powerlite Micro-Starter' below), and the solenoid is about the same size as the motor. <u>Price</u> should be the most obvious difference.

Modern Geared Starters:

<u>Coil-boost considerations on rubber bumper cars</u>

Within the last few years 'geared' starters have become available for the MGB as an aftermarket item. These simultaneously reduce the current drain on the engine **and** spin the engine faster - I've seen claims of double the cranking torque for nearly half the current drain - which both aid starting and increase battery life, they are also



smaller, lighter and quieter! In fact the solenoids on these are usually larger than the actual motor, and it is the solenoid that is inline with the pinion and not the motor. There are a number of basic types of starter from different manufacturers, with a variety of different adapter plates to mate them to the MGB bell-housing. Some come with a captive bolt ready to go into the bell-housing as one of them is shrouded by the motor. Others are assembled differently and both bolt holes are accessible. Some have a slotted top hole which makes it easier fit the motor - you start the bolt first hook the motor onto it, then while that takes the weight of the motor you can start the second bolt. Others require you to support the weight of the motor whilst trying to get one of the bolts started. They are available to replace both inertia and pre-engaged starters, because although the inertia starter pulls the pinion into engagement with the **back** of the flywheel and the pre-engaged (including these geared starters) push it into engagement from the front, the earlier flywheel has the teeth cut properly on both faces of the flywheel so will accept either type.

September 2021: A New Kid in Town (to me) is an 'epicyclic' starter which is like a conventional starter in that the motor is in line with the pinion and the solenoid is on the side unlike other geared starters which are the other way round. But that is because there is an epicylic gearbox between the motor and the pinion, like the overdrive, whereas the other geared starters only have a single idler gear between the two shafts. Very light at 5.2lb, but also very expensive at over �400 i.e. about six-times more than a modern 'lightweight' conventional starter. 'Lightweight' is by comparison to the original MGB starter which are still available but at twice the price of the modern lightweight they can only be of interest to 'purists'. Very confusing information in the MGOC ad for the Powerlite starter as well as on the Powerlite site itself:

- The difference between inertia and pre-engaged starters for the 4-cylinder MGB is that the former have 9 teeth on the pinion and the latter 10 teeth (V8 pre-engaged have 9 teeth).
- With the change from Mk1 to Mk2 the starter changed from inertia to pre-engaged, the electrics changed from positive earth to negative earth, and the gearbox, flywheel and engine back-plate changed which impacts the starter.
- MGOC states 'dual polarity' but MGB starters have always been 'dual polarity'.
- MGOC states they are for 1968 and later.
- Powerlite's RAC531 says "to replace the original 5" inertia type ... will fit ... MGB (early inertia type only) ... Negative earth applications only ... 9 teeth." The implication being that this can only be used on converted Mk1 cars, and probably only those with the original style of engine back-plate and gearbox. Which is odd as the picture shows a flying lead for the coil boost wire which is only on RB cars.
- Using Powerlite's model selector they say they have nothing for the MK2 and later MGB, but if you search on 'microstart' they list the RAC530 for 1968 to 1980 which has the correct 10 teeth, but apparently no coil boost wire for RBs.
- Powerlite don't appear to have a version for the MGB GT V8.

You **must** get the correct type of geared starter - there are different models for 3-synch and 4-synch - as the pinions have different numbers of teeth:

- Inertia starters (MGB to 67 and all MGC) have 9 teeth - note that the geared starter replacement for this is a pre-engaged starter, not an inertia starter.
- Pre-engaged starters on the MGB have 10 teeth.
- The factory V8, even though it is a pre-engaged starter, also has 9 teeth.

However there may be other differences such as mounting between the two types.

An early example I tried on the V8 was very poorly manufactured in that the adapter plate was only held to the motor by three self-tapping screws and some super-glue! Needless to say it broke free within a few days, so look for some substantial bolts connecting the plate to the motor. While it was on though it was remarkably quiet, so much so that the first time I turned the starter I though the motor was just spinning without being engaged with the flywheel.

Price: Geared starters are the most efficient but whether it is worth paying the very large premium on them is debatable. At the time of updating (July 2024):

- MGOC have a <u>reconditioned OE at �135 outright</u>, a <u>light-weight GXE4441 at �70</u>, a <u>geared at �225</u>, and a <u>Powerlite micro-starter at �375</u>.
- Motaclan/Leacy seem to have a <u>rebuilt OE at �101</u> plus surcharge on the old unit and a <u>light-weight at �82</u>.
- Brown & Gammons don't seem to do the OE any more, have a <u>'pre-engaged' at �90</u> (presumably a light-weight), and what they describe as a 'competition' (which in the photo is identical to the light-weight but the technical document describes as geared and hi-torque) at �222 which is slightly heavier than the only alternative.

- Moss Europe have reduced their prices with a higher-efficiency, lighter-weight alternative at �113 which appears to have the coil boost contact for rubber bumper cars, an OE at �170 plus surcharge of �48 pending return of the old unit, and a geared (described as hi torque) at �258 reduced to �232.
- Powerlite seem only to have a geared at �273, not the previously listed inertia or micro-starter types.

The light-weight varies in price from �70 from the MGOC to �113 from Moss so it pays to shop around, similar variations but in other directions for OE and geared. Brown and Gammons and Motaclan/Leacy seem to depict the same light-weight unit as Moss, so hopefully have the coil boost contact for rubber bumper cars as well. This isn't always the case, geared types don't seem to have it, but Moss US seems to include a sub-harness with the solenoid operate wire plus a second dioded wire going to the same solenoid terminal to provide the coil ballast bypass function when starting. A diode is one of three ways of providing the coil boost function if your new starter doesn't have it, as described here

September 2021:

Mark Robinson shopped around for a geared starter in America and got one for the same price in dollars as we would pay in pounds, so a bargain. However when mounted using the slotted hole at the bottom which aids fitting, that puts the motor below the solenoid and its connections for the battery cable and operate wire are above the motor and can only be accessed from above. Moss Europe shows the slotted hole on the other side of the solenoid to the motor, which puts the motor above the solenoid, and makes the connections more accessible from below. Another issue is that the battery cable connector is bent at a right-angle originally, but will have to be straightened to fit this starter. So with that and the positioning Mark has made up a short stub between the car's battery cable and brown wires, and the solenoid stud.

February 2017: I've just had occasion to replace the starter motor on my ZS 180. It's immediately apparent that the new one is much quieter and cranks noticeably faster than the old one. When I first had the car I felt that cranking it sounded much like my MGBs, i.e. significantly noisier than other 'modern' cars heard round and about. It's almost as quiet as a geared starter, but not quite. The motor is externally identical to the modern light-weight versions from the likes of Moss etc., so I'd have no problems about using this type on my MGBs in place of an OE.

Changing an inertia starter to a pre-engaged: *Updated April 2012*

Positive-earth, Mk1 cars used an inertia starter with a remote solenoid operated direct from the ignition switch. For one year negative earth/ground cars used a pre-engaged starter (with the solenoid mounted on the starter) again operated directly from the ignition switch. After that MGBs got a starter relay operated from the ignition switch, which operated the solenoid, which operated the motor. This was done to reduce the load on the ignition switch as the current drawn by the later, attached, starter solenoids is significantly more than the remote type, as it has to push the pinion into mesh with the flywheel as well as close an electrical contact.

When fitting a later engine to a Mk1 car, or fitting a pre-engaged (any type) starter to a Mk1 engine, there are several possible ways of integrating the new pre-engaged starter with the original wiring:

- Remove the original solenoid, reroute the original battery cable to the battery cable stud on the new starter, and extend the brown wires down to the new starter. This will work, but requires joints in the wires which is not a good thing, and the original ignition switch will be carrying the current of the new solenoid, which is quite a bit higher than the original, and may burn out the ignition switch.
- Leave the original solenoid in place, move the starter motor cable onto the battery cable stud of the original solenoid, connect the other end of that onto the battery cable stud of the new starter, and remove the white/red wire from the original solenoid and extend it down to the operate spade of the new solenoid. Leaves the original solenoid but it isn't doing anything other than acting as a connector block, and you still have the problem of joints in the white/red and the full current of the new solenoid going through the original ignition switch.
- You can add a starter relay to either of the above, which solves the problem of excessive current through the original ignition switch, but you have to find somewhere to mount the new relay and provide three new wires to battery, earth and the new solenoid. The original white/red transfers from the original solenoid to the appropriate terminal on the new relay.
- In response to someone having starter problems (first continual cranking then no ignition) after fitting a hi-torque starter, Matt Dabney suggested using the existing solenoid as the starter relay, which only involves moving the original motor cable from it's stud on the original solenoid to the same stud as the battery cable (the other end of which goes to what would normally be the battery cable stud on the new starter), then running a new wire down from the now empty motor stud on the original solenoid to the operate spade on the new starter.
- However the simplest method is to use the original solenoid as a starter relay as above, but leave all the wiring on the original solenoid as it is. The original motor cable goes to what would normally be the battery cable stud on the new starter, and the only other change is to simply connect a wire from that stud to the operate spade of the new solenoid - a distance of about an inch or so. Now the ignition switch operates the

original solenoid, that extends 12v down to the new solenoid, which operates and extends the 12v on to the new motor. The only difference to how the factory wired the pre-engaged starter on the later engines is that you won't have 12v on what would normally be the battery cable stud on the new solenoid, but then you don't need there to be as the brown wires are still with the battery cable on the new solenoid.

Jump-Starting: *Updated December 2011*

Jump Leads
Starter Pack
Battery Cable Post in the Engine Compartment

Never, ever, follow the advice given by a certain contributor to the MGOC magazine and 'clip the ends of the leads together'. It's true there was a drawing showing one lead clipped to the **insulation** of the other, but the following month it was obvious someone had taken the advice literally and connected the two clips together, destroying a battery. The person involved was very lucky the battery didn't blow up in her face. The contributor than had the unbelievable arrogance to imply that at least she will have learned a lesson!

Quite apart from the extreme hazard if the advice is misunderstood as in this case, even clipping one end to the insulation of the other is bad advice. The clips have teeth which will bite into the insulation and quite possibly damage it, and why have to cope with two leads at a time instead of just one? You only have two hands, but three ends. So if you clip the two free ends onto one battery or the other, the clipped-together ends will be dangling somewhere, and one of them at least will be live at some point. Far safer to separate the leads if possible and deal with one at a time as below. All the leads I have looked at appear to have two separate cables. If yours have the two cables tied together in some way, such that you can't completely separate the cables, then you should still deal with one polarity of cable at a time, then deal with the other. You will have to watch where the two free ends are dangling, as well as what you are doing with the ends you are dealing with, but at least the dangling bits should be short and they won't be live at any time.

Jump-starting, or 'boosting' is the act of using another battery - a donor - temporarily hooked up to a car - the recipient - to start it typically when its own battery is flat, the donor battery often being in another vehicle. **Great care must be taken when connecting the donor battery, if it is connected incorrectly explosions can occur at worst or electronic components like the alternator destroyed.** That said there are a number of myths and legends surrounding jump-starting to be ignored. One is that the arc generated when connecting jump-leads will destroy the diodes in the alternator of the recipient. It won't as long as you connect the two the right way round! The second is that having the donor engine running while cranking the recipient will burn-out the donor alternator. It shouldn't, all alternators have over-current protection built in.

You can get expensive heavy copper professional leads and cheaper aluminium home-use leads. The former are much more robust, can carry much higher currents and have safety-insulated clips, but the results of connecting them the wrong way round will be much more spectacular! The hobbyists leads have a certain amount of 'fail-safe' in that they cannot carry such high currents so are less likely to result in battery damage if connected incorrectly, but the connections between cables and croc-clips are a bit iffy (they will get quite warm in use) and the clips are usually uninsulated. You will not get as much cranking voltage with the hobbyists leads as with the professional but in my experience it should be more than enough to get the recipient started (6-cylinder BMWs excepted ...).

Either vehicle can be of either polarity (i.e. either positive or negative earth), but no matter what the polarity of either vehicle the connections are **always** positive to positive and negative to negative. You **must** confirm the polarity of both cars before you start. **Never** assume that colour-coded cables or plastic covers on the battery terminals are a reliable indication of polarity, look for '+' and '-' symbols on the battery case, or coloured rings round the posts. If you cannot see them check with a voltmeter. A voltmeter can also confirm which is the live terminal and which is the earth/body terminal, and even a newly flat battery should have enough voltage in it to indicate polarity. The MGB changed from positive earth to negative earth in 1967, other classic cars may be different, probably all modern cars are negative earth. If the recipient has not run for a long time and the battery has been out of the car in the mean time make sure the battery has been reconnected correctly. The positive and negative battery posts and clamps are of different sizes, but it is possible to force bolt-up clamps (not the 'helmet' variety) onto the wrong terminals given enough brute force and ignorance.

When connecting different polarity cars together **never** let metal parts of the cars come into contact with each other or this will short out one of the batteries and cause a very high current to flow, but then we wouldn't let out cars come into contact with anything else anyway, would we? And even on same-polarity cars the potential difference between them can be enough to cause damage to the surfaces in contact. Because MGB starter motor and battery cable are pretty well hidden the usual way of jumping to or from is direct to the batteries even though they are also relatively inaccessible. Note that on a V8 you might be able to use the toe-board stud but I have never done this, and with uninsulated clips the risk of the clip coming into contact with the chassis rail is quite high. If either car has twin 6v batteries you must take careful note of which are the +ve and -ve terminals of the two batteries taken as a single unit and not connect anything to the interconnecting cable that goes between the two.

Connect both ends of one cable first, then connect the second cable. If you connect both cables to one battery first you might inadvertently bring the free ends of the jump-leads together which will generate a big spark off a fully charged battery.

You can connect the two batteries together using the jump-leads direct on all four battery terminals, but the risk with this is that if you **have** got the connections the wrong way round one of the batteries may explode as you are leaning over it. For that reason it may be better to make the last connection to some sturdy chunk of earthed metal like the block. Easy enough on most cars other than an MGB as the battery is usually in the engine compartment, but a bit more difficult when two MGBs are involved. Personally I always tap the last croc-clip on very briefly first to see how much of a spark I get. Connecting a fully charged battery to a flat one will always generate a small spark but the spark from having the batteries the wrong way round is much bigger!

I've just come across these Kangaroo Safety Jump Leads from Airflow which should help guard against sparks and incorrect connection. They are in two halves, with an interconnecting plug. To use them you part the plug, put the two clips of one half on one battery, then the two clips of the other half on the other battery. Then you look at the LEDs in each half of the interconnecting plug which will indicate whether you have the clips on correctly. If you do, push the two halves of the interconnecting plug together. Could be useful on MGs with two black leads at the battery/ies and no polarity marking symbols or colours.

I always leave the engine of the donor vehicle running while cranking the other car. This ensures the donor battery is at its maximum voltage beforehand, recharges it during the brief pauses in cranking the recipient, and if one persists in cranking a car that just won't start it avoids flattening the donor battery as well.

Rather than cranking the recipient you can leave the jump-leads connected for some minutes allowing the alternator of the donor to charge the recipients battery, disconnect the jump-leads then try starting as normal.

Equal care needs to be taken when disconnecting leads, that they don't hit earthed or painted parts, or short together. Some advice says if a modern car is involved at one end or the other when the jumped engine is running the headlights, heated rear window and heater fan should be turned on full to minimise any voltage surges that might damage electronic units. Additionally some suppliers of electronic ignition systems for classic cars say they should not be jump-started at all or it may damage the module.

Starter Packs *Added February 2014*
There are various types of these containing a full-size battery, with mains-powered charger, and often a compressor, from �50 upwards. However these are pretty bulky and one wouldn't normally carry them round.

July 2019: I've had my jump leads for probably getting-on for 50 years and having been bought in my impecunious youth they were cheap ones with aluminium conductors and the clamps crimped on. Never terribly effective, and the last time I used them five years ago I had to wiggle the conductors in the clamps to get them to work. Now one of Bee's batteries suddenly failed and all the wiggling and additional crimping couldn't get enough power out of another battery, so Something Has To Be Done. In any event jump leads need a donor car next door, but we do a lot of touring on our own in some pretty remote locations. Capacitor packs need a donor close enough by to charge it up, which leaves lithium jump packs as the only way to be truly self-sufficient. True they have to be topped up every year or so, but that's not difficult. Looking around there are several different capacities but with three cars I need one capable of powering the biggest - Vee, so 3.5 litres minimum, and if you have a diesel in your fleet that reduces the maximum engine size a given pack will power. Halfords do a Noco GB20 for 4 litres (which is the minimum size from that manufacturer although the instructions say not suitable for diesel) at �79 click and collect. I could get it for a bit less mail-order, or alternative products cheaper still, but as it is an unknown quantity to me I want to be able to get a refund with no hassle. It comes half-powered, and took about four hours with a USB connector plugged into my desktop computer front panel to get fully charged. USB sources less than 2.1A will limit the current and so extend the charging time. No direct mains connection but USB mains plugs are available for a few pounds, as are car accessory socket adapters, although note that something described as '5W' is only a 1A source. I then note that the information says 'only suitable for single batteries', but two 6v batteries in series are exactly the same as a single 12v - as long as you connect the jump pack correctly, but that applies to any boost starting and charging method.

Although by now the replacement batteries had arrived I left the old ones in Bee so I could test the jump pack. Followed the instructions and all seemed when I connected it and switched it on, so went for a start. It cranked well enough and started OK but I must say I was expecting faster cranking with 400Amps, as it was it was slower than the batteries used to be before they croaked. As this was 1800cc I wondered what it would be like on the 2.5 V6, and the 3.5 V8. So I took the earth cables off Vee's battery, and put both of my old jump leads in series between the earth cable and the earth post to simulate a flat battery. Tried to start (without the jump pack!) and barely a groan

from the starter. Connected the jump pack (to the CABLES, not the battery!), switched on, and cranked again (cold engine parked overnight) and it spun the engine like billy-oh - noticeable faster than Bee. So that's OK. Did the same with the ZS with the same result, so for some reason it finds Bee harder to turn than the other two. Vee is low compression compared to Bee, but the ZS is higher at 10.25:1 Could be the starter circuit of course - poor connections, but with the new batteries in they whizzed the engine round - also cold and no choke. It's high summer of course so thinner oil even when 'cold', may be slower in the deep mid-winter, and I have to remember to take it with me whichever car we are using. Subsequently towards the end of the summer when the ZS battery had gone down through lack of use it only took moments to get it going. Needless to say I carry it in whichever car I'm in at the time!

March 2019: When I first wrote this section I had just been made aware of this 'Startmonkey 400' from British Motor Heritage. Claiming to start any car or van and delivering up to 400 amps, with enough capacity for 15 to 20 starts of 6 to 8 seconds each. Small enough to keep in the car, and rechargeable from either the cars electrics or mains. Expensive at �200 though. Now there are many different brands all significantly cheaper, some of them at a quarter of the price at around �50. You do need to charge them periodically to make sure they are ready for use - not much point in spending that much, and carrying it around, only to discover it hadn't got enough oomph when you needed it away from a mains socket. Several of them are capable of being charged from the car's accessories socket as well as the mains, so I don't see why you couldn't keep it connected all the time in the car i.e. fully charged at all times. However if your accessories socket is 'live' all the time as on MGBs from 1972 and some earlier you would need to be sure that the jump pack wouldn't discharge back into the cars electrics and flatten itself. If it is only live when the ignition switch is in the accessories or run position as it seems modern cars generally are you should be fine. Personally ~~I shall stick with my jump leads~~ (replaced with a jump-pack) and mobile phone. Some of the jump packs include a phone recharger, but the first thing I get on the rare occasions I change my phone is a charger that plugs into the lighter socket, and these are usually just a few pounds. Your battery would have to be completely dead, and your phone battery flat, to strand you then.

There are also loads of capacitor-based jump packs around, see this Google search. These are not intended to hold a charge long-term and be ready for use immediately, but if you have a 'donor' car nearby they charge in a minute or so then can be transferred to the car with the flat battery. A sort-of half-way house between a battery pack and jump leads - doesn't need regular charging like a battery pack, but doesn't need to be right next to a donor car like jump leads and doesn't have the hazards of incorrect connection either. But it does need a donor to be nearby and accessible, so even by that the self-contained battery type are better, and some of them are cheaper too.

There are gizmos around that plug into both cars cigar lighters and transfer a charge between them without using jump-leads at all, a LED indicating when the recipient has enough charge to try starting it. I don't know whether these can cope with either polarity or can only be used when both cars are negative earth. I also don't know how long they would take to put sufficient charge back into the recipient to allow it to start. When collecting my son's BMW with a near completely flat battery I couldn't even get that to start with jump leads and a donor vehicle, even with the donor engine running, and having left it charging like that for half an hour. In the end I had to call out the AA for their starter pack.

Finally, if a normally easy starter suddenly refuses to start one day there is little point in cranking it until you flatten the battery. If it doesn't start given double the normal cranking time then you should be checking the ignition and fuel supply. If it is a hard starter anyway, well, if it is an MGB there is something wrong that you should have seen to a long time ago, you are knackering your batteries out of laziness.

References:

- Typical conventional jump-leads
- Lighter-socket jump-leads
- AA recommendations.
- Halfords recommendations.
- UK Health and Safety Executive recommendations (pages 5 and 6, begins at para 24).

Battery Cable Post in the Engine Compartment *June 2020:* Given the faff of getting to the batteries in an MGB I've long pondered having a battery cable post in the engine compartment, for connecting a jump pack should it be required. I know some marques have this as standard, and it's 'just' a matter of getting a suitable post somewhere in the engine compartment and a cable down to the starter (or the connection point under the floor on the V8). After coming to the end of working for a month or so painting at a pal's place and the prospect of not having enough to do in the Covid lockdown, I started looking seriously.

First question is where to mount the post - not much point in buying the makings until that is decided, not least without knowing how much cable will be needed. I don't like drilling holes in bodywork, but on Bee there is a

convenient space just aft of the coil, and the clamp bolt can be used to mount a bracket for the post.

Next what post to use. I Googled various terms looking for one with a cap that would insulate the terminal when not in use, then flip back to connect the jump pack, but the only ones I could find were through-panel and hugely expensive. Eventually I settled for a surface-mount 8mm post with small base as taking up the least space but big enough for starting current - 8mm is close to the battery cable post on the starter. I need something to insulate the post when not being used, and they have various 'boots' that slide onto the cable and fit over the termination. An enquiry comes back with red push-on cover 35mm cable size max, so order both at the very reasonable price of �5 plus �4 P&P, and they arrive in a few days.

Next a bracket - I used a bit of 5mm aluminium off-cut and made a stepped T-shaped bracket to fit the base of the post, and go under the coil clamp bolt. The step holds the nuts that attach the post to the bracket away from the wing. Measuring from there down to the starter with enough slack to make a couple of right-angle bends comes to about 450mm.

Unfortunately 12v Planet only have battery cable by the metre i.e. unterminated, so more searching comes up with SplitCharge who have no less than 19 combinations of colour, current capacity, terminal sizes and lengths. 110 amp should be fine for such a short distance, 8mm terminals each end, at �4.41 including P&P, which also arrives in a few days.

My initial thought was to route the cable down with the others against the firewall then go forwards to the starter along with the brown wires. But that brought it very close to sundry pipes and the clutch slave, unless it had been quite a bit longer. At the starter end it was better if the cable went straight down to the terminal, and I could have got away with a shorter cable. So I end up with six of one and half a dozen of the other where the cable goes back towards the firewall, then angles forwards and down to the solenoid terminal. Engine rocking has to be considered and proximity to the chassis rail and solenoid, but I have some split corrugated sheathing which slides over the cable to protect it at that end.

Subsequently I fit one to Vee as well, piggy-backing the post bracket on the alarm siren bracket.

V8 Starter

I have had two separate bouts of solenoid chattering on the V8 a couple of years apart. Both initially were only when the engine was hot, although eventually it was doing it on cold starts as well. In both cases improving bad connections in the brown - starter relay - solenoid circuit cured the problems (for two years in the first case) but eventually I did have to go for starter replacement. I suspect the starter was on the way out all along, the bad connections were just making it worse.

To my surprise I was able to replace the starter **without** removing either the tubular manifold or down pipe on the right-hand side, but I did have to remove the rack in order to get sufficient movement with a spanner on the top nut. Subsequently (I tried an alternative starter for a while but went back to the OE item) I used a pair of 3/8" extensions and a universal joint to get to the top bolt between two of the pipes on the manifold, meaning I didn't even have to remove the rack. The situation with the original cast-iron manifolds may be different.

Replacements: The alternative I mention was one of the 'gear reduction' starters beginning to crop up all over the place. They are much smaller and lighter, in fact the solenoid is bigger than the motor, and bigger than the on the original starter so should be more robust, it being the solenoid that usually fails on V8 starters. The first time I tried it I thought it was just spinning and not turning the engine over as there was no rocking of the engine and no grinding, just a steady hum, but then it fired up. Because of the gear reduction the motor has a lot more torque, hence the smaller size, and spins faster and so take a lot less current which should take a lot less out of the battery at each start. However the connections were in a different place meaning I had to connect the cables **before** I could fit it which meant lying on my back under the car holding the motor up in the air with one hand, while I attached the cables with the other. There is also no boost contact for the coil on rubber bumper cars and all V8s on the ones I have seen. This last could be simulated with a relay, but with the lower drain on the battery it may not need it. They are about 50% dearer in price though. The problem with mine was that the motor assembly was attached to the adapted plate with just a couple of self-tappers, and needless to say these came loose after just a few days. On another occasion, and with beefier mountings, I could well be tempted to fit one. Be aware that there are after-

market starters available described as 'hi-torque' - not all of these are geared, Caveat Emptor. *May 2019:* It seems only two types of replacement are available for the factory V8 - the original style and geared. Prices are very variable, Clive Wheatley has the original 3M100 type at �120 exchange and the geared type at �252. SC Parts has the original at �230 plus a �264 core charge until you return the original, and the geared at �264.

Conversions: I've seen a couple of comments now about the starter motor fouling things when a Rover V8 from another application is used for a conversion. On at least one of these the solenoid is on the side of the motor when installed which will definitely foul the chassis rail. It needs to be below as per the original, but to get an original you are faced with finding one from somewhere, maybe to use as an exchange, or fork out nearly �500 as above. In which case it would be preferable for several reasons to get a geared for half that. These geared starters are basically a standard motor on an adapter plate orientated to suit the application, and SC Parts has just such an adapter plate meaning you have the potential of getting a motor elsewhere and modifying it accordingly.

Oils & Filters

Oil Filters

Oils and ZDDP *Added March 2009*

March 2023: It's been four years since I last updated this section, I gave up because things were changing every year and every year I had to search anew for the data. At that point I defaulted to using Halfords Classic (which now has a plastic pull-up spout with ring-pull cap that is torn off the spout). It's available locally, it's said to be made by Comma, and their Classic (click Download Technical Data Sheet) has 800ppm of zinc and 700ppm of phosphorus plus 2200ppm of calcium which I'm sure is good enough for my engine the mechanical components of which have been running for over 30 years. If I were running with new cam and followers I would probably opt for Fuzz Townshend's Heritage 20W/50 which has 1300ppm of 'Zinc as ZDDP'.

Previous updates

For a couple of years or so I've seen a certain group of people banging on about zinc dithiophosphate (ZDDP) in oils and how a reduction of levels of this additive in modern oils will damage your engine. An apparently clear case of modern versions of something not being an improvement for our 'historic' technology. However this is almost equally balanced by people recommending ultra-modern very low viscosity synthetic oils saying "if they are good enough for Ferrari or whatever they are good enough for my MGB". Quite apart from the ZDDP issues there is a third camp that says these very low viscosities are **not** suitable for our engines as they are specifically designed to meet the requirements of modern engines, which with their catalysts, very low bearing clearances, and completely different designs are totally different to engines of the 60s and 70s, let alone the fact that most of ours have done very high mileages and have even bigger clearances by now. As in the old joke that if you laid all the world's scientists end-to-end they would never reach a conclusion, I just switch off and ignore the argument, coming down in favour of the higher viscosities as that at least makes more sense, and not seeing the point of spending nearly double on synthetic, especially with the con-trick of them only coming in four litre cans instead of five!

But first a digression into viscosities and how they have changed over the years. I'm old enough to remember when GTX came out, but turned my nose up at it as the 'GT' label was being stuck on anything and everything at the time, most of it cheap and tacky. But eventually it 'got its knees brown' and had been around long enough, as well as being more readily available it seemed to me, so I started using it. Originally 20W-50, probably some time in the 80s or early 90s it changed to 15W-50 which was obviously an improvement. Come the late 90s or early 2000s it changed again, but this time to 15W-40 - not so good. I immediately noticed a drop in hot idle oil pressure in the V8, which is low enough to begin with, although no change in the roadster. Unhappy about this I started using Halfords 'red can' in the V8 which was 15W-50, and as I couldn't see the point of spending the higher amount on GTX for the roadster switched that as well. But in the last couple of years Halfords have dropped the 15W-50 'red can', the next available grade also being 15W-40 - back to square one. They do however have a 20W-50 'Classic' oil (that comes in a 'proper' metal can to boot). I did buy that last year, but was concerned to find the screw cap had no seal on it, so technically anyone could put anything in it (subsequently I realised the 'seal' was coming off with the screw-cap on those cans, but they have now adopted a plastic pull-up spout with a ring-pull cap that is torn away from the spout). As yet another digression and while researching this topic I came across people recommending buying Mobil 1 loose from Sh*t-Fit, taking their own cans. When others expressed concern about the potential for contamination, if not being sold something completely different, a couple of people stated that they had contacted Mobil who confirmed that they did indeed supply their oil loose to Sh*t-Fit. So they might, but what guarantee have you or Mobil got that some Sh*t-Fit scum-bag hasn't padded it out with something else? The same thing used to concern me many years ago when petrol stations had oil dispensers on the forecourt - you cranked a handle and dispensed it into a small can, then poured it into your engine. Then the can went back on the shelf to gather more dust and flies ready for the next customer! Some people used to insist on bottled oil, but all the garage did was use the same system for filling the bottles! But back to the subject.

So I'm not keen on Halfords Classic 20W-50 because of it being unsealed (I subsequently discover that all the cans come with a plastic insert but it's hit and miss when removing the cap as to whether it stays in the can or in the cap!), there doesn't seem to be any other 20W-50 readily available locally. Then in this month's Enjoying MG MGOC are advertising Castrol XL 20W-50 and recommending it for its higher levels of ZDDP (but see below), so maybe I ought to look into this ZDDP thing after all. Is there something in it? Or is Roche simply repeating what he has seen elsewhere, like he did with his "you will ruin a battery by storing it on a concrete floor" comment of a year or so ago (some years ago someone posted on an MG mailing list "Don't store batteries on concrete floors or you will ruin them". There then followed a long and heated debate about just what physics might or might not be involved in causing a concrete floor to damage the internals of a battery, which again I didn't get involved in as it seemed like rubbish to me. A couple of weeks later the

original poster came back and said "No no no, I meant that if you put an old battery on a concrete floor and it leaks it will ruin the **concrete**!" Oh, how I laughed!).

The gist of a number of articles I have read is that yes, ZDDP is necessary to 'cushion' certain sliding components, and the flat tappets and camshaft lobes of our engines seem particularly prone to wear without it, new cams and tappets failing in as little as a few hundred miles. A progressive reduction in zinc (and other additives) has been required by environmental agencies over recent years both to reduce pollution and because they can reduce the life of catalytic converters. The American Petroleum Institute (API) grades oils into 'service categories' and containers are labelled with (amongst other things) 'API' followed 'SA' to 'SM' for petrol and 'CA' to 'CI4' for diesel according to oil formulation and performance. SA to SH are obsolete (our engines originally used SB, SC, SD and SE), as are CA to CE. Originally each new formulation was an improvement and backwards compatible, until it comes to SL which is where the reduction in zinc and other additives started happening. The European equivalent of the API is the ACEA (Association des Constructeurs Europeens d'Automobiles, or European Automobile Manufacturers Association). They have their own way of grading oils which seems much more complicated than the API with class, category and year indicators so I'll stick with the API ratings.

The recommendations I have managed to glean are:

- Although our engines were built anywhere from 1962 to 1980 and so in theory span four service categories the basic design didn't change over that period and so SB and later rated oils are theoretically suitable for all MGB engines, although generally the later the better.
- For its ZDDP and other additives SJ rated is the most modern you should use, not SL or SM (there is no SK) which is what most current petrol engine oils are rated at today.
- Castrol GTX 20W-50 is said to be suitable for already run-in engines, even though it only contains half the ZDDP it did originally. However it doesn't seem to be available in the UK any longer. **Don't** use lower viscosities of GTX at all, and don't use GTX 20W-50 for running-in newly rebuilt engines. There are online sources in the UK e.g. Opie Oils for other 20W-50 oils for 'older' cars rated at SF such as Silkolene (which I seem to recall was used by Rolls-Royce in the 60s and 70s).
- Valvoline VR1 (API SL, mineral, £25 per 5L online or £19 locally to me) and Redline 10W-30 or 10W-40 synthetic (API SL/SM/CF at £43 per US gallon i.e. 3.7 litres!) are also said to be suitable after running-in because despite the higher ratings they are said to contain enough of the required additives, although how they can then be labelled with these higher ratings which imply lower additives isn't explained. Valvoline VR1 SL has claimed (link broken) to have 75% more zinc than SM, but what I'd really like to know is how does that compare with SJ and other SLs?
- This posting (deleted) purports to show a letter from Royal Purple stating that RP XPR 10W40 has over 1500-1600 ppm of ZDDP and, get this, "we could take all of the ZDDP out of our engine oils and still have 4 times the wear resistance of even the VR-1 oil due to our Synerlec additive technology". At this point the whole topic is degenerating into farce where the poor punter is none the wiser.
- Use Castrol HD30 for running-in - if you can find it.
- Some current Diesel and 4-stroke motor-cycle grades also contain enough ZDDP - at the moment (but see below), but these are also under review.

As to practicalities in the UK:

- MGOC Castrol XL20W-50 20 litre drum at £96 delivered, but needs rather a lot of space, and you have to consider storage life and conditions, I've read five years maximum and frost free. They also have 4.5L cans at £29, plus postage. They are rated API SE/CC so suitable for our engines, but don't have the benefits of the later SF to SJ formulations.
- Halfords Classic 20W-50 is also API SE/CC, £17 per five litres i.e. a bit more than a gallon so comparable to the MGOC bulk price without the storage issues. Personally I'm not happy about the unsealed cap though. I subsequently discover that all the cans come with a plastic insert but it's hit and miss when removing the cap as to whether it stays in the can or in the cap!
- A fellow MG-er has some old-stock Unipart Green 20W-50 (part no. GUL7005) that is rated at API SF/CL and so also suitable. Only two places seem to stock it online - Rimmer Bros at £14 and mini spares at £13. No indication of API rating on either site, so check first, although it does seem that where you can still get 20W-50 in various brands they are to SJ or earlier ratings and so suitable.
- The Mini supplier of the above makes me think of Min-Its locally to me, and sure enough they do stock 20W50 but it's Valvoline VR1, at API SL and £19. I certainly don't want to muck about with mail order, so it's a toss-up between Halfords Enhanced Diesel SJ 15W40 or Valvoline SL 20W50, and I opt for the latter (subsequently rejected).
- *January 2012:* Comma Sonic (NLA) at API SL CF is claimed to have about 0.2% each of Phosphorus and Zinc, which is typically double compared to most of what I have found so far. Note Comma Classic (API SE CC) has less than half this and looks to be in the same cans as Halfords Classic.

April 2018: Comma X-Flow type SP still available with the data sheet showing the same quantity of zinc at 0.11%/1100ppm. Unipart 20W/50 Mineral Classic Engine Oil PROM300, API SF/CD and "Formulated to meet the demands of petrol and diesel engines of older non-turbo design engines. Good anti-wear, anti-oxidisation and anti-rust properties". An 'older' format, the product data sheet indicates that 'Zinc Alkyldithiophosphate' is at a concentration of 0.5% to 1%, so not precise but definitely not exceeding 1% or 1000ppm. New kid on the block is Classic Oils Heritage 20W/50 apparently endorsed by Fuzz Townshend. API SL/CH-4, but with 1300ppm of Zinc as ZDDP i.e. significantly more than others.

December 2017: Not much to add: Comma X-Flow type SP, the datasheet for which specifies API SL CF and Zinc 0.11% Calcium 0.30% Phosphorus 0.10%. Millers Classic Sport 20W/50 now states SPI SL/CF but the only statement about ZDDP is "It is formulated with full ZDDP (zinc phosphorus) for ultimate protection" which could mean anything. A couple of sources for Comma found by Googling, and rather cheap at £14 for 4L, whereas 5L of Millers from Opie Oils is £38! Beware Comma Classic 20W/50 which despite being API SE CC only has 0.08% zinc and 0.07% phosphorus. Ditto Castrol Classic XL 20W/50 API SE/CC which only has 0.08% 'Zinc as ZDDP' i.e. the same as modern oils and no mention of phosphorus.

March 2015: I've got Comma Sonic 20W/50 in both cars at the moment but have been a little concerned about the very slow rise time in the V8 over winter so was hoping to change to a 15W/40 to API SJ, but have not been able to find any. Note that Halfords 15W-40 enhanced Diesel oil is now labelled Mineral Petrol and Diesel Oil rated ACEA A3/B3 and API SL i.e. no longer SJ, however it still has the same CF/CF-4 diesel rating as previously. It's made by Comma and they were able to tell me that it contains 0.11% Zinc, 0.1% Phosphorus, and 0.3% Calcium. Also Comma Sonic is no longer produced, the replacement being Comma X-Flow type SP. This is also SL with the same zinc and phosphorus as Halfords Mineral Petrol and Diesel Oil, but only 4 litres. Millers Classic Sport 20W/50 is still SJ, with 1250ppm or 0.125% ZDDP, so about the same as the Halfords and Comma SLs i.e. not as much as Comma Sonic used to be. I suspect environmental regulation has ordered the reduction.

January 2012: As well as coming across the reference to Comma Sonic the Peter Donlan subsequently wrote saying he is now using ZDDPlus stocked by Frost in a new engine. At the same time Peter Burgess has also mentioned he uses Zincoat from Chemodex. As they are both subject to UK law on claims, I'm hoping the products 'do no harm' at least.

September 2011: **A cautionary tale.** A pal has had to have his engine rebuilt after only 20k, cams and followers pitted and worn were the main problem. He has his car serviced by a local classic specialist (it was previously restored by them), subsequently enquired what oil they used, and was told it was a semi-synthetic 10W/40 to API SL. The garage wasn't aware of ZDDP issues (nor apparently interested when told), so said pal is replacing it with Halfords Classic (20W/50 API SE). As this tends to confirm problems with SL (and hence SM), especially with newly rebuilt engines, I shall definitely steer clear of it in future. I have recently read that previous use of earlier formulations protects the cams and followers to some extent if changing to SL, but only seen one reference to that, and the writer may be getting it confused with 'lead memory effect' for valves and seats with the change from leaded to unleaded petrol. After a couple of years using Valvoline VR1 (20W/50 API SL) in the V8 I did think it had become a bit noisier, and one contained noticeably less than 5 litres, so had already stopped using it anyway. This spring I got a couple of 5L cans of Unipart Mineral 20W/50 API SF at £17 each, used one and shall keep one for next year, then try to stay one or two cans ahead. Failing that Halfords Enhanced Diesel (15W/40 API SJ). Classic Oils is advertising a number of classic mineral 20W/50 oils, all (bar three where there is no API formulation specified) at API SF and SG. They also have Penrite running-in oil which should be used for the first 300 miles to bed in the rings and bores on a newly rebuilt engine.

August 2009: After a bit of effort I got some data sheets from Halfords. These confirm they are made by Comma, but also contain some down-right confusing information on ZDDP content. For the Classic 20W/50 under hazardous ingredients it states ZDDP at <1% i.e. less than 1%. Fair enough for Elf and safety info, but of no use to us as other product information quotes ZDDP constituents at much less than this, typically less than 0.1%. But then looking at every other Halfords oil, including full synthetic and enhanced mineral diesel, which have very different API classifications, they all specify between 1 and 10%! I.e. anywhere from 10 to 100 times the amount needed!!

Given the amount of web site and mail list chatter about the loss of ZDDP you would think that plenty of additives would be available given the number there are for other engine, gearbox, petrol etc. situations. But I can only find references to one, made in America, and reputedly only one eBay supplier of that in the UK. As there are no warranties as to how effective it is, or more importantly that it won't wreck your engine even faster than having no ZDDP in your oil, I'll leave you to find it for yourselves.

May 2009: Came across a page from LN Engineering and Charles Navarro (who he?). A loooong article (120k of pure text) entitled 'What motor oil is best for my air-cooled Porsche' but is largely relevant to our engines. He concurs with much of the above, but states that there is no evidence of Porsche catalytic converters suffering from the higher levels of zinc and phosphorus in earlier formulations for motor car engines, although he also says motorcycle oils are usually SG, SH or SJ with excellent anti-wear characteristics but will kill catalytic converters. He states that Zn and P (ZDDP) levels of 0.12% (1200ppm) for normal drain intervals, 1450ppm for extended drain intervals are ideal. Comparing wear he states increasing ZDDP from .03% to .05% in an engine with 180lb valve springs reduced wear by 90%! With 205lb

springs increasing from .05% to .095% similarly reduced wear by 90%. He gives the following table of additive averages in a range of oils tested or examined, but unfortunately doesn't say what the oils are:

API	P (ppm)	Zn (ppm)	B (ppm)	Mo (ppm)	Ca (ppm)	Mg (ppm)	Na (ppm)	Total Detergents
SE-SJ	1301	1280	151	357	1936	293	214	2443
CI-4	1150	1374	83	80	2642	199		2840
SL	994	1182	133	273	2347	109	22	2479
CJ-4	819	1014	26		2075	7		2082
SM	770	939	127	122	2135	13	139	2287

He prefers good quality oils in the first place to using additives, says rates of 2000ppm as recommended by some are simply not needed and too much can be as harmful as not enough. He repeats the target is 1200 to 1400ppm, and gives rates of addition using STP or GM EOS to achieve it. But of course you need to know what the amounts are to begin with, and unfortunately there is nothing in the article about this, although there may be in the many links. One posting found by Googling reports Castrol as saying SM grades with reduced Zinc and Phosphorus are known to cause problems in classic engines. They recommend their Syntec for classics, it contains a minimum of 0.12%/1200ppm of Zn, Phosphorus not mentioned. But to throw it all up in the air again I happened on a posting somewhere from said Charles Navarro saying he has correspondence from Castrol saying their GTX 20W/50 will remain at 1300-1400ppm, and their new Syntec 20W/50 also has those levels!

I found a set of Castrol UK product data sheets (click on 'View Complete Technical Data Sheet List") which make interesting reading. Amongst the many products the following levels of zinc and phosphorus are specified:

Product	ACEA	API	Zinc	Phosphorus
Classic XL 20W-50		SE/CC	0.08	
Classic XL 30		SB	0.084	0.077
GTX 15W-40	A3/B3	SL/CF	0.1035	0.093
GTX High Mileage 15W-40	A3/B3	SL/CF	0.1035	0.093
GTX Professional 5W-30	A1/B1	SL	0.099	0.091
GTX Professional 10W-40	A3/B3	SL/CF	0.0933	0.091

Many other commonly available products are listed (e.g. Magnatec, Diesel and Motorcycle) but don't have entries for zinc or phosphorus content. So far from Classic XL 20W/50 having **more** protection, it actually has less than either standard or high-mileage 15W/40, which have the highest of all Castrol products checked.

Castrol products for the USA are very different and product data sheets are listed here (click on "View all Product data Sheets). For all GTX standard and high-mileage viscosities whilst there are entries for zinc and phosphorus in the tables there are no values shown. For the Syntec products there aren't even any entries. GTX Diesel 15W-40 has 0.13 and 0.11 respectively, and 'GRAND PRIX MOTORCYCLE 4-STROKE' products have 0.11 and 0.10 respectively.

I did a similar search on Mobil UK product data sheets. Some like Mobil 1 Fuel Economy 0W-30 quote 0.10 phosphorus, Syst S Special V 5W-30 0.08, Super 3000 XE 5W-30 0.08, Synt S 5W-40 0.09, Mobil 1 0W-40 0.10, Super 3000 Formula R 5W-30 0.05, SHC Formula V 5W-30 0.08, Super FE Special 5W-30 0.10, LL Special G 5W-30 0.09, SHC Formula MB 0.08, Syst S ESP 5W-30 0.08. No entries for zinc entries, and the remainder of the Mobil products either didn't have phosphorus entries or they were blank.

References:

http://www.ttalk.info/Zddp.htm - ZDDP issues.
http://www.opieoils.co.uk/pdfs/Is-there-a-flat-tappet-issue.doc - flat-tappet issues.
http://motorcycleinfo.calsci.com/API.html - API Service Categories.
http://lukoil-lubricants.com/info/classification/00007/ - ACEA and API classifications.
Castrol UK product data sheets.
Castrol US product data sheets.
Mobil product data sheets.
Valvoline Racing VR1 product data sheet.
Mixing and switching between mineral, semi-synthetic and synthetic oils.

Oil Filters

Removal
Filter types and quality

The 1977 LHD Workshop Manual AKM3524 gives the bypass valve opening pressure as 13 to 17 psi. Note that this is the pressure differential between the input and the output. On cold starts with thick oil this pressure can be exceeded, which can lead to holes being punched through the filtration medium. Note that some filters do not have a bypass valve.

The various styles of filter and head used over the years:

Engine	Dates	Head	Filter	Notes
18G, GA	All	8G740	1H1069	Teclamit suspended replaceable element
18G, GA	All	1H1052	1H1053	Purolator suspended replaceable element
18GB	Oct 64 - Nov 67	8G740	1H1069	Teclamit suspended replaceable element
18GD, GF, GG, GH	Nov 67 - Apr 70	12H2244	12H2258	Teclamit Inverted replaceable element
18GG, GH, GJ, GK 18V 581, 582, 583 18V 672, 673	Mar 70 - Sep 73	12H3273	GFE114	Inverted spin-on cartridge
18V 581, 582, 583 18V 672, 673 18V 779, 780	Oct 73 - Jan 74	12H4405	GFE148	Suspended spin-on cartridge, see Note below
18V 836, 837 18V 846, 847 18V 797, 798 18V 801, 802 18V 883, 884 18V 890 - 893	Feb 74 on	12H3273	GFE114	Inverted spin-on cartridge

Note: An odd one this, only four months, it looks like someone at the factory had the bright idea of making oil changes cleaner, only to rediscover some major reason why they were inverted in the first place! It's said that the change from the original suspended filter to the inverted for Mk2 cars was necessary because the pre-engaged starter that was fitted at that time was longer. The starter changed to the 2M100 type on 18V engines, so it's possible that is shorter and so the hanging filter would be re-used.

After trying various makes over the years my preferred filter is the Mann W916/1. Available from loads of online sources at anything from under £3 to more than £15, but for the cheaper ones check for VAT and P&P. At the moment (September 2019) Car Parts 4 Less have them at £4.06 including VAT and free delivery.

The Parts Catalogue quotes GFE114 for both the 4-cylinder inverted and the V8 hanging. Looking at equivalents for that Mann W920/21 is amongst more than 50 different types, and I know Mann have online specifications for many if not all of their filters. Looking at W920/21 - within one basic type there can be many /suffixes covering things like thread, bypass valve pressure and how many anti-drain-back valves are fitted - and W916/1 is close to W920/21 in all those areas, with the Imperial thread, so I'm happy using that on both cars. The 4-cylinder hanging is specified as GFE148 which has a smaller overall diameter and is shorter than the others, implying perhaps less filtration medium, but maybe there are space limitations.

Removal:

Limited access with the later inverted canister type, definitely needs a tool. Several types - the type with a strap and handle are not really suitable as there is so little space to swing the handle. I've been using a Halfords chain type which uses a socket wrench and long extension for as long as I've had a car - 55 years. The only problem I had was on a 1500 Midget where I couldn't get even that square onto the filter and the chain broke - easily fixed with a repair link. Similar types with a fabric strap (cheaper), and yet others with three legs that clamp onto the end of the filter but they are more than double the price of the chain/strap type and still need a socket wrench and extension.

Care is needed screwing one back on! On the inverted at least the adapter thread is not quite vertical, and it's very easy to cross-thread.

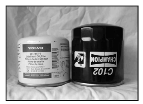
In response to a query about owner conversion to suspended I had to say that from my own experiences with one inverted and two hanging filters I can say for sure that I prefer the inverted! When removing a hanging filter (V8 and ZS) as soon as the seal moves away from the filter head oil starts running down the outside of the canister, and wearing gloves to protect myself from hot oil there is no purchase whatsoever, even though the filter is spinning freely by that time. I have to have sheets of paper to hand to grip it with, which are better than the gloves but still slip and it takes a significant time to get it off altogether. And all the time I'm doing it oil is dripping off the bottom, so I have to have the same 'nappy' of several thicknesses of newspaper underneath it (V8) to catch it. Bad enough on the V8 which is at least tackled from above, but on the ZS which is removed from below the oil is running up my arms as well! At least I can position a bucket under that to catch what is running off, just using masking tape wrapped round the filter for grip. With the inverted on the roadster I position the newspaper underneath formed into a shallow bowl same as for the V8, and once slackened can spin the old filter off and get it 'right way up' much quicker and easier than with the other two.

Filter types and quality

Inverted spin-on filters need an anti-drainback valve to prevent the filter from emptying when the engine is switched off, which delays oil reaching the bearings on start-up. Not needed on hanging filters, but I'd expect all good spin-ons (i.e. the Mann 916/1) to have them as a matter of course. However not all do, and some are very poor quality.

For years I used Unipart, Champion or Halfords and had no cause for concern. Then someone posted that after a recent oil change, pressure was taking much longer to build (not just on the first start but subsequently) than before, even when the engine had been off only a matter of hours. So he unscrewed the new filter and was surprised to find no oil flooded out as is usual with the inverted cartridge filters. Thinking he had a bad filter with a faulty non-return valve he fitted a new filter, only to find the same thing happened. I'm pretty sure he had this problem with Unipart and Champion, and I can't remember the final outcome (or even if one was posted). I continued to use filters as before but kept a closer eye on pressure rise than hithertofore, but noticed no change. As I change my oil and filters hot I also continued to find the filters full of oil on removal, however the last Champion 102 I bought does **not** have an anti-drainback valve. One thing to bear in mind that when starting a 4-cylinder engine daily pressure rise should be practically instantaneous. Only if left for a week or more should it take a few seconds to rise, which it will do more slowly, but should still only take around 6 to 10 secs. for full pressure. V8s are renowned for their very slow start and rise times, after just a few hours, but this is because of having twice the number of cylinders i.e. bearings plus hydraulic tappets. Early V8s had the gauge tapping on the filter outlet, moved to the oil pump in December 73 on car number 1149 "for improved reading on pressure gauge when starting engine", which is what mine has, I dread to think how slow it must have been before. I've tried an alternative gauge with larger bore plastic tubing compared to the copper capillary, but it made little difference, neither does bleeding the capillary compared to having it full of air. It's just a factor of the engine.

To get back to filters, my interest was now piqued, and doing some internet research came across Russ Knize's Oil Filter Study (this is an edited version, the original has gone) which goes into quite a bit of detail about filter construction, albeit of American filters, which shows that the type and quality of materials and construction used can vary quite a bit, anti drain-back and relief valve included. However that is dated 2000, and I subsequently found a more comprehensive 2008 version here. Why the old one has been left unchanged I don't know, but there it is. At the same time a well-known source started advertising filters with 'an improved anti drain-back valve' so I bought some in 2005. Part number GFE121F they turned out to be Fram filters PH2857A. Fram make a number of different 'grades' and some don't get a very good write-up. Even worse, when fitting one to the roadster I found the pressure rise time was longer than with the Halfords and Champion, so I kept them back for the V8 which uses the same filter but hanging, and reverted to Champion in 2006. I then came across recommendations for a Volvo filter (3517857-3), made by Mann (W917). As I have a Volvo dealership nearby I bought one in 2007, at £7.64 at the time about 50% dearer than Halfords/Champion. I was pleased to find that these filters gave a shorter rise time which lasted the life of the filter. More listening and watching saw K&N Gold filters get an excellent recommendation. After much research I managed to find somewhere I could order these (HP2004), but it was a trek across Birmingham to collect them in 2008 rather than a pleasant trip down a country lane, and they were 50% dearer than the Volvo i.e. double the price of the Halfords/Champion and four times the price of Unipart! In the event they were no better than the Volvo, so for 2009 it was back to Volvo for the roadster, using Champion for the V8 now I have used up all the Fram.



But it was only on purchasing the Volvo filter in 2009 that I noticed it was shorter than the other filters I had been using. I asked if they had been changed but was assured they had not, so I suppose I just didn't notice before. I wasn't particularly bothered by this, until I read something very recently where filter internal depth can be a big issue. There have been several changes in filter head design and orientation over the years, and one of these was to fit an anti drain-back tube to the head that goes up the middle of the filter. This stops oil draining out of the filter via the outlet, as well as the anti drain-back valve in the filter cartridge reducing how quickly oil drains back into the feed pipe. It is absolutely vital that the filter you get is deeper than the length of this tube, and by at least 1/2".

The account I read said the filter was so short it completely blocked the end of the tube, which is the only outlet for oil, the relief valve being inside the filter on cartridge filters unlike the earlier replaceable element type where it was in the filter head. There is a long and boring video (including the Dumb Present Owner filming the running of his engine with no oil pressure!) which demonstrates this using a depth gauge, two filters and a filter head, but you really only need to see these three frames to get the idea. The narrator keeps banging on about the depth of the 'relief valve' but it is the length of the anti drain-back tube and the available depth inside the filter he is measuring of course, which may or may not include a bypass valve. The internal space on the Champion is 2.785", the Volvo is 2.57", and the Mann 917/1 is 2.75" (the last two going inside the bypass valve spring). The Mann 916/1 is 2.93" internally, and the Unipart GFE422/121 is 3.02", these two being the same external height at 3.76". The tube on my filter head is 2" long, and fits inside the bypass valve spring, so plenty of room even for the shorter Volvo and Mann 917/1. Much less difference internally than externally between the Champion and Volvo, i.e. a short filtration cartridge in a long can? Leading you to think you are getting a more effective filter? *September 2016:* However note that currently the Mann 917/1 as well as being shorter is shown as having a thread of M20 x 1.5, whereas the 916/1 has a thread of 3/4"-16 UNF, i.e. the 917/1 is not an exact equivalent, and I suspect the Volvo 3517857-3 is the same.

There have been questions about the differences between GFE121 and GFE422. One opinion was that the former had has a magnet on the case but the latter didn't, subsequently debunked by cutting open examples of both, although some filters do seem to have them stuck on the outside. Not sure what effect this has, the can is ferrous, which surely acts as a Faraday cage blocking any magnetism from the inside? Not so, if the magnet is powerful enough it's effects will extend through the metal can. You can get magnetic 'bracelets' to encircle the can, but if you are that concerned you would be better off with a magnetic sump plug and be able to see the effects. Anyway, the GFE422 seems to be a replacement for the 121, being identical, and a parts rationalisation, the two numbers being applied to different applications of the same filter at one point. These are from Unipart, which at just over £3 including VAT are very cheap (worryingly so?) compared to the Halfords/Champion at £5, the Volvo 3517857-3 at £7, and the K&N at £12! Mann W916/1 is a longer version of the Volvo/Mann W917/1, almost as long as Unipart, Champion etc., but I have not been able to find any UK sources from Google, only in mainland Europe. Subsequently Michael Beswick found them stocked by Central Auto Supplies (now Motor Parts Direct) at £2.60 plus VAT (making the others expensive rather than the Unipart cheap), and in *November 2014* I find them listed by Halfords at £3.19. *March 2019:* Halfords now charging £6.26 for the Mann 916/1, and only a week later £8.22! Euro Car Parts have them at £5.89 with free delivery, and at the time of writing a discount code making them £2.94! Bargain.

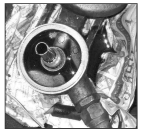
A fuller list of equivalents can be found at GermanFilters.com but is reproduced here in case the page vanishes, and a list of specifically Mann equivalents for the Champion C102 and Unipart GFE121/422 filters can be found here.

As well as the oil filter study referenced above there are a number of short videos on filter construction here (however don't bother with one titled 'detailed video' as it is nothing more than some idiot taking one out of its box!) and you don't have to see many before you start noticing the different qualities of construction. Several seem to use a very similar 'cartridge' (cellulose/paper with metal end-caps and perforated core), the differences being in the thickness of the case (largely irrelevant) and the quality of the bypass and anti-drainback valves. Some filters don't have a bypass valve at all, just a pressed spring plate which is simply there to seal the centre hole and press the cartridge down onto the base-plate to seal that end. There should be a spring valve as part of this end plate, although some filters are claimed to have the bypass valve as part of the anti-drainback valve, and hence less easily identified. The purpose of the bypass valve is to allow oil to flow if the filter medium should get blocked with dirt, but perhaps more importantly it can also open on cold starts when the oil is very viscous and little flows through the medium. Without this pressure relief as well as lack of oil to the bearings pump pressure could rupture the filter medium, effectively leaving you with no filter at all. The Mann types take about 1 bar or 15psi to bypass, nicely inside the Workshop Manual spec of 13 to 17 psi. Wix (WL7124 for the MGB) seems to come out well, but like the Mann W916/1 don't seem to be available in the UK from a Google search (however a chap at Stoneleigh had a couple of Mann W916/1 at £3 so I bought one, and I won an eBay auction for another at 99p, albeit plus £3 p&p, so I'm OK for a couple of years). **June 2011:** Nigel in Belfast has written to say that his local motor factors stocks the Mann W916/1.

Anyone still thinking about using Fram (including GFE121F for the MGB remember!) should watch this - the ends of the filtration medium should be clipped together to form a cylinder such that with (cardboard!) end caps all the oil has to flow through the filter, but only half of the length is held in the clip leaving a dirty (pun intended) great hole for unfiltered oil to flow straight through! Also this which seems to show a collapsed filter cartridge, quite probably from not having a bypass valve. Whilst there seem to be several different grades of Fram the element seems to be common (poor), with only minor differences in the valves (poor to not much better). STP (made by Champion!) are even worse than Fram, having the same cardboard end caps (all the other filters viewed have metal) and no bypass valve at the closed end, but only having a plastic former for the filtration cartridge whereas all the others, even Fram, have a perforated metal tube.

Filters not sealing - hose positioning *March 2019:*

March 2014: After several years with no problems getting replacement filters to seal straight away at each service, I started to get the occasional one that chucked about an egg-cup of oil out at the first start, then sealed OK, and was fine until the next service. Then a couple of years ago it didn't seal itself, and I had to slacken and retighten the new filter before it was OK. Then last year I had to do that four times, and fit a second new filter, before it sealed.



I was beginning to think there must be a problem with the filter head (adapter attached to the block to allow the use of an inverted spin-on canister), even though once sealed there was never a problem until the next service, so got a used one from Welsh MG as a precaution. Again not a problem for the rest of the year, but this year when I removed the filter I cleaned up the sealing surface of the filter head and had a good look at it. And even with my eyes and possible distortion from glasses it immediately looked as if the sealing surface was warped. Smeared some copper grease round the seal of a new filter, wound it on until it just touched, and removed it again. The only grease on the sealing face was at two areas 180 degrees apart from each other, and nothing on the rest. Regreased the seal and fitted the filter again, this time turning it half a turn after contact before removing it again, and this time there is grease round three-quarters of it, but not at the remaining quarter, which is where it has been spurting from. So definitely suspect, and must be changed.

My next concern was how tight the bolt into the block was, after being undisturbed for possibly up to 40 years. I could imagine the bolt shearing, and then what would I do! So got underneath with a long extension on the socket, tentatively applied some pressure to the ratchet handle bearing in mind the brake pipe in the vicinity, and the bolt came undone - it was barely finger tight.

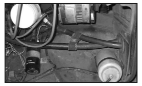
Next possible trauma - the oil cooler hose. An adapter between that and the filter head, with a 9/16" Whitworth hex on the hose connection, and fractionally smaller than that on the adapter. I only have one 9/16 and a Metric spanner which is slightly larger. With the spanner on the hose fitting Sod's Law dictates it is the adapter that comes free first. No big deal, I'm removing the filter head so could unscrew it from the hose. But the 'start' on the new one is quite likely to be in a different place, meaning the cooler hose would be under torsion, and in any case the replacement filter head has its own adapter already fitted. But with the 9/16 on the adapter, and a penny in the jaws of the metric spanner makes that a snug fit on the hose fitting. Squeeze the handles together between my two hands (avoids putting stress on the adapter or filter head) and the hose fitting comes free. Remove that and tie it up out of the way to stop it dripping. With that off and the bolt removed the old filter head comes free with a bit of wiggling.

With a new filter screwed on to the old filter head until the seal just touches, there is no-less than 65 thou or 1/16" inch clearance half way between the two places the seal is touching. Even tightened a further half turn there is still 25 thou or 1/32". How did that happen? It's been getting harder and harder to get a seal, so it must have been warping more and more over the years, but how?

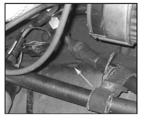
Any way, check the new filter head with a filter and as soon as it touches it is touching all the way round, so that should solve the problem. For good measure I run a whetstone round the flange that goes up into the groove on the crankcase until that shows clean metal all the way round.

What to do about the sealing ring? It's been in there up to 40 years, and from past experience it can be a beggar digging them out, and there is not much room to get one's arm up to get at the one on the MGB. I poke it with a pointed screwdriver and it still shows some resilience, so opt to leave it in-situ. But for good measure put a smear of flange seal round the lip of the new filter head and bolt up, comparing the angle of the adapter for the oil cooler hose with a photo of the original I took earlier, and fit the hose.

I'd already drained the oil, so refilled it. I'd also decided to take the plugs out, disconnect the coil and crank it on the key first of all in case there was a disaster with oil spurting out all over the place, as that should chuck much less out than an engine on fast idle having to slow and stop. Cranked for a few seconds, looked OK, then cranked again until the oil pressure just started to rise. Still OK from on top, get underneath to see a slight glistening against the crankcase immediately beside where the filter head contacted it. Was that a leak? Or a trace of oil left behind from what leaked out on removal of the old filter head? Replaced the plugs, connected the coil, and fired up. Full oil pressure, and after a few seconds there was a thin line of oil slowly making its way down the side of the crankcase - buggah, should have changed that seal. Nevertheless, running it for ten minutes or more up to full temperature, it had only just reached the flange on the crankcase where the sump attaches, so not major, it will just have to leak like all the others. It was only subsequently when showing a neighbour the warped filter head, when I noticed that the flange that goes up into the groove on the crankcase was like a switch-back! That would have put a set on the seal, making it less likely to seal to a flat surface (the opposite problem of a flat filter seal failing to seal to the warped filter head). Definitely should have changed the seal! Oh well, next time. Next day I thought it was worth tightening the filter head bolt a bit more, as I could feel it tightening onto rubber and not anything solid. Couple more clicks on the socket ratchet, and that together with the old seal quite possibly moving to accommodate the new filter head seems to have stopped the leak - at least I thought it had, but it still weeps a bit, so I shall have to bite the bullet. *March 2019:* Forgot all about this and no leaks evident since, so left it alone. I didn't change the copper washer on the centre-bolt either, I know people are paranoid about these and re-anneal (soften with heat) at every oil change, but I've never done it on multiple cars over 60 years and not had one leak.



Overnight subconscious pondering also made me realise the cooler hoses go through the wrong holes - the filter head hose is through the upper hole instead of the lower. The strap tying the two hoses together was also very near the filter head. When I went to re-attach the hose to the new filter head I had to push it down quite a bit, when then bent the hose fitting downwards so the threads were nowhere near in line. To bend that back up, while the hose was pushed down, was taking more force that I was prepared to use, so I slid the strap forwards towards the radiator diaphragm which made it much easier to align the threads. It occurs to me that the force I wasn't prepared to use, had been acting upwards on the adapter in the old filter head for anything from 25 to 40 years, in precisely the direction that the filter head had 'bent'. Will I correct the hoses? Probably not until the engine has to come out, or the cooler or hoses replaced.



Subsequently I noticed a depression in the inner wing, free of paint and rust, which looks like the oil hose elbow has been rubbing or hitting it, even though I've never been aware of a knocking. The elbow is well clear of it now, but it also raises the question of just what angle the filter head should be wrt the block. At the moment it is angled slightly backwards, which puts it close to the distributor as it was before. At right-angles, or even slightly forwards, would give more clearance to that but put the elbow closer to the alt. However that could be compensated for by adjusting the angle of the elbow.

Gavin Sidey on the MGOC forum with a similar problem, but the 'grease ring test' indicated the adapter was flat unlike Bee's. However in this case after tightening the filter, then running the engine and getting oil spurting out, he was finding the filter loose, indicating perhaps it had jumped a thread. The threads are indeed very rough where the filter tightens, so he has one from Welsh MG on the way.

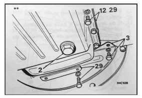
V8 Engine

V8 Bearings *Added March 2009*

Bearing (let's get that one out of the way as soon as possible) in mind the V8 is now on its 3rd time round the clock, I have done 75k in it, and the last major work was done getting for 100k ago, I've been thinking that I really ought to check the clearance and condition of the shells and journals. I'm going to have to examine the existing ones first anyway as I don't know what size they are (has the crank been reground or not when the rebore was done?) and I'd been advised that they can take a long time to order and I didn't want the V8 sitting round half dismantled for months. So I'm planning to have a look, reassemble unless I found something truly bad, and then make the decision on whether to replace or not so I could use the car while they were on order. So some unseasonably fine weather in March when it wouldn't be too cold a job but before the main running 'season' seemed like a good time to do the job.

Get the front of the car up on stands under the spring pans. I'm going to remove the rack as I want to remove the cover from the oil pump, having erroneously used sealant on the gasket when I did the top-end several years ago. It's not a big deal, but it increases the clearance inside the pump which reduces flow and pressure slightly, and every little helps. That needs the wheels off and the tapers on the track-rod ends cracked, which is a doddle with my scissors tool. Remove the bolt from the lower half of the steering UJ, remove the crossmember bolts, and using a screwdriver to wedge open the slot on the UJ a little the rack is off.

Look at the sump and realise that the right down pipe will have to be removed in order to drop the sump. A bit of a bummer as there was no space on the left side of the car to get to the middle clamp which needs to be undone to slide the pipe back, which needs to be done to disconnect the down-pipes from the Y-pipe! Whilst I could have rolled the car out of the garage to give me more space the drive is on a slope and I can't push it back in again, and I didn't want to run the engine otherwise oil would be dropping down on me all the time I had the sump off! Think Ahead! I can get to the down pipes, Y pipe and the rear clamps OK but the middle was a real struggle. I was lucky in that a pair of channel pliers I had spotted in the Pound Shop just a couple of weeks ago just got to the nut and moved it, it would have been more of a struggle with sockets and spanners. It's always a fight to get the down-pipes out of the Y-pipe, even more so to get the down-pipes off the manifold, eventually I settled for swinging them out of the way.

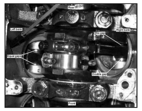


Next problem was having removed all the sump nuts I find I need to remove the semi-circular cover-plate covering the back of the flywheel to give me that extra 1/2" or so for the back edge of the sump to drop down below the bottom of the bell-housing so it can then clear the cross-member. Must have had to do that before when I replaced the sump but forgot, so have to retrieve a couple of bolts to support the sump again while I remove the cover plate, then I can remove the sump. First thing I saw with the sump off was a lump of metal sticking through a hole in the baffle plate! Immediately realise with relief it is the dip-stick ...

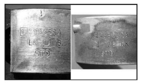
Next off was the oil strainer. I did wonder if I should remove the baffle plate first as it partially covers the strainer bolts, but found out when replacing them that is not the correct order! Found the strainer nuts barely more than finger tight, if they had come any looser it would have been sucking in air which wouldn't do the bearings any good. Then the baffle plate comes off and all the bearings are revealed. Discover that oil lies on top of the baffle plate even though the engine is tilted quite a bit, but only when it starts dripping on me.

Decide to work from front to back, even though the front ones are over the cross-member, I'll leave the easy ones for later on when I'm more tired. Start with No.1 big-end though, followed by No.1 main. As I only started after lunch and it is now nearly tea-time I stop after these two and leave the rest for next day. The 16-point nuts on the big-end caps are useful as the studs are at an angle of course, and I only have a short swing as I have no hoist or pit. I use the torque wrench to undo them as it gives me more leverage than a standard socket wrench, but doesn't need as much room as a breaker bar. Makes the big-end nuts easy, although the main cap bolts are still quite an effort. Sometimes the big-end caps come off just with finger pressure, sometimes they need a wiggle with the channel pliers. I start off loosening the caps with the nuts still on a few threads so it doesn't suddenly come free and fall on the ground. All the mains caps need quite a bit of wiggling with the channel pliers as they slide up into slots and are a snug fit.

Given the mileage of 200k I'm surprised to find all the bearings are standard size, i.e. no crank regrind (just possibly a replacement crank I suppose). Even more amazed to find the big-end journals are perfectly polished, with most of the shells showing little or no signs of wear. Mains are a little more marked for some reason. I'm using Plastigauge to check the clearances, so apply the mineral grease to the shell, silicone grease to the journal, cut a length of strip for the shell, refit and torque up. The big-end caps have a rib on one side, which must go on the same side as a pip on the con-rod (of which more later!), and the main caps have an arrow that faces forwards. Be careful to get the caps the right way round, and also back onto the original pistons if you remove more than one at a time which I didn't. When torquing up do each nut/bolt on each cap bit by bit, not all on one then all on the other. Also I found that it wasn't enough to simply move the wrench till it said 30 ft lb (big-ends) or 53 ft lb (mains) as on the big-ends if you held the bar of the wrench in the same position once you had reached 30 ft lb the torque actually reduced as the cap settled, so you needed a bit more movement to get it back to 30 ft lb. I had to do this several times on each nut before it stabilised. Undo again and remove the cap to check the Plastigauge. By putting the mineral grease on the cap and the silicone on the journal as recommended you end up with the Plastigauge stuck to the journal. Ok if you are on the bench, less so if you are in my position, so I swap them round so it sticks to the cap instead. And now the major discovery!



As I say the manual says that the rib on the big-end end caps must go on the same side as a pip on the con-rod. I check the first two and notice they are both towards the back of the engine. Then I check all the others and find they are the same - both end-caps and con-rods. That doesn't make sense, if they should all go to the back why doesn't the manual simply say that? Then I notice the shells are offset in the end-caps, and then I realise that is because each pair of pistons shares a big-end journal, so each big-end only has to cope with one of the radii that is at the edge of the journal, and the shells are offset away from the radius. The even-numbered pistons all show a chamfer on the rear edge of their shells, because the shells are offset **towards** the radius instead of away from it! So all my even-numbered con-rods i.e. the right side of the engine are the wrong way round!! A whole lot of thoughts race through my head now, I wonder what on earth was the effect on clearances, torquing down, stiffness in turning the crank when it was assembled like that. I also wonder about little-end positioning, and look up inside the bores to see equal gaps either side of the little-ends on the left-bank but double-clearances one side and no clearance the other on the right bank. The rebuilder can't have checked the clearances, unless the torquing down had simply pressed the chamfer in, and it must have made the crank stiff to turn. It is obviously a major error on the part of whoever rebuilt it last time, but what should I do about it? I can't turn the con-rods round on the journals and reuse the existing shells as that will make the wear patterns completely different, I will need new shells. And even with new shells what will happen when I turn the pistons in the bores - assuming I can physically turn them through 180 degrees, as well as what effect that will have on the position of the rings in the piston grooves as well as wear patterns between rings and bores. Then common sense kicks in and I realise that if it has done 80k none too gentle miles in my hands over the last fifteen years, and quite probably getting on for 100k in all since it was assembled like that, then it is unlikely to do anything different any time soon.



So it is a steady plod through the bearings one at a time, Plastigauging, then cleaning off and refitting the end-caps. Can't see the point of removing them all together which just increases the risk of getting them mixed up or dirty, and I would have to leave at least two mains caps in place at a time as the engine is still in the car, and I've decided to run with the existing shells for the time being. I oil each shell immediately before refitting even though priming the system should flood them with oil anyway (see below). All the bearings are at or just inside the upper limits of .0021in (.05mm) for mains and .0023in (.06mm) for big-ends. But does that mean they are on the limit of needing replacing? Or that is the upper limit for new bearings? *August 2010:* Even more surprised to discover that the quoted big-end figure at least is for new bearings, existing ones can go up to .003" (.08mm) before needing replacement according to this Dutch SD1 rebuild site!

That done it's time to start reassembling. Clean the base of the block ready for the sump with new gasket. Cut a new gasket for the oil pickup and use Hermetite Red for reassembly. Should have fitted the baffle plate first as it is a bit of a fiddle with the pick-up in place. Then clean the sump, scrape off the old gasket and sealant. Spread Hermetite red along the raised ribs and round the bolt holes. Lay on the new gasket, then more Hermetite on that. Very carefully offer up sump and gasket so it doesn't pick up any dirt on the surfaces. Have the bolts to hand! With one fitted each side I can relax and fit the others, starting each one, making sure the gasket is positioned correctly, before tightening any. With them all in I can go round and round and round nipping each one up bit by bit. Could have sworn they had a torque figure of 6 ft lb so the flange isn't distorted, but can't find that in the book, so do mine to about 10. (Subsequently found a source for other V8s which says 17 ft lb). Clean the flywheel cover and refit that.

Next is the big struggle to get the down-pipes and Y-pipe reunited. I manage to get the left pipe fully onto the manifold, but the right just won't go back up. Eventually I get it off altogether and use coarse abrasive paper on the inside to clean

it up, after which it does go on with a bit more of a struggle. Then it is a matter of walking round from front to back to front again a couple of times as the rear clamp despite being loosened right off isn't allowing the pipe to slide through it while I push the Y-pipe onto the down-pipes, so I have to 'walk' it through a bit at a time. At least the manifold and Y-pipe clamps are relatively easy to do up, I can leave the middle and back ones until I can get the car out of the garage for more space. Next job is the oil pump, but as it is now 4:30 and I have spent the whole day on the car decide to call a halt there.

Next day is a rest-day as we have other plans including a picnic lunch on the hills overlooking Henley-in-Arden in Warwickshire as it is such a beautiful day, unbelievable for March.

Thursday it's oil pump time. Whilst in theory you can change the gasket just by removing the bolts and lifting the cover away a little, in practice it is going to be stuck down and need scraping so better to get the cover off altogether, which means undoing the oil cooler pipes. These have a male-to-male adapter between the pipe and the cover, and the pipe nut has to be undone before the adapter is loosened from the cover as other wise the adapter can't be unscrewed from the cover! There seem to be several sizes of nut, all large size, and all requiring open-ended spanners. I really struggled with this last time as I didn't have any spanners that would fit, could only get one undone, and had to resort to unscrewing the timing-chain cover from the end of the other hose. But prior to Stoneleigh last month I carefully measured the hose nuts, steel pipe nut on the filter, adapter nuts and the flats on the oil cooler and managed to get spanners to fit the last two. Together with one spanner that I already had which fits the hose nuts but is a bit big I did manage to get the hoses off the cover and so could completely remove the cover. The cover bolts are 5/16" sixteen pointers so need a special socket as all my small ones are only eight-point. Some of the bolts are also recessed so it needs to be a deep socket as well. I found the heads of the bolts pretty worn last time, I should have ordered a new set from Clive Wheatley but omitted to do so. I knew one was particularly bad and indeed the socket just slips round, but I manage to tap it round with a drift first on one side then the other. All the others come undone OK. Get ready for some oil to run out when the cover is loosened, and to drip from the oil gauge connection when that is done (if yours is on the pump like mine and not on the filter as earlier). Then it is a matter of making myself comfortable while I scrape the old gasket off the timing cover, remember it is only alloy so take care! Stuck well to the timing cover, only a couple of specks on the pump cover (Sod's Law) but patience and care sees the job done. It's safest to remove the loose gear (the front one) from the pump while the cover is off to avoid it falling onto the ground. The driven gear similarly only pushes in but it's longer shaft, engaged with the distributor spindle, makes it less likely to fall out. Scraped clean I refit the loose gear then pack the pump with Vaseline ready for priming. Lay the new gasket on the cover (observe orientation!) offer it up and fit bolts making sure the gasket is correctly aligned. This is easiest done by putting one bolt through the cover and gasket before offering it up and just starting that bolt before fitting a second bolt on the other side. The rest are easy. Nip them all up then start torquing them. The MGB GT V8 Workshop Manual supplement says 13 ft lb, but I find I can only get them just over 10, after that turning more doesn't seem to make any difference. Worried about stripping the threads I stop there. Later on I find Land Rover (p14) information that says 9 ft lb for non-Suffix B engines and 3 ft lb for B-suffix engines! Misprint in my manual? They stayed on and leak-free, but several years later when I came to remove the pump cover to transfer to a new timing cover the socket spun on several of them, and one had to be drilled out. Oil pipes go back on next.

Time to fill with oil and prime. I've been looking at oils and their ZDDP content recently, and ideally want a 20W/50 more than a 15W40, and an API SJ rather than an SL and certainly not an SM. Halfords do a Classic 20W50 to SL but the cans are unsealed (I subsequently discover that all the cans come with a plastic insert but it's hit and miss when removing the cap as to whether it stays in the can or in the cap!) which worries me. Next best thing seems to be 15W40 enhanced diesel oil which is SJ. But a friend says he managed to get some 20W50 from a Mini place near him, which makes me think of my local Mini specialist Min-its in Hockley Heath. Sure enough they have Valvoline VR1 20W50 SL spec in 5L at about �19 which is only a tad more than Halfords, so that's the one for me. With the oil in I remove the distributor so I can get a drill on the oil pump to prime. This is a huge benefit over the four cylinder, as you can just spin the V8 pump and so get oil right the way through the engine before you turn the crank. With the four-cylinder you have no choice but to crank with the plugs out and hope. The longer it cranks without pressure the more wear it is putting on the bearings, pre-oiling the shells will only last so long. But before removing the distributor remove the cap, and turn the crank until the rotor is pointing to No.1 plug lead, which should be where the front vacuum capsule screw is. This is important, because unlike the 4-cylinder the distributor can go in as many ways as there are teeth on its skew gear, but only one way is right if you want the orientation of the vacuum capsule to be correct. Then as you remove the distributor watch the rotor turn slightly as the skew gear disengages, and this is the orientation you will need on reinsertion. Once you have done this don't turn the engine or you will have to retime from scratch.

I've long wondered whether the very long, very small bore pipe from the pump to the gauge is the cause of very slow gauge rise on V8s compared to 4-cylinder cars. This is after the take-off was moved from the after the cooler and filter to immediately after the pump i.e. the same as for the 4-cylinder cars, so what it was like before I dread to think. I have another gauge with larger bore plastic tube which fits the adapter on the pump so use that so I can compare gauge rise times as well as monitor pressure from the engine compartment while I'm priming. That connected, I use my patent pump driver which consists of a bar with a flat ground on the end to engage with the slot in the pump (some versions of the V8 for other applications have the slot and flat reversed) and a length of rubber hose which is a snug fit over both pump shaft and bar to keep the two engaged. Run the drill on slow speed, this time there is no instant slurping and gurgling like there was last time, but I persevere and start to see the gauge rising. Keep spinning the pump, and the pressure rises oh so slowly, so it can't be the pipe. There are so many outlets from the pump given five main bearings, eight big ends, sixteen hydraulic tappets and rockers, it probably takes that long to fill all the passages which is has to do before it will develop any pressure. But develop full pressure it eventually does so I'm confident fresh oil is flowing through the bearings. Remove the temporary gauge and fit the normal pipe.

Refit the distributor being careful to position the rotor relative the vacuum capsule when you had removed it. Check the orientation of the drive dog on the bottom of the distributor and turn the oil pump slot to the same position. Insert the distributor, if it fully seats all well and good, if not turn the crank **a little** and try again. When inserted put the crank back to the TDC mark and recheck the angle of the rotor. Plugs still out so ignition on and crank, and watch for oil pressure on the cabin gauge, which I get. Time now to fit the plugs and leads, and go for a start. The first time I tried after a few revolutions the starter was almost stalling, which immediately said to me ignition was happening at the wrong time. Turn the engine to one of the TDCs and remove the distributor cap and for some reason the rotor is about 90 degrees out. Odd, how did that happen? I try a couple of different ways to try and determine the top of the compression stroke without removing the rocker cover, but give up and just go for one of them. Remove the distributor and reinsert it with the rotor in the correct position, and try again. This time I don't get the stalling but I get popping in the exhaust, so I reckon it is still out but this time 180 degrees out. Remove the distributor again and turn the crank 360 degrees, refit observing rotor orientation again, and this time it fires up as it should. Set the correct timing with my timing light and tighten the distributor down. Recheck timing and still OK. Phew, major milestone. Subsequently I thought maybe I had cranked it with the distributor out to get oil pressure on the cabin gauge before starting, but as it's the distributor that drives the oil pump, and I did get pressure, the distributor must have been back in by then. Also even though I turned the crank while checking the bearings, I didn't take the distributor out until after I had finished that and was ready to prime, so it wasn't that either. It remains a mystery.

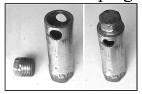
Now time to refit the rack - not ideal with a hot engine! This is a fiddle single-handed, you have to balance the rack on its mounts but forwards, rotate the rack shaft and steering column until the groove in the UJ is **exactly** in the middle of the notch in the rack shaft, get the splines just started, then get down by the front and push the rack shaft into the UJ. Much easier to write than do, the only place you can get an arm down to the rack to position the end of the rack shaft right on the end of the UJ from above is immediately behind the radiator, and it is very easy to dislodge the rack so you have to get underneath and reposition it again. Any road up, eventually it goes in, fit and tighten the clamp bolt, and the rack to cross-member bolts. Remember to check the horn at some point if the button is in the wheel centre as while removing and refitting the rack the column shaft and wheel are moving in and out of their tube which affects the horn contact and wheel slip-ring. With the rack fitted attach the track-rod ends to the steering arms, the road wheels, and put the car back on its wheels. Roll the car out of the garage so I have easier access to the middle and rear exhaust clamps, and we are done. Clean and pack away the tools and tidy the garage, get cleaned up and changed, and go for a test drive - it's good to have her on the road again. Check the oil level beforehand though and find it is mid-way between Min and Max. Normally 5L of Castrol or Halfords has always brought the level right to the Max mark on the dipstick after an oil and filter change, the lower level may be because I completely emptied the sump, lost some from the top of the baffle plate and the oil pump, but I'm surprised it was as much as the half a litre it took to top it up. Maybe the Valvoline, which came in an old-fashioned 'square' plastic container is only a gallon i.e. 4.54L and not 5L. I've have to wait and see what happens next time.

Subsequently one highly respected opinion is that the rings turn in the pistons anyway, so wear on those and a particular orientation in the bore isn't an issue. Even if I'd known that before I finished the shells and considered turning the pistons in the bores from below, space is very restricted with the crank and its large counterbalances in the way, and I don't know if it would have been possible, also I would have needed new shells. As it is I'll just carrying on driving it as before, but given that the compressions have always been uneven and I know I have some blow-by on hard acceleration I doubt I'll open the engine up again top or bottom until I'm ready to have a rebore, and possibly a crank regrind, and that depends on if there are +30 pistons available or I can get it resleeved. In any event a major expenditure, which at typically 3k miles per year I may well not get round to.

Cylinder Heads

There is a particular issue with the V8 in that the plug body is deeply recessed into the head, with very small clearance around the hex. So small that my original 1/2" drive plug socket of 1.1" outside diameter wouldn't fit the hole. I managed to find another of a slightly smaller diameter (1.087" OD) that fitted, but only just. Since then a pal has mentioned someone he knew had to use a 3/8" drive socket, I've checked mine and that fits as well (1.070" OD). So if you are having trouble finding a 1/2" that fits, try a 3/8". I have investigated the smaller-bodied 16mm (instead of 21mm hex) plugs, as used in my past SD1s, but there don't seem to be any with an equivalent reach (BP5FS has been suggested but is shorter at 10.9mm so compounding the thread-strength problem), and they all seem to be tapered seat instead of gasket seal, so not suitable without recutting the seats.

October 2017: Having replaced the heads on the V8 I find even my 1.087" socket binds in one head, and doesn't fit at all in the other, and although I mention above 'my' 3/8" drive fitted, try as I might I can't find such a socket today, only for the smaller 16mm hex plugs. I'd buy one, but not without checking the OD first, and Halfords don't have them. I had modified a box-type spanner when I rethreaded one plug in an old head as it ended up slightly canted over and the socket no longer fitted, and I was fortunate that I still had this in the back of the car (which was in the paint shop) when I came to fit the plugs to the new heads for the first time. But that's awkward as being short-reach with a tommy bar one has to unscrew the plug one flat at a time.



Back home and after Vee was back on the road I needed a more permanent solution. Next ploy was to weld a bolt head to the top, so I can use a standard socket. Searching for a suitable bolt I found the results of a previous experiment which was a 3/4" bolt head welded to the end of an original axle level/fill plug, the ones with the tapered square hole which are such a pain, subsequently replaced by current-stock plugs which have an Allen key hex socket - and found that was a perfect fit for the plain-end of the box-spanner! That still left the hex part too large to fit in the recesses, which are a range of sizes, so I worked along them one by one filing down the corners of the hex bit by until it fitted them all. Works well, a 3/4" socket on a sort extension loosens them, then the plug spanner can be turned by hand as it gives a good grip, then the plug can be lifted out. Replacing the plug is turned by hand first, then with the spanner by hand, then final tightening - carefully! with the socket. *November 2017:* Re-reading "try as I might I can't find such a socket today" I re-measure all my sockets and realise that the one in the 3/8"-drive socket set that I rarely use these days is the 1.070" one, and does fit all the V8 plugs! Doh ... So I've swapped that over with the one in my main socket set (which already has a 1/2" to 3/8" adapter) ... leaving my home-brew in the V8 boot ... just in case.

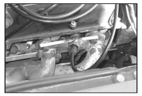
Stripped threads! *September 2011:* I hadn't thought about it before, but V8 plugs have the standard fine thread, they are short-reach instead of the longer reach of the 4-cylinder (although apparently later heads have 3/4" reach instead of 1/2"), and of course are in an alloy head, so much more care needs to be taken to avoid stripping the threads. Needless to say I didn't think about that until I stripped one! I've never used torque when tightening, but whilst some sources say you only need 15-22 ft.lb. for 14mm gasket-seal type (as opposed to tapered seat) in aluminium as opposed to 26-30 ft.lb. in cast iron, others give the same figure for both. There is also a question-mark over applying anti-seize to the threads - some recommend it, but only if the plug body is black or plain steel, if applied to pre-coated or nickel-alloy bodied plugs the torque should be reduced by 30%-40%. It's also advised in various places not to remove plugs from a hot aluminium head as this in itself can weaken the threads. But then another site says you can remove them overnight-cold, or just switched-off hot, but not in between, because they have different rates of cooling contraction and the head grips the plug tighter at cooling temperatures.

I think the one thing that people **do** agree on is that in any engine you should always start the plug by hand no matter what, screw them in as far as you can with a plug socket on them still by hand - with a short extension in the case of the recessed plugs on the V8 - until they bottom, and only use the socket wrench (OK, maybe a torque wrench!) for final tightening.

Unfortunately I did remove a couple of plugs from a pretty warm engine, at a pals house in order to fit a Colortune to see if a rich mixture was the cause of Vee being difficult to hot-start. Annoyingly I didn't need to do this, as immediately before I had checked the lifting-pins and if anything they were a smidgen weak, certainly not rich. But I did, to no avail as the colour was blue with orange flecks which is apparently correct (although I find them difficult to read and much prefer the lifting pins, but others say they find **those** difficult to 'read'). On replacing the plugs I always put them in by hand until they bottom, but using the socket wrench No.1 wouldn't tighten after a couple of clicks which was a bit concerning, so I stopped anyway. It was only after that I realised I hadn't changed the plugs for some nine years and 25k miles, and although visibly in good condition that is a loooong way past the 10k change interval. So I changed the plugs (which was a bit of a saga in itself, having bought new using a Bosch number I had written in my Workshop Manual years ago, only to find they were the wrong ones, and I had a brand-new set in the boot anyway!) but tightening No.1 by hand as usual it just kept turning, it never bottomed. I looked at the plug I had taken out but there was no aluminium on it, so removed the new one and the threads were completely filled with a spiral of aluminium!! I was devastated. But nothing to lose, I screwed it again carefully until I could just feel some extra resistance, and fired up the engine. I was quite surprised it didn't pop out, not even when I blipped the throttle quite hard, although I can hear a faint ticking which is probably a small combustion leak. Got it up to temperature with the fan cutting in and out, switched off, and restarting both then and a few minutes later and on subsequent occasions has been instant, so the ancient plugs do indeed look to have been the original cause. But what do I do now?

Helicoiling should fix it, but can it be done in situ on the V8? Does the head need to be removed so you can all the aluminium chips out from the retapping process as well as for access? I really didn't want to do that as the last time I had a head off one of the bolts snapped, and that had to be drilled out and the block retapped, which was pretty traumatic. I'd rather undo the engine mounts and lift and/or tilt the engine to give the required access, coat the tap with grease to catch as many chips as possible, and put grease-coated cloth or cord inside the cylinder with the piston at the top to catch as much as possible of the remainder, and take my chances. And how do I get the car to an engineering place to do the helicoiling anyway with the plug as loose as that?

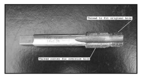
Looking at No.1 plug I reckon that I can fit a plate between the two exhaust manifold bolts neither side of it, with a metal tube behind the plate over the insulator and bearing down on the body to press it against the head. However the plug is at a compound angle to the plate, being tilted upwards as well as backwards, making the cutting of the end of the tube a pretty precise requirement. As far as the tube goes I remember I have a couple of old (very old, one of them at least came to me from my Dad nearly 45 years ago) box-spanner type plug spanners, the type you use a tommy-bar with. These are swaged out to make the hex, and the other, round, end is a perfect fit over the ceramic insulator to press down on the metal part. As far as attaching the outer end to the plate goes, rather than cutting the end of my 'tube', if I drill a hole through the plate and oval it in the correct way, I can get the correct alignment of the tube over the plug. I mark out and cut a plate (ex-BT equipment blanking plate from 1975 or so) to fit the space and the bolt holes, and project the end of the plug onto the back of that to get the centre of the hole for the tube. Drill and cut a round hole, then with the tube inserted through the hole cut the bottom right and top left out further bit by bit to get the correct angle on the tube, and centred over the plug. I remove the top exhaust manifold bolts each side, put the bolts through the holes in my plate with the thick washers **behind** the plate, and refit the bolts. This spaces the plate out by 1/8" or so (and hence will press down hard on the plug when the thick washers are finally fitted on the other side) while I tack-weld the tube to the plate in a couple of places. Carefully remove the plate and tube, and blob weld round the tube on both sides of the plate. I'm confident the weld will take to the steel tube OK, but the plate has some kind of yellow (passivated zinc?) anti-rust coating so I'm not so sure about that. However by having blobs both side of the plate, the worst that will happen is that the tube could rotate in the hole, but not while it is pressed against the plug. Check the plug is screwed in as best it can, fit the plate and tube over it and bolt down, and fit the plug lead. The rubber end of this projects past the outer end of the tube, so can easily be fitted and removed with the plate and tube in place, even though the plate and tube will have to be removed to remove the plug. However since that is only a once per year activity at best, that's not going to be a problem. Start the engine and no ticking this time, so run it down to Halfords to see if I can exchange the plugs. No problem, they have to order them and I have a choice of "�4 each for delivery tomorrow, or �2.70 each for deliver in 3-4 working days?" so I say "The latter please, I've got ten years ...". I also get �5 back against the incorrect plugs, the only bit of good news in this whole sorry saga.



So now I need to give it a bit more running including motorway blasts, and decide whether I can trust it up to the Lake District for our annual walk in two weeks time or not. I could live with it failing on the way back as I'll simply get it AA Relay-ed back home, but it would be a bit of a buggah if it failed on the way up. If it's near home then get it brought back and use my pal's car instead, if it happens near the lakes then get a tow from the other car going on the trip, then Relay-ed back home afterwards. But seeing as how the plug didn't blow out when not held at all, I don't really think there is going to be a problem now it is being pressed against the head by the tube and plate, which should press even harder when the tube gets hot and expands. (In the event it ran beautifully there and back, 420 miles, 34mpg). Subsequently the pal above, who does part-time MOT-ing at a local (to him) garage, says he knows they have had to helicoil heads in the past when a plug thread has stripped, and he can borrow their kit overnight. It'll have to wait until October though, when he is coming past on his way to Wales for an overnighter then coming back past next day. Watch this space!

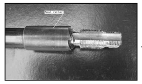
Thread repair: *October 2011:*

Said pal brings the repair kit. This involves a lot more than simply Helicoiling, it is a special kit for spark plugs as they bottom onto the insert, so needs a flat and smooth surface, whereas standard helicoiling usually has a bolt going through a plain hole in another part before going into the thread so it doesn't matter that breaking off the tang on the helicoil insert leaves a rough part sticking up. I fed a rag in through the plug hole with the piston near the top, then pumped some grease through the plug hole onto the cloth, so that hopefully any chips that escaped from the cutter would be trapped by the grease on the cloth. **Make sure** you have very long-nosed pliers, or a pick, to hoick the cloth out again. You are going to be doing this after cutting the oversize hole for the insert, but before fitting the insert, so it will be easier to get out than feed in. **Make sure** the piston is low enough to allow the cutter to go all the way into the head (until the end of the cutter thread is just below the outer face of the head, not screwed all the way through so it drops into the cylinder ...) without fouling the piston.

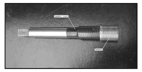


The first part of the process is to screw the thread cutter into the remains of the thread. The first portion of this is the same thread as the original hole, and when that is fully screwed in it pulls the cutter itself into the head to cut the oversize thread for the insert. It also **should** ensure that the new thread is exactly on the same alignment as originally ... but read on. Both parts have flutes as for cutting taps, which I completely filled with grease to catch the chips. The first part starts with thread straight away, rather than the short plain bit you find on a plug, and this made it impossible to start by hand as I just couldn't find the start of the threads, whereas I could still screw the plug straight in. In the end I just put the wrench on the end of the cutter pressed down a bit and went for it, and it seemed to pick up the thread OK. Once started it screwed the rest of the way in by hand, i.e. was not tapered, and this was where the second problem occurred. The trouble is that with a stripped thread there may not be enough original thread left to pull the cutter part in to cut the oversize thread, which was what happened to me. This was exacerbated by the main cutter thread also being parallel and not tapered, which makes it difficult to get started, compounding the problem of the stripped original thread. It would have been better if both parts

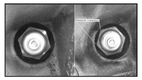
had been slightly tapered - the first to cut a new thread only slightly oversize so as to stand a better chance of pulling the main cutter through, and the main cutter also tapered to make it start easier. As it was I had to press down on the end of the cutter as hard as I could whilst turning it with the wrench before the oversize part would start to cut in, and this may have caused the subsequent problem I had. As usual half a turn or so to cut the thread, then back off a quarter turn or so to break the chips off. After several turns you really need to remove the cutter, clean the chips out and regrease, as all the chips seem to be pushed forwards into the flutes of the narrower part of the cutter. This actually gets **more** important as you go on, as the narrower part gets pushed further and further into the combustion chamber. Initially the chips are retained by the plug hole, but right at the end the last chips will be free of the plug hole and without grease in the flutes would drop into the cylinder. I didn't realise this at the time, but cleaning the oversize hole once I had removed the cutter I caught a big dollop of grease and chips which was hanging on the edge of the hole inside the combustion chamber.



However before that, while the thread cutter is screwed fully into the head, and the upper threads are just below the surface of the head, you slide the seat cutter over the thread cutter and turn it with the tommy-bar until you can see a clean seat all the way round the hole. Why is this needed if the new thread is exactly on the same alignment as the old? Read on. And in any case as the cutter is angled, I'm thinking it is really intended for tapered-seat plugs, and not gasket seal as these are. Then it is a case of removing the seat and thread cutters, winding the piston back up so I could hoick the cloth out which was daubed in grease and had caught a few more chips, and finally cranking the engine with coil disconnected to hopefully blow out any remaining chips.



Next stage is to insert the ... insert. Pick the correct length insert which should be as close as possible to the old, but shorter not longer, however **not** shorter than the threads of the plug, as these could pick up carbon which will make the plug difficult to remove in future. Dip the end of the insert tool into oil, turn the insert onto the end of the tool two turns, then carefully screw the insert into the head. The insert should bottom in the head quite easily, turning by hand, then use the driver to screw the insert tool into the insert, which expands it slightly to make a gas-tight seal to the head. When that starts turning freely remove the insert tool, and you are ready to replace the plug. Another thing I noticed is that the loose inserts screw onto the plug easily, which means when they have been expanded into the head they are slightly larger internal diameter, so the plug is now slightly loose in the head. This may be deliberate, and indeed plugs do usually wobble in the threads slightly until they bottom, but I would have expected the insert to have been a tight fit on a plug until it had been expanded into the head.



I screwed the plug in by hand as usual until it bottomed, no more wobble than normal, but couldn't get my usual plug socket on for final tightening, and this is the third problem I have mentioned a couple of times. Looking onto the end of the inserted plug, which sits in a hole in the head casting, I see that instead of being exactly in the middle of the hole as normally, it is slightly offset to one side! The hex of the plug is completely enclosed by a hole on the head casting, with only a very small clearance around it, and the new thread had obviously cut at a slight angle to the original. I feel sure this is down to my having to press down as hard as I could on the end of the cutter to get it started, because (a) the first part was running in stripped threads and (b) the cutter part was effectively a plug tap instead of a taper. I suspect this is a known issue, which is why they include the seat cutter as part of the kit. When I first had the V8 the plug socket I had always used on the roadster was too big to fit in the hole, but fortunately I was able to get one slightly smaller, but even that only just fits and the chrome coating has worn off over the years. I reckoned if I thinned the wall around part of a socket I would be able to get it on the plug, turning it one flat at a time. I didn't want to attack my main socket as that would weaken it for the plugs on other cars, but I do have yet another box-spanner type plug spanner. I ground two of the hex edges of that down and down, but still can't get it on the plug. Then I remove the plug altogether and try to fit it in the hole in the casting, to find that is too big as well! So I reduce the remaining hex edges a little until it fits in the hole, and by that time it will go over the plug, and I only need to tighten it a couple of flats, removing, turning back and refitting one flat at a time. So no big deal, I'll just have to carry that in the toolkit along with everything else! In the fullness of time, when the engine has to come out for the clutch or whatever, I should be able to grind back that part of the hole a little to allow my usual plug socket to fit.

Finally reconnect coil and plug leads, crank up, no grease smoke out of the exhaust, or misfiring from chips caught in the valves, or combustion leak from the plugs, so hopefully all is well!

V8 Engine Steady *November 2020*

V8 engines can move quite a bit from torque trying to rotate the engine in its mounts and cause the off-side exhaust manifold to hit the rack shaft or inner wing and part the near-side engine mount. Vee had had two of those problems even with packing the off-side mount so the repaint and engine rebuild was a good opportunity to fit Clive Wheatley's engine steady bar, which is an impressive piece of kit. It attaches to the front of the near-side head using the three lifting bracket bolts - the bracket stays in place, the other end goes straight across to a hole drilled in the inner wing. Each end of the bar has two thick rubber bushes, each between two cups, either side of the bracket at the engine and either side of the inner wing, with one cup fitting inside the other as the bush compresses to prevent the bush being squeezed out sideways and splitting. At the inner wing there is a reinforcing plate like a trapezoid that fits in the wheel arch, and has to be orientated to fit up to the top of the wing, so that determines how high the hole in the wing can be, fore and aft positioning is not critical. The bar has a threaded adjuster with lock-nut that determines the effective length of the bar and hence the rotational positioning of the engine in the bay, i.e. to get the engine 'flat' and not lifted up one side and pushed down the other.

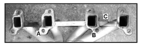
Despite having fitted it originally, and removed and refitted it as part of the engine rebuild, I can't remember the exact process I used originally, but it needs thought as tightening the bolt bushes also changes the effective length of the bar, and you can't adjust the bar length with all four bushes clamped up tight. I seem to recall I just fitted the lower outer head bolt first, then clamped up and adjusted unto the other two holes on the bracket came into line with the holes in the head, which used the 'natural' position of the engine in its mounts to determine the length of the bar.

Coming to write this section I referred to Clive's image and noted that he shows the adjuster at the engine end of the bar whereas I have mine at the wing end. Now I'm pretty sure the bar came assembled, and I would only need to have removed the components at the wing end to install it, so don't know how my adjuster came to be at the other end. I did note when refitting it in a freshly painted engine bay that care was needed wielding spanners, whereas had it been at the engine end I would have had more space. In an idle hour or so and when the weather had warmed up a bit I removed it and refitted it the correct way round, as well as working out the process for fitting and adjustment, click the thumbnail.

A comment had been made that the steady bar transmits quite a bit of vibration onto the body. Well, it would if it's stopping the engine from moving around, but I've noticed no change in the sound or feel since fitting it and neither has the Navigator and she is pretty sensitive to things like that. I was told it could be seen by running the engine at idle with the driver's door wide open. Without the bar the engine rocks and the door doesn't move, but with the bar the engine is steady (!) and the outer corner of the door is moving up and down. Yet to be tested, but I wouldn't have thought a V8 should rock at idle unless something is wrong somewhere. Yes if the engine does rock I can imagine the steady bar transmitting that into the body, and an open door (either door, I'd have thought) would show that more clearly than anything else on the body. But how often is the car left idling, and with the door open? Even if that door movement does happen it's still got to be better than the manifold hitting the rack shaft or inner wing and splitting the near-side engine mount.

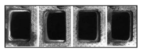
V8 Exhaust Manifolds

I've had continual problems with these since I bought the car. It came with tubular/block-huggers, and I found one of them kept cracking round the collector box. After rewelding 2 or 3 times I decided enough was enough and bought new mild-steel items from Clive Wheatley. The right-hand one is a real pain to remove as you have to pull the steering rack forwards quite a long way, by contrast the left-hand is a doddle. Another problem with these is that in use they warp, in such a way that the outer ports turn in towards the middle two. This has two effects - one is that you can't get the bolts back in unless you file out the holes, and the other is that even when you have done that the outer flanges are then cocked at an angle so they don't fit flush with the head and the gaskets blow!



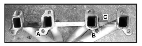
With the new manifolds I decided from the outset to weld struts between all four flanges (picture) so they couldn't turn in to each other. These struts are placed over the link between the two halves of the paired gaskets i.e. in the lower half of the flanges, so as not to obstruct the plugs or dipstick tube. However I also discovered that whilst the faces of the flanges aren't cocked at an angle to the head, the outer two on both my manifolds are further away from the head than the inner two. I enquired about getting them machined, but two engine machinists I spoke to said they cannot hold them securely enough to run a grinder over them like one would when skimming a head or block. I did separate one of the old single gaskets to add to the new double gaskets to give some extra thickness on the rear port of the left-hand manifold but obviously it wasn't enough, as it started ticking slightly on acceleration quite soon after fitting. This year it suddenly got noticeably worse, and so is at risk of failing the MOT.

A few minutes saw the left-hand manifold come off. The good news is that the struts seem to have done their job as all the bolts went back in OK. However with them all in the manifold was 'hanging up' slightly so I did file one hole out a little so the manifold slid in and out easily when all eight bolts were half screwed in. With the outer ports further away from the head than the inner two it was obvious that these had been blowing from the staining on those gaskets, whereas the inner two are fine. So I guess this type of gasket is OK given correct alignment and spacing of flange to head. From the staining I could see that the two outers had been blowing towards the inner ports, so obviously when tightening down these outer ports, because they have further to go than the inners, they turn in slightly, the very thing I'm trying to avoid with the struts. This means that the gasket isn't clamped as tight on the inner edge as the outer, and the inner edge blows.



Another problem is that the alignment of the manifold ports to the head ports is very poor (picture). Clive tells me this wasn't discovered until he had some one-piece flanges made for RV8 manifolds and

in an idle moment held these up to the block-hugger manifolds. He was shocked to discover that although the bolt holes lined up the ports didn't, by 3/16" or more in some cases. Even though the holes were oversize so some misalignment would mean the ports weren't partially blocked, the amount of misalignment is so great that the head ports **are** obstructed to some degree. At that time he was having the flanges stamped out by one metal-basher in Dudley, and the pipes formed and welded by someone else. When he queried this with the stamper they admitted that the flanges weren't made especially for the Rover V8 but were for another application and seemed close enough! This was some time ago, Clive now has the flanges laser-cut by someone else and they are supposed to be a much better alignment, but at �400 for a new set I'm going to have one last go at getting a good seal on these. Incidentally, someone wrote to me recently saying they had no problem with a set purchased from the MGOC, but Clive supplies the MGOC anyway, they simply charge even more for them (subsequently Clive abandoned the idea).



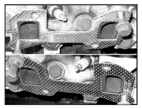
Changing the gaskets could probably be done by leaving the manifolds in-situ and still connected to the down-pipes and remainder of the exhaust, in which case you could probably reckon on less than an hour for each side. But I wanted to check the surfaces of the flanges, so removal was the order of the day. Even so the left-hand manifold came off in about 20 mins. I can use one of several spanners or sockets (9/16" or 14mm) on most of the bolts but the two inner lower bolts need a specially ground-down spanner as access is restricted, and the lower rear needs a long-reach 3/8" drive socket, or at a pinch a standard socket with the end of the wrench only just slotted-in, not fully seated. The long-reach is fine for the left-hand manifold but on the right-hand the rack shaft is still in the way. I've seen sets of Allen bolts for the V8 manifold and one would probably be useful in the lower rear of the right-hand manifold, and as a replacement for one of the two lower centre bolts (the left in this picture), but the other one is almost completely covered by the end pipe, indeed the bolt has to be fiddled into the hole and started into the head with the manifold clear of the head. If you leave it until the manifold is tight up against the head you can't get it in.

I used a flat-faced whet-stone to run over the faces until I got a shiny ring all the way round, which probably took about an hour. With a straight-edge across all four flanges I could see the faces were still flat to the head, but the rear port was about 1mm back from the others (picture) and the front port about half that. The new gaskets are the same shape and size as the old two-port ones, but slightly thicker, even where they haven't been compressed by the flanges. I decided to use the old ones from the two inner ports - which hadn't been blowing - as extras on the outer two. I'd removed the down-pipe by this time as I wanted to bolt the manifold up to the head without anything getting in the way of it being fully flush, so refitted the manifolds and gaskets, and with the other down-pipe to Y-piece, middle and rear clamps on the exhaust loose refitted of the left-hand down-pipe. Tightened everything up, started up - and still had a tractor in the garage! I had assumed that the left-hand gaskets which had been blowing slightly for some time had suddenly got worse - but no, it was the right-hand manifold!

So, nothing else for it but to pull the rack to enable complete removal of the right-hand manifold, as I wanted to check its faces as well. A couple of hours more work to flat the flanges, check the gaps, and reassemble with old but sound gaskets on the front and rear ports plus new two-port gaskets. More scrawling around underneath to reattach the down-pipes to the manifolds and Y-piece, start her up, and everything was fine :o) Another hour or so to refit the rack, wheels, and the middle and rear clamps and a successful test-drive. Not too exuberant yet as I have the MOT in a couple of days and I'd rather get that out of the way (she passed) before risking blowing them again. I must remember to check the tightness of the bolts at least annually, I was surprised how loose they were when I came to take them off, which may have contributed to the blowing.

June 2020: A secondary problem with the block-huggers is that there is a vertical sliding joint to the down-pipes with just a simple clamp the same as used to clamp sliding joints in the rest of the system. Given the weight of the system and there is no front support like there is with the 4-cylinder, the down-pipes tend to slide off. The PO warned me about that saying it had happened to him, so I periodically checked them and one day thought they were a bit low, gave them a wiggle, and they fell off! To refit you have to slacken the middle and rear clamps, and the Y-pipe to down-pipe clamps, wiggling and pushing back to get the rest of the system off the down-pipes. I've long pondered how to make it more positive, but haven't come up with anything yet. Talking about the RV8 option with Gary Roberts I noticed Moss show a longer pipe which turns back before the joint, so this problem wouldn't happen. However be aware that other suppliers show them with the same vertical joint, hence the same likely problem. One also has to get the longer, right-angle pipes through the holes in the inner wing, one assumes that can be done with everything else in-situ.

Gaskets:
An easier way?

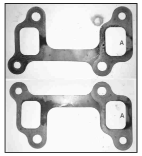


Another problem concerns the gaskets - I have tried four different types so far. Originally they were single, metal-faced sandwich gaskets. The next were thinner, green and black composition and were useless. Not only didn't they compress much, but with the very small overlaps between flange and head blew a piece out on the first decent run. The third type (pictured) are used on RV8s and are paired i.e. one gasket covers two exhaust ports, which makes them easier to install as only two bolts are needed to align each gasket, whereas all the bolts are needed to align the single type. More recently I came across Land Rover tin shim which are useless.

August 2024:

I was reluctantly forced into replacing the original gearbox with a Vitesse Mazda 5-speed but it came back with the near-side manifold blowing quite noticeably. They had advised me that on removal that both manifolds were cracked between the centre pipes - which they were - but no signs of blowing i.e. soot offering to get a quote of a local place for TIG welding. But as they couldn't give me a guide of price or timescale I told them to refit as-is as I wanted the car back - but I subsequently wondered if I had been foolish! However using a 'listening tube' (length of hose held to my ear with the other end pointed at various places round the manifold) I'm not convinced it is the crack that is blowing but one of the flanges. This does fit with something the fitter said to the effect that there is only a certain amount of time they can spend getting it leak free. Also preparing to remove the manifold I checked I could move all the bolts and they are really tight, I'd say far more than the 13 ft.lb. they are supposed to be, which also fits with trying to correct a flange leak. Looking closely at the edges of the flanges I'm pretty sure they have used the tin-shim Land Rover gaskets which I have tried in the past and didn't work. So I have bought a set of original singles and a set of RV8 (paired with the same construction) to go back to how they were for the five years - blow free - before this work. I know V8 manifolds are a pain but even so.

To get the manifold off is quite a big job as all the pipe clamps and supports (bar the off-side manifold to down-pipe as that side isn't blowing thank goodness as it needs the rack to be pulled forwards to get off) have to be slackened which is five altogether, then the main part with Y-connector pulled back off the down-pipes, then the down-pipe wiggled off the manifold. I doubt there is enough room to wiggle the manifold with the down-pipe still on, nor in practice will they pull apart without wiggling. But I reckoned I could just slacken/remove the manifold bolts, ease it away from the head, and that would allow me to slide the old gaskets out and the new ones in. It's the front pair that I think are blowing which are easier to get at than the rear pair. Three of the four bolts can be removed straight but for the two lower inners the manifold has to be pulled away from the head gradually as they are undone as the heads foul the pipes. This has to be done until the bolt clears the head thread, then it can be tilted and removed. Reverse to fit - make sure those bolts are started first!



With all the bolts out I remove the gaskets and the paired one is indeed an LR tin-shim and has been blowing badly - not just soot but heat discoloration exactly where I thought it was blowing from. Get a new paired RV8 gasket, and an old single that I had split into two thinner sections, and refit. This time I tightened the six accessible bolts to the correct torque figure of 13 ft.lb. and used the stiffness of those to judge the tightness of the remaining two which can only be done with a spanner. Start up with the bonnet lowered and no blowing heard from the cabin. Under the bonnet with my listening tube initially I think maybe there is a slight blow, but after a few seconds I can't even hear that. So success, and at about an hour a lot of time and effort was saved.

June 2019:

One of the near-side ports has been blowing very slightly since the engine was reinstalled a couple of years ago, despite using extra-thicknesses on the outer ports as described above. However I've come across these Land Rover gaskets (ERR6733) which as well as being a better fit to the ports are 3-layer with compression rings around the ports and in theory capable of sealing up to a 38 thou difference in gap comparing one port to another (but see above!). *September 2019:* The ticking from that port is getting much more noticeable under acceleration so I take the plunge and slacken the rear bolts as well as removing the fronts to change that gasket. I only bought one to try, really I should have bought a pair and changed both that side. Initially I thought the front was now silent, but with a piece of hose as a listening-tube it's blowing as bad as ever.

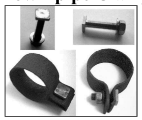
All the paired type have similar sized holes which are up to 3/16" bigger on each edge than the head ports, although the LR type have two diagonally opposite holes only just big enough for the bolts which gives precise alignment. I suppose there is an element of not covering up some of the port with the oversize holes, and also perhaps variations from head to head, but maybe they are intended for heads with bigger ports. If the holes were smaller it would significantly increase the amount of overlap with my heads which would reduce the chance of them blowing.

I thought I remembered that the original single gaskets were thicker than the paired type so with the engine out for gearbox overhaul, which needs the manifolds (and a lot of other stuff) to be removed, I bought a set of the original single gaskets. On measuring new singles and unclamped areas of old paired-type I found they were both the same thickness at about 44 thou, with previously clamped areas on the paired gaskets at about 20 thou. I fitted a manifold to an old head without any gaskets and with the bolts on the inner pair of ports tightened found that the gap on the outer pair was about 20 thou, plus or minus. Which gave me an idea. I then fitted half of a previously used paired type to each outer port, tightened them down, and measured the gap at the inner ports at about 8 thou, and with the inner bolts also tightened it was coming down to 3 thou or less, so potentially much more even clamping on all four ports with four singles plus halves of old paired type on the outers. However there is still the problem of the paired type having less clamped area than the single type. If the paired type will compress from 44 to 20 thou, and one assumes (I know, I know) the singles will compress by the same amount, maybe six singles per manifold i.e. one each on the middle pair and two on the outers are the way to go? But as that means buying another set, and I have enough old paired-type, so I think initially I'll go for four singles, and half of an old paired type on each outer, plus exhaust cement.

An easier way? *February 2019*
It's even fiddlier fitting six single gaskets, keeping them on the top bolts while I line up the manifold and start the bolts, trying to avoid unstarted bolts getting knocked back and the gaskets falling off, then insert and start the lower bolts ensuring all the gaskets are lined up correctly. Putting Vee's gearbox back in after the rebuild I took great care - as I thought - lining everything up but sounding like a tractor on the first start showed the extra on the off-side front was not on the lower bolt. Annoying as I had used cement, which had dried by now, even more annoying as the full system was attached. I wondered if I slackened the bolts it would give me just enough room to push the errant one into position, and it did, and sealed OK.

It subsequently struck me that if I fitted all the bolts and gaskets, then wrapped thin wire over and under each adjacent bolt it would keep everything in position while I offered it up and started each bolt, then I could remove the wire. Maybe next time. Incidentally the Holts exhaust assembly paste stays soft for longer than other stuff I have tried in the distant past, and acts as a lubricant making it much easier to push the downpipes up onto the manifolds, and the Y-connector onto the down-pipes. Enough to do dozens of exhaust systems, and even though I can imagine it drying out before I'll need to use it again at just a couple of quid cheap enough to throw away.

Down-pipe Clamps: *December 2019*



I have had to remove and refit parts of the V8 exhaust system more times than I care to remember in the past nine years for various reasons, usually associated with problems with the manifolds. Even raised on stands or ramps it is a bit of a fiddle getting both arms under the car with a spanner in each hand to loosen or tighten the clamp bolts, complicated further by having to make sure the clamp stays in the right place during tightening. One day I happened to spot a bolt lying in the street and as usual picked it up 'in case it came in handy'. It was stainless and with a thread that took a 1/2" AF (with some spanners and sockets, some others are a fraction two small) nut, but with a square-shaped, low-profile head about 1/8" high instead of the more usual hex head. I immediately realised that the head would fit snugly in an exhaust clamp and being square would not turn with the nut, so I would only need one spanner to tighten it. Also being stainless they should not corrode or wear with repeated removal and refitting. I noticed that close to where I found it was a road sign, and the sign was fixed to the post using several of these bolts together with stainless washers and nuts. The heads of the bolts slotted into an aluminium extrusion so it could be slid to the correct position for any size sign which explained the unusual shape and size of its head. I need about half-a-dozen of these for the V8 and when out driving one day I noticed some council employees working on a sign so stopped and asked about these bolts. They said "Oh, you mean 'Sign Affix" and happily gave me a handful. I don't know whether 'Sign Affix' is a trade name (couldn't find it on the web), is the right spelling, or just a generic description, but that is what it sounded like. Click on the image on the left to see the items as supplied, and as fixed to a clamp with the bolt shortened a little for convenience. *Update February 2019:* While on a forum this cropped up and more Google searching revealed these, which are almost certainly exactly what I have as the page even mentions they are for sliding into sign fixing channel. *End of update.*

Update May 2007: I had to undo these to deal with the exhaust manifolds yet again, and was disappointed to find one of the down-pipe to Y-piece clamps wouldn't undo. I could turn the nut back and fore on the bolt a little way, but as soon as I applied any more force the square end of the bolt turned in the clamp. Because the bolt head is so low-profile I couldn't get enough purchase with grips, so had to grind it off without damaging the clamp. That was OK, and I did have another bolt and nut, and why the other one came undone just fine but this didn't I'll not know now, as the bolt end and nut were destroyed by grinding them off, of course. Maybe I should consider myself fortunate the down-pipe to manifold clamps came undone just fine, and the stuck one was so accessible.

Update August 2009: Had to have these off again to remove the V8 sump for a bearing check in March and everything came undone OK, and the manifold didn't seem to have moved in a couple of years or so. But four months later I'm aware of a slight wittering just as I start letting the clutch out and the engine tilts over a bit. Look underneath and the down-pipes do seem to be a bit lower than they should be. Peering in the engine the left-hand one does seem to have dropped about an inch, the right-hand one about half that. So undo all Y-piece and all clamps aft of that and get the Y-pipes off the down-pipes, to find that even though the manifold clamps are still tight the down-pipes can be swivelled on the manifolds quite easily, hadn't noticed that before. Slacken them off and push the pipes back up and tighten them again, but they can still swivel to some extent, hardly surprising then that they do work down. They are a pain, and all because there is no positive clamp on the two, just a friction grip. I'm going to have to think of something more secure than this, it's a good job I'm not doing hundreds of miles a week as I used to.

June 2019:

After maybe 10 years, and straightforward removal and refitting for the engine work two years ago, I became aware of a wittering sound as I was pulling away in 1st that by sound and location seemed to be exhaust-related. Got underneath and waggled the pipes by the front, middle and rear joints and clamps but all seemed secure. Another trip and I'm sure its the exhaust so had another go, and this time could move the near-side down-pipe in the Y-connector. The clamp looked like it had thinned out quite a bit, but whether to go for replacement of both with the pukka clamps, which needs the whole exhaust to be slid back, or whether to do something simpler with a couple of long trips coming up. In the end I decided to go for a conventional U-clamp from

Halfords as I can fit those without doing anything other than removal of the old clamp. The stainless nut and bolt came undone easily, and peeling the clamp off the pipe showed significant corrosion, so probably stretched and come loose. Halfords kindly let me try a 1 7/8" and 2" on the car, and 1 7/8" it was. Bought two at �1.40 each, although only fitted one at this stage which can be done with the car on its wheels. Given the small gap between the two arms of the 'Y' you can't get two of these in line like you can the strap-type, so I'll order two of the correct type from Clive Wheatley ready for a proper job later on, and I see he is doing them in stainless now which should be better.

Heat Damage to Inner Wings: *December 2019*

Another problem was the proximity of the tubular manifolds to the inner wings, and heat damage and corrosion. I had to weld a patch in to the off-side to get it through the MOT one year and attached a piece of stainless steel sheet over the worst of the area which worked well, but with the engine out for rebuild and body paint an improvement was called for.

V8 Hot Tapping/Slipping liners *May 2017*

For many years I have had tapping from the engine when hot, worse on a hot start after heat soak. Various suggestions from people who hadn't heard it, and taking it to an engine man wasn't much help - he said he didn't know what it was, couldn't guarantee to fix it with a rebuild, "but it sounds 'orrible".

In 2002 I had a cooling system problem which was pushing water out of the overflow. A combustion leak check of the cooling system was negative, so it didn't seem like head gaskets. Eventually I took the heads off as an exploratory, and changed the water pump as I happened to have a new spare available. One of the suggestions for the noise was hydraulic tappets, so at the same time I changed those, the camshaft, and the timing gears and chain. No sign at all of any wear on the tappets and cam, but the new chain and gears eliminated the timing jitter that I'd noticed. After all that the cooling system problem had gone away, but the noise was just the same.

Then in 2009 I decided to check the bearing clearances, as by then they had done getting-on for 100k. With the sump off I just happened to notice that the right-bank pistons were off-set on the gudgeon pins! The con-rods are handed in that there is a front and a back, but as each pair - 1 and 2, 3 and 4 etc. share a big-end journal each pair have to face each other, they don't all face the same way, which these were. The MG V8 Workshop Manual Supplement is quite clear in this. Subsequently I happened to meet a chap who had rebuilt a Rover V8 in a TVR using a Haynes manual, and he said that was the way the manual said to install them. He thought that didn't seem right so didn't follow it, so maybe whoever reassembled my engine used the Haynes manual. As it happened all the bearings were at or just inside the tolerance for new bearings. I will have to swap those right-bank con-rods and pistons round, but that will mean the big-end bearings would be reversed on the journals, so I will need new shells for the right bank at least. A set is for both banks of course, so changed them all. I'll leave the main bearings, as I don't need to alter anything there, and felt I would have problems getting the upper shells out with the crankshaft in-situ. Bear in mind that all this work has been done with the engine still in the car.

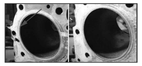
In 2014 I get round to removing the right bank head and sump, get the pistons and con-rods out, and turn then through 180 degrees. I've read that some pistons are handed in that the little-end is slightly offset to one side, so pistons have a front face as well, but there is nothing in the V8 engine supplement about this, and a set with another short engine aren't marked, so I carried on regardless. Got it all back together, and I wasn't really surprised to find the noise was exactly the same.

If anything in this sorry tale could be called amusing, perhaps this is it: In August 2015 we went on the Pendine run (in the roadster), and driving into the finish we had just parked up when I noticed a V8 pulling in ... and it was tapping. I said to the Navigator "He's got a tap!" She said "What on earth do you mean?" thinking I meant some type of domestic plumbing control attached somewhere. When I said "It's tapping like Vee" she just collapsed in laughter, and after that there was no way we could have approached the occupants with a straight face, so couldn't take it any further.

All this time Vee's body had been getting tattier, but I didn't feel like spending a lot of time and money on doing that with a noisy engine. Ideally, I would get the engine out and have that rebored and reground in the hope that cured the noise, and only if it did would I do the body. But pondering long and hard I realised I did not have the space or the resources to get the engine and gearbox out, strip and rebuild the engine, then if successful strip and get the body repainted. Eventually I decided it would have to go off somewhere that could manage both jobs.

And in September 2016, that is what happened. That is all a massive saga with many trials and tribulations along the way, but as my block had already been rebored to plus 20, the workshop felt it wasn't a good idea to go to plus 40 (although pistons are available and others have done this without problems), and could supply an unrebored block as a replacement. Also these was evidence of piston slap from wear marks on some of the pistons and bores, so that is a possibility, although usually that happens on a cold engine. The fact that on a couple of very long runs to Cornwall and Scotland the engine had quietened down, and remained so for few trips when I returned home, did make me wonder whether it was something to do with little-end lubrication, especially as an engine man said the pistons were a bit stiff on the con-rods. Disappointed as my block was the original for the car, but not prepared to insist they reuse it and be

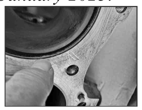
lumbered with any consequences and no recourse, I said OK. Another thing the chap who stripped the engine noticed was that the right-bank pistons were facing the wrong way, i.e. after I had turned them round. Definitely marked 'front' when cleaned, I hadn't noticed when turning them round, and as the manual said nothing about it, and another set weren't marked either, I wasn't looking for it. It seems to be something particular to oversize pistons.



Eventually (April 2017!) another engine man when he saw my bare block said "The liners are slipping", and No.1 liner is definitely not flush with the block (all the others are). Now the noise has definitely been towards the front - although more difficult to tell which side, and did seem to be as noisy at the top as the bottom. This slippage wasn't evident when I had both heads off in 2002, and at various time when I'd had the sump off they were definitely sitting on the lips, but of course I couldn't see the tops then. And when I did have both top and bottom off, it was only the right bank. It would be typical Sod's Law that whichever end I could see, top or bottom, the liner was flush with it. This chap fits 'top-hat' liners which have a flange at the top which sits in a groove in the block, are machined flush, and the head clamps them in position no matter what happens at the bottom, but they are usually only fitted to large over-bores as slipping isn't usually a problem in 3.5s. Big (expensive!) job though. So, with a definite problem with the old block (the slipped liner) dare I have more confidence that a replacement block and pistons, with my crank and con-rods will be OK? We shall see ...

November 2021: Amazing that four years has passed by, and thankfully no hot tapping. Then in October Pete Martin writes saying that amongst other issues his engine rebuild 20k ago is now tapping when hot. Near No.1, as loud at the top as the bottom, and bored out to +20, all as mine was. That set me off Googling and I found a very long Land Rover forum post on how one chap cured it by pinning the liners to the block, hedged about with many warnings about how easy it would be to trash the block, but with some amusement as well. Not very clear about exactly what was done but I'll give the link here anyway. Passed that on to Pete who found a much better description and photos which he sent back to me. The second article includes a link to a YouTube video that shows a block having been heated up on a grille and at 71C i.e. well below the operating temperature of the engine five of the eight sleeves could be removed by hand. He talks about Rover having relaxed the tolerances so the liners weren't gripped as tightly and that allows them to move, but that misses the point that the liners are supposed to be pressed down to a lip at the bottom of the bore, the liner and block face then machined together, and the head gasket and head sit on top. With my liner being visibly a couple of mm below the surface of the block it seems more likely to me that the liner wasn't pressed down as far as it should have been in the first place. While re-researching this I was amazed at how many videos and other links there are out there on slipping liners or hot tapping, when for years I couldn't find any information at all, including anyone who had ever heard of it. Although while this one is titled 'slipped sleeve syndrome' to me it's more like a porous block as coolant has been escaping from between the liner and the block.

January 2023:

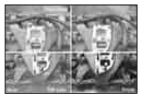


Pete Martin gets back to me having stripped his engine, and has a similar slipped liner, this is after having the block face ground during the rebuild. He has opted for top-hat liners, and to avoid a similar problem the block will be warmed (not on a barbecue grille!) and the liners chilled with liquid nitrogen before fitting. Expensive, but hopefully that will sort it once and for all.

V8 Inlet Manifold *June 2017*

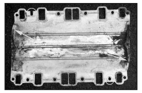
Which carb feeds which cylinder?
Gasket installation

V8 - which carb feeds which cylinder? *May 2015* The V8 firing order is 1 8 4 3 6 5 7 2, with cylinders 1 3 5 7 on the near-side bank, and 2 4 6 8 on the off-side. Each carb feeds two cylinders on each side - the outer cylinders on one side and the inner cylinders on the other. The port arrangement is basically two 'Y'-shaped manifolds, one on top of the other, clearly seen externally on the casting. However only by removing the adapter between carbs and manifold can you see which carb feeds the upper 'Y' and which the lower. The question came up on the MG Enthusiasts forum and I copied and pasted the text from a V8 Forum post that stated the near-side carb feeds 1 4 6 7 and the off-side 2 3 5 8. However someone else said that was wrong and it was the other way round. So I independently asked two people with very extensive V8 experience, who both came back saying it was indeed the other way round, i.e. the V8 Forum was wrong. One said he thought it was that way, and the other saying that's how the original Rover manifold is, where the carbs sat on top. Allen Reeling said he had blown compressed air through a spare, and it is definitely as the V8 Forum says.



But pictures trump descriptions, so the next time I had my inlet manifold off I fed wires through from the carb ports to each cylinder port, and it is as the V8 Register said i.e. the near-side carb feeds cylinders 1 4 6 7, and the off-side 2 3 5 8. Or to put it another way, each carb feeds the outer cylinders on its adjacent bank, and the inner cylinders on the opposite bank.

Gasket installation *June 2017* Part of extensive work on Vee in 2016/17, the installation of the inlet manifold and its gasket caused some head-scratching. I've done this a couple of times now, both tin gaskets previously, but this was a



composition gasket with other differences. The WSM says they are marked 'FRONT' and one of the bolt holes near the front on the right (off-side) is 'open' i.e. slotted. The previous tin gasket wasn't marked but did have the 'open' hole so it was obvious how it fitted. The new gasket has neither, also there are sealing rings round all the holes on one side of the gasket only, and it is flat so not obvious which way up it goes let alone which way round. I ring the supplier and he doesn't know, so he rings his supplier who says the sealing rings face downwards i.e. into the heads. Fine. However when I compare it with an old tin gasket, I realise that it can only go up one way, as the right bank is offset relative to the rear, and that puts the sealing rings uppermost! Still no info regarding which way round it goes, but careful comparison indicates that the two ends are identical, so hopefully it doesn't matter. Old tin gasket, with circles round two bolt-holes only one of which is 'open', and arrows where each bank is offset relative to the other.

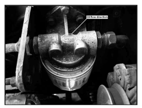
New gasket, no 'open' hole, the same offset. Although this means the sealing rings are always upwards, it doesn't seem to matter which way round the gasket goes on.

Then the WSM says "fit the gaskets but do not tighten the clamp bolts until after tightening the manifold bolts". The gasket clamps are either end of the crankcase, between the two sets of ports, and are metal brackets that press the gasket down onto a rubber seal that fits onto the crankcase. However after suffering a persistent oil leak from the right rear corner that someone said was from this gasket, and is very common, it occurred to me that it could be because those clamps are only tightened **after** the manifold bolts. The holes in the gasket are larger than the bolts, so there is 'wiggle room' of the gasket relative to the heads and manifold. The gasket is also flat, and springy, so when then the manifold bolts are loose the gasket is trying to push upwards in the middle, i.e. away from the crankcase and rubber seal at either end. If you tighten the manifold bolts first it clamps the gasket in position, so when you tighten the clamp bolts it is trying to pull the gasket down, may stretch and leave gaps, or even tear. So I reckoned that if I fitted the gasket using one manifold bolt at each corner first to position it, then fitted the gasket clamps but didn't tighten the bolts, that would hold the gasket in the right position while I removed the four bolts, dropped the manifold on, fitted each manifold bolt again not tightened. Then I could tighten the clamp bolts to pull the gasket right down onto the crankcase, and only then tighten the manifold bolts. What with silicone sealant (not something I would normally use but felt probably better here than non-setting) on the crankcase edge and on top of the rubber seal, and sealing compound round each port of the heads and the inlet manifold, it was all a bit of a palaver. Time will tell.

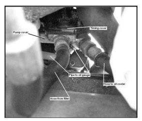
June 2024: Recently aware of a drip from the rear of the engine. Feared rear main seal but the back of the flywheel was dry (very handy having the removable cover at the bottom of the bell-housing) so probably hose gaskets again. During the gearbox replacement the installers said the top of the gasket was swimming in oil, so the job will have to be done again. Part of that will be to Helicoil one of the manifold bolt holes in the right-hand head as that never tightened fully in the replacement heads.

V8 Oil Flow *Added January 2009*

Twice in recent months questions have been asked about the direction of flow through the V8 oil pump, so time for a new topic. Unlike the 4-cylinder pump the V8 pump is external to the engine, part of the front cover. It has two ports - an inlet and an outlet, mounted on the pump cover, which covers the gears, which run in a cavity in the front cover, driven by the end of the distributor shaft, which itself is driven off a skew-gear on the end of the camshaft. Note that this means that when the distributor is removed, cranking the engine will **not** turn the oil pump and so **not** develop any oil pressure. However what it does mean is that with the distributor removed a drill with suitable bar can be used to turn the oil pump and so develop the initial oil pressure after a rebuild, which is much better than having to crank or even worse run the engine which is what you have to do on the 4-cylinder.



Passageways in the pump cover and the body of the pump i.e. the front cover casting, suck oil from the pickup in the sump on the one hand and deliver oil to the galleries that feed the bearings on the other. Thus the oil passes through the pump cover and body **twice**, however it only goes through the gears of the pump once - picking up from the sump and delivering it to the oil cooler via the front port on the pump cover. The return path from the filter to the rear port on the pump cover goes direct from the pump cover into the front cover on its way to the bearings. The filter is situated between the oil cooler and the return port on the pump, an arrow on the filter head indicates oil flow direction is from the cooler and the front port on the filter head, though the filter itself, out of the filter head on its rear port, to the rear port on the pump cover, and from there to the bearings. I've read from two different sources that early editions of Roger William's 'How to give your MGB V8 power' had a diagram showing the direction incorrectly, corrected in later editions, so be warned.



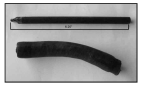
Originally the take-off for the oil gauge was on the inlet side of the filter head, but after concerns from owners about low oil pressure readings it was moved to the pump cover outlet port i.e. before the cooler. As such I suppose it does give slightly higher readings as the later position will benefit from the back-pressure of the resistance of the oil cooler, but it doesn't alter the pressure to the bearings of course, which is going to be even lower on the outlet side of the filter. As such it is nothing more than

a sop to paranoid owners. The V8 oil system is described as a 'high-flow, low-pressure' system (they can say that again), and the hot idle oil pressure **is** much lower than for the 4-cylinder. An acquaintance who is ex-Police and ran V8 MGBs on motorway patrol duties, which were never switched off long enough to cool down, said in his experience it was a matter of "What hot idle oil pressure?" i.e. there was none! However the Workshop Manual Supplement quotes it as 42psi running (which is correct) and 34psi idling. There is no way you are going to see that at a hot idle when it has been idling for long enough for the electric fans to cut in. In winter, and immediately after running at a decent speed in free air for 20 minutes or more maybe, but as you idle you will see it drop and drop. Indeed the 4-cylinder oil pressures are quoted as 50 to 80psi running and 10 to 25psi idling which is **lower** than the figures quoted for the V8, and I've only ever seen my roadster as low as 25psi after idling for a very long time in very warm weather, usually it is around 30psi or higher.

V8 Oil Pump *Added April 2010*

The Workshop Manual Supplement specifies the 'normal' i.e. running pressure as 42psi (at 2400rpm elsewhere), and the idling pressure as 34psi. Whilst the former is quite possible the latter when hot is a case of 'I wish'! Because of lack of air-flow through the oil cooler when stationary - particularly with the RB under-slung cooler, plus a significant amount of hot air coming forwards and rising past the under-slung cooler with the cooling fans running, whilst hot idle may initially be a respectable 25 or so psi, this gradually drops the longer you remain stationary, and can end up below 10psi on the gauge. Or has Roger Parker has put it with much experience of Police V8s: "What hot idle pressure?!".

On the V8 the camshaft drives the distributor shaft directly via a skew gear and the distributor drives the oil pump via a tongue and slot. Up to 1976 all Rover V8 engines had the tongue on the distributor and the slot in the oil pump shaft. With the introduction of the SD1 the engines for that car had electronic ignition using a 35DE8 distributor, and this had the slot on the distributor and the tongue on the oil pump shaft. Points engines e.g. Range Rovers changed to the later drive arrangement in 1978, but kept points for a further four years! See Fitting a V8 into an MGB by Roger Parker.

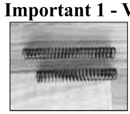


One benefit of either type of drive is that the distributor can be removed and a drill with suitable drive shaft inserted into the hole to drive the oil-pump directly. After a rebuild or any interference with the oil delivery system it is far better to build up oil pressure this way than cranking or even worse running the engine and hoping it eventually shows on the gauge. Have the drill on minimum speed, and I gripped the chuck firmly with my hand as well to slow it even further. If the pump has been opened up or its hoses removed you will need to pack it with Vaseline first.

Note: The down-side is that if you crank with the distributor removed the oil pump is disabled!

Oil pump cover: Care is needed tightening the screws as they are in alloy. There are three torque figures quoted in various places - 3, 9 and 13 ft.lb. The factory MGB V8 manual says 13, but I got mine up to about 10 and they didn't seem to be tightening any more so I stopped there. For 'other' V8 engines 3 ft.lb. is quoted for 'suffix B' engines, which seems a bit low for oil under pressure. 9 ft.lb. is quoted for 'other' V8 engines without suffix B, so I wouldn't go above that. When I had Vee's engine rebuilt I supplied new cover screws as the old ones were quite chewed. Ran up the engine at the painters and no leaks, but when backing her off the trailer and into the garage at home she left a trail up the drive! It was from the cover, and the screws were barely tight. Then I noticed that there was a soft plastic collar under the head of each one that I hadn't noticed before. Imagining that had deformed and reduced the torque, I removed each one in turn (to avoid having to reprime the pump) and removed the collar.

Important 1 - V8 relief valve *June 2019*



The following has come to me from Gary Roberts and a V8 bulletin board:

"Early V8 engines had smaller pump gears (less volume). When the Rover V8 engine was fitted to MGBV8 due to potential gauge reading concerns from owners the pressure was raised to 42psi @2400rpm by using a spring 69 mm long 0.56" wire, in a special pump head (same as Flotec today).

> Issues for Rover occurred with oil flow, and with the arrival of the SD1 V8 they decided to increase the oil pump capacity (approx. 30%), by using deeper gears. Also they changed the pump spring to one 80mm long and 0.047" wire, giving a pressure in the range of 30 - 35 psi @2400rpm, because this was the limit of loading for the dizzy/cam/cam bearing."

A problem arises if you try to use the SD1 spring (to get the lower pressure in an SD1 engine used in a V8 conversion) in a Flotec (i.e. factory MGB V8) pump head in that the longer spring becomes coil bound and can prevent the relief valve opening at all. This can burst the oil filter canister at speed, and damage bearings and gears. To check this measure the clearance from inside the plunger when fully seated to the face of the pump cover (A), then check the spring in the plug, with the sealing washer on the plug, can be compressed such that the exposed portion is less than A. The fitted length of the spring should be 1.8", which is A plus the distance from the recess in the plug to the face of its sealing washer. The load at the fitted length is 14.1 lbf, which can be measured with the spring in the plug with its sealing washer fitted as before, compressed so that the exposed portion is equal to A, and measuring the tension in the spring on scales or with a spring-balance.

A document headed 'Buick High Volume Timing Cover Assembly Instructions' included with the new front cover from Clive Wheatley with deeper gears for Vee's rebuild shows two types of pump head each with three springs giving 40, 60 and 70psi running pressures. The document gives the spring colour, number of coils and how far it protrudes from the pump head before the cap is fitted for each. The type 2 head looks identical to the gaskets I have, the type 1 has the passages (and the relief valve) in noticeably different places.

Important 2 - gasket *June 2019*

Also from Gary: The oil pump gears should be proud of the front cover face. The factory V8 manual specifies this as 0.0018", and the gasket is designed to space the pump head away from the cover by a few thou more than this to give a running clearance. If there is insufficient clearance the gears, front cover and pump head will wear rapidly and could damage the drive and timing chain, and if there is too much clearance oil pressure will be reduced particularly at hot idle. One problem is that the factory V8 manual does not say anything about the final clearance required; a second is that the gears can protrude varying amounts; and a third is the gaskets can vary in thickness. Various web sources say the running clearance should be 2-3 thou, which with the 0.0018" thou specified in the factory manual for the gears being proud of the front cover face (however the drawing showing the measurement of this shows a 3 thou feeler gauge inserted) would require a 4 thou gasket. However Gary has found his SD1 pump gears protrude by 6 thou so a 4 thou gasket would lock the pump, and a gasket from Brown & Gammons measured 17 thou - which would give an 11 thou running clearance on his oil pump, and 15 thou on factory cover and gears! He has an alternative gasket from Real Steel which measures 10 thou so usable with his cover and gears but at the upper limit. He also writes that American sources often contain a set of gaskets of various thickness so you can choose the one that suits your cover and gears. When having the engine rebuilt a bottom-end gasket set I got does indeed contain two oil pump gaskets - measuring 4 thou and 12 thou on my dial caliper. But an old gasket removed from my original cover measures between 12 thou and 14 thou depending on where I take it, whereas the gears protrude between 2 and 3 thou with my feeler gauges on an area with no gasket, and between 6 and 8 thou clearance to the faces of the gears where there is still some gasket, i.e. probably too much.

Ideally one would fit the gears and pump head with gasket to the cover before the cover is fitted to the engine, so you could measure the end-float with a dial gauge. Not being aware of any of this when my V8 was rebuilt I just supplied the new cover with deeper gears, new gasket (from memory thicker than the 4 thou one) and original pump head to the rebuilder and left him to get on with it. As the hot idle pressure and particularly the pressure rise time is noticeably worse than before, I obviously need to take the pump head off and check how proud my gears are and the thickness of the existing gasket, as well as that the relief valve plunger isn't stopping short of fully closing which can be another cause of these symptoms. New gaskets from Clive Wheatley measure 4 thou so ideal for the 0.0018 protrusion of the gears specified in the manual - if that is what I have on the new cover, but with three 4 thou and a 12 thou to hand I have plenty of scope - two 4 thou giving 8 thou if needed.

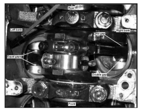
December 2019: With the engine out and gearbox out (separately) for a gearbox whine to be investigated it's a good opportunity to investigate the oil pump. Removing the cover I find the thinnest 4 thou gasket there, not a thicker one as I suspected. Checking the gears even a 1.5 thou feeler gauge is gripped to some extent, which with a 4 thou (the thinnest) gasket is going to give 2.5 thou clearance which going by the various web sources above is what it should be. So that's not the cause of the slow pressure build-up, which means I'm going to have to live with it. One thing I noticed working on the engine in an unheated garage when external temps have been just about zero, is just how gloopy the Halfords Classic 20W/50 oil drips have been with gauge and cooler pipes disconnected. But as pressure rise-time is equally long in summer - more so if restarting warm about 1/2 hour after switch-off, it's not that either.

Other aspects *May 2014* Arthur Johnson has written to me about a couple of other pump aspects.

- 'Tadpole' valves: This is an alternative valve piston which instead of being a cylinder consists of a spherical head on a slimmer body - hence the name. It is supposed to overcome a problem whereby the valve cylinder gets scored and can cause the valve to jam open sending oil pressure to zero and destroying the engine. Loads of references online, but given the number of these engines that were manufactured for new vehicles and the number that have been re-used in V8 conversions I can't help thinking it isn't a major problem. However you only need it to happen once ...
- Adjustable valves: The coarse metric oil pressure adjuster screw thread on his valve leaked so badly, whether the engine was running or not, he was obliged to remove it. Researching the WWW he came across information for a TA0 1502 Adjustable Oil Pressure Regulator from TA Performance (USA). At what Arthur describes as 'eye watering total cost' - it cost $20US for the regulator plus $88US for postage - they sent one. As far as he is aware it is the only oil pressure regulator being manufactured and available for the Buick/Rover V8 engine.

On arrival he realised that the original Buick oil pressure relief valve bottom plate plug has a diameter of 3/4" with a UNF thread. The equivalent MGB V8 oil pump plug, [MGB V8 part number 602071] is 13/16" diameter with 14 TPI which he assumes is a pipe thread. Consequently, the adjustable relief valve unit, as intended for an original Buick engine, will not fit a Rover MGB V8 oil pump and he needs to modify a 602071 plug to accept the 3/8" UNF adjustment threaded "rod" plus nyloc lock-nut and sealing nylon washer.

V8 Pistons *August 2013*



As I wrote in V8 Bearings in 2009 I discovered whilst checking the clearances that all the right-bank con-rods had been installed the wrong way round. The con-rods and end-caps are marked on one face, and each pair where they share a journal must have these markings facing each other. The left-bank has the odd numbered cylinders, and the right bank the even. So the left bank must face backwards, and the right-bank forwards. **All** the con-rods were facing backwards, so the rebuilder must have noticed the markings, but not understood their significance. The effect of installation this way is that whilst the left-bank con-rods run centrally in the piston, the right bank con-rods run off-set to the rear. *June 2014:* Happened to bump into a chap who had used a Haynes manual to reassemble the Rover V8 in his TVR, and he told me that Haynes do say all con-rods should face the same way. He thought about it and looked at it, and decided they were wrong. Incidentally he had a similar hot tapping, but cured it with a new cam and followers - wish I had been as lucky.

For years I have been plagued with a hot tapping noise at the top of the engine, which originally started on the right bank (but more recently has become more general), and as soon as I discovered this problem with the right-bank I immediately thought that the off-set running of the right-bank had caused accelerated wear. I pondered what to do for some time, i.e. take the engine out, fully dismantle it and have it fully checked over for wear and rebuilt as necessary. But I was mindful of one rebuilder I took it to who said he could rebuild the engine, but couldn't guarantee to cure the noise! That said I eventually decided to do the minimum work to correct the problem, and see what the result was. That would be turning the con-rods and pistons round, which would need new shells as they would be running in the other direction and have a different wear pattern. So I bought a set from Real Steel, but not the main bearings as getting the upper ones out would be a fiddle, and particularly I didn't want to disturb the rear crank seal and risk precipitating a leak. What with moving house and all that entails, plus other issues, it wasn't until August 2013 that I was in a position to tackle the job.

From my previous look up into the works I wondered if there might be enough room to turn the pistons from underneath i.e. not having to remove the head, so that was the plan. I realise that turning the pistons in the bore may well have an effect on the rings in that they could move in the pistons, and even if the didn't the gaps would be on the wrong side. But the objective was to prove whether or not the off-set con-rods was causing the tapping with minimum work and expense, so I would have to live with the consequences of anything else. At least I have my full-length ramps this time giving much easier access to everything under the car.

First job is to drain the oil, and I change the filter there and then.

From past experience I know I have to slacken the rear, middle and two Y-pipe exhaust clamps, wiggle the Y-pipe off the two down-pipes, and slide the whole thing backwards, so do all that while the oil is draining.

Next is to slacken the right-hand down-pipe to manifold clamp, and pull the down-pipe off as it passes under the rear part of the sump.

Next is to remove the cover-plate at the front of the bell-housing, as otherwise that prevents the rear of the sump moving back far enough, to be angled down far enough, to be withdrawn backwards, as several inches of the front part of the sump are above the front cross-member. That reveals the back of the flywheel, which is completely free of oil, as is the inside surface of the cover-plate. I've been plagued with a small leak from that or the back of the sump for years, despite removing and replacing the sump several times with new gasket plus sealant, but it looks like it must be the sump gasket.

Next is to remove all the sump bolts, even though one pair are right above the cross-member, and two adjacent pairs slightly above it, all are relatively easily accessed, and the sump is off.

Then the windage tray/sump baffle comes off, and this time I'm wise to the fact that oil sits on top of it after draining so angle it appropriately to retain that oil until it is no longer above me!

Then the oil pick-up strainer comes off, and again I find that the two bolts are only just nipped up - strange.

So with not much more than a couple of hours work the dog can see the rabbit. I wonder whether to be noble and tackle the most awkward one first, i.e. the front one over the cross-member, and leave the easier ones until I'm tired. But common sense prevails in the shape of I need to work out what I have to do, and how, and how to position everything, and it will be much easier doing that an easier one, so the back one it is.

No.8 end cap comes off, and I'm pleased to find I can move the piston up and down, and turn it, relatively easily.

However that's where it comes to a grinding halt, as no matter where I turn the crank, even with the piston fully up, either the studs foul the journal, or the big-end is sandwiched between the webs and counter-balances on the crank. I need to ponder what to do i.e. put it back together and live with it, or get the head off and carry on, so for the rest of the afternoon (only having started after lunch) I just concentrate on cleaning up the sump and block flanges ready for refitting at some point in the future.

Next day I decide to carry on i.e. remove the head, so embark on another bout of dismantling.

Drain the coolant by disconnecting the bottom hose. I know this is going to leave coolant in the engine above the level of the water passages to the head, but the only way to get at the drain plug that side is to remove the starter, which is several steps in its own right, and as I'm getting the pistons out cleaning up them and the bores will be easy enough.

Disconnect the fuel and overflow hoses, distributor vacuum pipe, rocker cover breathers, accelerator and choke cables from the carbs.

At least the carbs, air-box, K&N filters and plenum can be removed from the inlet manifold as an assembly with just six easily accessible nuts.

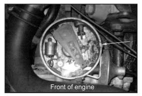
Remove the distributor cap and leads.

Disconnect the servo hose and temp gauge sender from the inlet manifold and remove the distributor vacuum pipe.

Disconnect the heater return hose from the return pipe under the inlet manifold, and remove the heater control valve from the adapter pipe on the back of the manifold.

Remove the two hoses from the front of the inlet manifold to the water pump - the heater return and the bypass.

Remove the plugs - relieved to find they come undone easily after my greasing the threads and minimal tightening having stripped two of the threads in the past. No sign of any blow-by on any of them except No.4 which still has a damaged thread and is awaiting fitting of an insert as I did for No.2 cylinder. In the meantime the plug is held in place with an external clamp secured under two of the exhaust manifold bolts - a real DPO bodge if I'd seen anyone else do that!



Turn the engine to TDC on No.1 cylinder using the timing marks, and photograph the position of the rotor.

Carefully remove the distributor and photograph where the rotor is now pointing, as it moves slightly when withdrawn from the skew gear on the end of the camshaft. This is to aid reinsertion in the correct position. Plug the hole with a screw of paper.

Now for the biggie - undo the inlet manifold nuts! Last time one sheared and I had to drill and retap the head, so was one of the things I was quite worried about. But I work out from the middle to the ends first one side then the next, bit by bit, and they all come undone nicely, so the inlet manifold is lifted away. I'm leaving the valley gasket in position for the time being to stop anything falling into the engine from above. As well as cleaning the head faces I wire-brush all the bolts, making sure all traces of old thread sealant are removed. If left this can make reinsertion stiff, which can result in incorrect torque values on tightening. However the manual says that old sealant can make bolt **removal** very difficult **next** time, which seems odd.

Remove the right-hand exhaust manifold bolts from the head which is always a bit of a fiddle as the lower one on cylinder 6 is partly covered by the pipe for No.8, so an open-ended spanner has to be used, and even that needs the edges ground down to make it slimmer. Some of the bolts weren't very tight. When I get to the lower one on No.8 I can't anything on it as it is partly covered by the pipe, the bulkhead is behind it, and the rack shaft across the head! I don't remember having to remove the rack in any of the (several) previous times I've had to remove the manifold, but there you are. I say 'remove' but in fact all it needs is pulling forwards a couple of inches, which can be achieved by removing the lower clamp bolt, and the four rack to cross-member bolts, but leaving the track-rod ends attached to the steering arms, which simply toes the wheels in a bit. The rack bolts cause me a bit of a problem as they don't seem to go up into the sockets or spanners far enough to grip without slipping off, even though again this has been off and back on more times than I care to remember. I was beginning to wonder if this would be a show-stopper, but eventually I do get them all undone. I vow to fit washers under the heads of the bolts to lift them clear of the rack casting a bit on refitting. Finally I can get all the manifold bolts out and tie it up out of the way of the

head, retrieving the gaskets and keeping them in order for refitting. Some do show some exhaust blow-by. It's not possible to withdraw the driver's side manifold from the engine compartment, on either RHD or LHD cars, unless the steering rack is completely withdrawn. Interestingly the Workshop Manual Supplement makes reference to this, even though there were only seven LHD cars ever built, for American Federal testing before full production began.

Now for the second biggie - undoing the head bolts - same worry as before. But they all start moving as they should, so again it is a case of bit by bit working through the sequence in the manual to avoid distortion. With all those undone off comes the head, and the gasket, and I'm ready to start on the pistons after a day and a half of work removing and cleaning things up ready for reassembly. As part of that I pour a little petrol into each combustion chamber to check for leaky valves (I replaced two exhaust valves on one of the heads last time), but all is well. One mistake was not removing the rocker shaft and push-rods before I undid the head. One possible benefit of that was perhaps that the open valves unstuck the head, but when I did lift it away some of the push-rods stuck to the rockers and some to the tappets, and I was lucky not to have lifted them out and lost the order. With the head fully off I punched a series of holes in a piece of cardboard for the head bolts as well as the push rods, so I could keep everything in the same place. The consequence of not being able to remove the drain plug on this side of the engine was coolant dripping everywhere as the head came free. Fortunately loads of thick newspapers being available were able to soak it up.

However next day I have a dental appointment in the morning, and visitors in the afternoon, so take the day off.

On restarting I try and get No.8 piston out, and it comes up so far then is really stiff. Eventually by using a mallet and a drift from underneath it comes out, albeit still stiff even when the rings are past the top of the bore, and I realise there is a ring of carbon around the top of the bore, as well as more carbon than I would expect on the crown of the piston. With each piston out it is weird looking down the bore and seeing the garage floor!

With the piston on the bench I find that with the con-rod off-set as it was in the engine it moves very freely, but moved to the central position where it should have been, it is quite stiff and takes some pushing to get there. But I can see oil in the holes through to the gudgeon pins, and with a bit of working back and fore it does get freer. The gudgeon pins are an interference-fit in the con-rod, and rotate in the piston, so offset the gudgeon pin has been offset in the piston. Good job it is shorter than the width of the piston, at either extent of its travel, or it would be gouging the cylinder walls when off-set. With the stiffer action where it should be i.e. in the middle I have high hopes that running on 'new' surfaces as they are the bearings will not have any play in use and should be quiet - if that is what has been making the noise. If that's the case then even though they probably won't last as long as new bearings - the 'new' surfaces being narrower than completely new bearings, they should be good for a while at least.

Clean up the piston and realign the ring gaps for the different orientation of the piston. This is confusing. The book says "Position the oil control piston rings so that the ring gaps are all on one side, between the gudgeon pin and the piston thrust face." Thrust face? This turns out to be whichever part of the cylinder wall the con-rod is pointing at on its expansion or power stroke. With the clock-wise rotation of the Rover V8 - looking from the front - the thrust face is on the left (still looking from the front) on both banks, i.e. the inner face (by the inlet manifold) for the odd numbered cylinders, and the outer face (by the exhaust manifold) for the even. Fair enough. It goes on to say "Space the gaps in the upper and lower ring rails about an inch each side of the expander ring joint." Again fair enough. But for the compression rings it says "Position the compression rings so that their gaps are on opposite side (sic) of the piston between the gudgeon pin and piston thrust face". How can the two gaps be on opposite sides of the piston, but both be on the thrust face? Also the drawing shows all five gaps very close together, and all over one end of the gudgeon pin which isn't a thrust face! The first thing I do is ignore the drawing. In the end I settle for the oil control expander ring gap right on the thrust face, the ring rails an inch either side of that, and the two compression rings between those and the end of the gudgeon pin - one on one side and one on the other. I've no idea whether that is correct but it's the closest I can come to the instructions.

By this point I suppose I should have removed the rings, inserted them in the bores, and checked the ring gaps. There is a process for doing this described in the manual using the piston inserted first upside down, then pulled back so the bottom of the skirt puts the ring 'square' in the bore. But I didn't do this, neither did I check the bores for diameter and ovality, for my 'minimum work' objective until I have either cured the noise or know for sure what is causing it.

I bought a ring compressor for this job and haven't used one before. I did find a YouTube showing how to fit pistons to a tractor engine (OK, MGB engineering has always been of an agricultural bent). This was useful in that it said to oil the rings before fitting the compressor over the piston. Not having used one before it takes a couple of goes to work out that one has to press down firmly on top of the compressor when the piston is started in the bore, so the bottom of the compressor contacts the top of the block all the way round, or a ring can pop out of the gap if the compressor is tilted a bit. Tap the top of the piston with the wooden handle of a hammer and it **should** slide down into the bore easily. It wasn't as easy as that to begin with, and what with that and finding they were a bit stiff coming out as well, eventually I realised that as well as cleaning up the piston I needed to completely remove the carbon ring from the top of the bore, even though it didn't feel very thick. At least doing that I couldn't feel any wear lip at the top of the bore, and as before could still see honing marks over parts of the bore surfaces.

By the time I got to the last piston, i.e. the one over the cross-member, and had completely scraped the carbon off the bore before attempting to remove the piston it pushed up and out very easily, removing all the scrapings as it did so. When refitting that one I had oiled the piston skirt and the bore as well as the rings, and it went in very easily as well.

I had been fitting the new shells to each piston as I put it back, and its partner on the other bank, Plastigauging each as I went. All came in at between 1.4 thou and 1.9 thou, so not a massive reduction from the 2.0 (although one was 1.8) to 2.3 I had measured previously with the old shells, but still useful. In any case I'd rather have more flow through the bearings than a high pressures from low flow. By the time I had done the last piston in theory I was ready to start putting it all back together. But it was late in the afternoon and I decided to stop there. But lying there and just gazing up, I suddenly realised I had got one of the end-caps the wrong way round. I had noticed the crank get a bit stiffer part way through when turning for the next pair, but put that down to the new shells, even though I copiously oiled each half before fitting. With that shell the right way round, and all the torques rechecked, the crank did spin very easily. Incidentally I double-checked each piston and end cap were correctly orientated by feeling for the dimple on the con-rod - both banks - as well as looking at the end-cap. Speaking of torque, I noticed both this time and the previous that with my bendy-bar torque gauge, if I tightened it to the 33 ft lb and held it there, the torque would reduce slightly. So it needed a bit more movement to get it back to 33 ft lb as things settled in. A click-wrench wouldn't have shown that, meaning that you would have to click it several times over several seconds to make sure it was correct.

Suddenly woke in the night sure I hadn't written down the last torque value, which made me think I hadn't removed the cap after Plastigauging and hence hadn't cleaned off the Plastigauge! Next morning first job was to remove that last cap, and sure enough there was the Plastigauge. So cleaned it off, re-oiled, replaced and torqued the cap, and rechecked the torque on all the others as well as the main-bearing caps (that I hadn't touched).

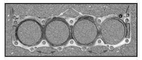
Now it was time for reassembly. Started off again with the bottom - putting the windage tray/baffle plate back, then the oil pick-up. Put some sealant on the gasket, and thread-lock on the bolts, in the hope it doesn't come looser than I would like, as it seems to have done the previous twice.

I've always used Hermetite Red as a non-setting gasket sealant in the past but I do find it separates into a liquid and a very stiff paste in the tube over time, and although I've never had a problem with it elsewhere I've never been able to seal the sump with it. So this time I used a Loctite non-setting, non-silly-cone sealant. Ran a thickish bead around the groove in the sump flange and the bolts, placed the gasket on top of that, and ran a thinner bead round the top of that. Wiped the drops of oil that had been developing on the bottom of the block ever since I got the sump off, wiped down with carb cleaner and a clean cloth, and very carefully lifted the sump into position. You have to fly it up and forwards, nose up behind the crossmember, and the tail down under the bell-housing, being very careful not to touch anything along the way and contaminate the sealant. Have a minimum of two bolts very handy, in easily accessible holes, so hold it in position while you fit the remainder of the bolts. Get all in before any of them are anywhere near beginning to compress the gasket and the sealant so you have the maximum wiggle. Then work round gently tightening, there is no torque figure given, I used 10 ft lb. Overightening will not get a better seal, and will distort the sump flange, actually making things worse.

I can't put the exhaust back until the manifold is back on the head and the head on the engine, so that is next, removing the rocker shaft first. Next I have to remove the old valley gasket as that will get in the way of refitting the head, and that means cleaning up the left-hand head face and plugging the ports with scrunched up paper to stop anything falling in. I also cover the valley with a clean cloth, as the tappets, cam and crank are exposed from above. Another job is to make sure there is no oil or water lying in the bottoms of the head stud holes, leaving that there can crack the block from hydraulic pressure as the studs are tightened. I smear Wellseal onto the block face of the new head gasket - tin even though composite are available - over the whole surface as evenly as I can. The composite are thicker, which I didn't want as that would reduce compression ratio (a friend fitted composite in place of tin to his Range Rover and said the reduction in power was awful, so he immediately had the heads off again and refitted the original tin type), but more importantly with one tin gasket on the unremoved head a composite on the other, and that being higher, would means the inlet manifold would be tilted which would have implications for sealing. Not a massive problem for the intakes themselves, but it would be for the water passages between head and inlet manifold. Place the gasket on the location studs in the block, but the gasket is not completely flat so one end keeps lifting off its location stud just enough for it to slip down a bit, which is going to make things awkward when refitting the head. I should have put the gasket on the block before applying the Wellseal, primarily to check all the holes were correct, which would have revealed the problem and given me the chance to correct it, but there we are. Smear more Wellseal on the head, by which time the gasket is *just* staying on both location studs, and carefully refit the head.

I'd previously cleaned all the bolts by wire-brushing to remove all traces of any previous sealant, which can make them stiff to insert which will give a false torque reading. Some bits of old thread seal are stubborn, but rather than run a hacksaw along the thread valleys as I would normally, I don't want to roughen the threads, so I use the smooth edge of a paint scraper pressed down hard and that gets the sealant out. The manual says to replace any bolts that show signs of

stretching, or the fourth time the head is replaced. I can't see any signs, and this is the second time I have replaced them, presumably at least once before that for the rebore, making the third replacement. I'll definitely need to replace them next time, but hope to get away with it this time. Screw the bolts in by hand as far as they will go, being sure to use long bolts for the middle three upper, short for the bottom four, and medium everywhere else. Work through the bolts in sequence tightening bit-by-bit - top row middle to right then middle the left pair, then middle row the same, and finally the bottom row.



However the top and middle bolts are positioned at each 'corner' (more or less) of the combustion chamber, and the bottom row are 'extras'. This bottom row weren't provided at all on later Land Rover/Range Rover engines, and the current recommendation is that when they are present, to only torque them to 25 ft lb or so instead of 68 ft lb for the others. No breakages, which is a relief. The reasoning behind the lower torque on the lower four is that nine bolts torqued to 68 ft lb on the exhaust side of the bores, but only five on inlet side, tends to give a weaker seal on the inlet side of the head. The result of this can be blow-by into the crankcase on wide throttle openings, which can be shown by marks on old head gaskets. I'm certain I only torqued these to 25 ft lb last time, but the gasket I have just removed, and the two I removed previously, and another from someone else, all show this blow-by. I have always been aware of a burnt oil smell coming into the cabin on hard acceleration, which I had put down to blow-by past the piston puffing fumes out of the crankcase breather, but which was probably this head gasket blow-by. I 'cured' it by extending the inlet side of the breather down past the bell-housing to the bottom of the engine!

With the head on I refit the exhaust manifold, and with the flanges being out of line as they are I use double gaskets on the outer ports as they are stepped back a little from the inner pair.

With the exhaust manifold on I can wiggle the right-hand down-pipe on, and wiggle the Y-pipe onto both down-pipes. I've never been happy with these as when orientated correctly for the Y-pipe one of the down-pipes projects about an inch further back than the other. The longer one eventually bottoms in the Y-pipe, and the end of the shorter one barely reaches the end of the split in the Y-pipe. I debate shortening the down-pipe, but it is the left one, and even with the clamp fully loosened it doesn't really want to come off so I decide to leave it how it has been for nearly 20 years and 100k. Another thing I notice is that the front box, which is oval, is slightly twisted so one side is closer to the ground than the other. So I loosen the clamp where it attaches to the end of the Y-pipe and twist it straight. Then it's a matter of tightening the manifold clamps, Y-pipe clamps, middle and rear clamps.

With the manifold on I can also refit the steering rack. Oddly both shafts on the V8 only have notches for the UJ clamp bolts whereas the roadster has one shaft grooved all the way round. This means the rack shaft has to go back in one particular positioning of the splines or the clamp bolt won't go through. Given the number of times this rack has been on and off, mainly for the manifold, I'd marked the spline that has to go between the two halves of the UJ clamp many years ago. There's so little room that I can't get enough force on the shaft to push it all the way in, but just getting the tip of the shaft in, then getting underneath where there is plenty of room grab it and to shove the whole thing back, only takes a moment. Peering through the clamp bolt hole will clearly show if you have got it right, or are one (or more) splines out. I then refit the rack to cross-member bolts, with washers under the heads of the two rear ones that go down into welded nuts. However the front bolts are supposed to go upwards with nuts on the top (and not as I had refitted them last time thinking it would be easier that way) puts the deeper nut (than the bolt head) on top so much more meat to get spanners and sockets on. With a long 1/2" drive socket extension, then a 1/2" to 3/8" adapter, then a long 3/8" extension, then a medium wobble extension, and finally a socket means I can tighten all four from above the radiator. Only fit the UJ clamp bolt - or at least tighten it - once the rack bolts are installed to allow wriggle-room for the rack brackets to line up with the cross-member brackets. So that should be all the underneath work.

Now time for the inlet manifold and valley gasket. I noticed that both tin and composite valley gaskets were available, so for some reason specified the composite, at a few pounds more. I suppose I thought the compressibility of the composite would form a better seal, even though I hadn't had a problem with the tin before. But on receipt I note that it's not composite as head gaskets are composite, but the original tin with some kind of black coating each side. And Googling to see if this needed a different torque figure to the plain tin, came across a South African Land Rover site where one of these had been used, the coating had come off the bottom, fallen in to the sump, and blocked the oil strainer! I shan't be using one of these again, no matter what. Clean the head surfaces and the front and rear edges of the crankcase with carb cleaner, and the top and the groove of new rubber seals. Again clear out the bolt holes in the heads and crankcase walls of any water or oil. Put a pea-sized blob of silicone (yes silicone in this case) sealant in the four notches where the triangular bit on the end of each valley seal goes, and seat the seals on the edges of the crankcase, noting they are handed in which way they go round. Put a small bead of silicone sealant around each of the four water passages of the valley gasket, both sides, even though only the inlet manifold only has through-ports on two of them, and place the valley gasket in position. Fit the metal retainers to the front and rear walls of the crankcase, again being handed in which way they go round, and position the gasket such that the bolt holes line up with the heads. Refit the inlet manifold, and get all the bolts started by hand, being aware that the two font bolts are longer than the others, and the bolt with the screwdriver slot goes in the third position from the front in the right-hand (facing forwards i.e. even numbered cylinders) head. This is because the raised part for the carb plenum partly coves that bolt so you can't get a ring spanner on it to begin with, so presumably the slot is there to use a screwdriver to get it started. However an open-ended spanner fits, so the slot isn't really required anyway. The manual only says to tighten the gasket clamp bolts (13 lb ft) after the head bolts have been tightened to 28 lb ft. However unless the valley gasket is fully pulled down **before** the head bolts are tightened, pulling it down **after** they are tightened is going to stretch or even split the valley gasket. Hmmmm. But part-way through tightening the bolts I suddenly remember I haven't removed the paper plugs from the left-bank cylinder head ports! So it has to come off again, I remove the plugs, and refit it again. I've done that once before on a 4-cylinder, but in the carb intake ports. No big deal there but a major cockup if I had got to the point of filling with fluids and starting it to find that the left bank didn't run. Even worse if it had sucked the plugs into the engine! I also have a bit of a problem with some of the bolts. There are supposed to be two long ones at the front and the implication is that all the others are the same length, but a couple of them are getting quite tight before they have contacted the inlet manifold. So those and some others come out again, and I see I have two lengths about 1/4" different. By trying shorter ones in the 'stiff' holes, and longer ones elsewhere, I am able to get all of them contacting the inlet manifold fairly easily. The stiffness is probably from never-used threads where a longer bolt has replaced a shorter one, even though I **thought** I had retained the bolts in their original holes in the manifold while off the engine.

Next comes the two rear heater hoses to the manifold and the front heater and bypass hoses to the water pump. I'd removed the water valve from the adapter pipe, and its hose from the heater, as that was easier than disconnecting the control cable from the valve. The gasket had ripped, so I cut a new one and put a smear of sealant both sides. There is quite a bit more overlap between the flanges on the valve and the adapter than there is on the roadster between the valve and the head, which has quite a large hole. On removal I'd noted some surface cracking around the longer heater hose where it changed size, so had bought replacement hoses for both as they are tricky to get at with everything in place. I'd replaced them about 10 years and 40k ago when I last had the heads off so not too bad I suppose. The front pair were replaced at that time also, but they look OK and are quite accessible, so I refit them. The top hose goes back on, only having been replaced in June this year.

Next comes the carb, plenum, air-box and filter assembly. Clean up the surfaces, no gasket here, so just a smear of non-setting sealant around the ports. Drop the assembly on the studs and tighten the nuts.

With all the major stuff on there are the smaller things like carb choke and throttle cables, carb fuel and overflow hoses, servo hose, crankcase breather hoses - rocker covers to carbs and the one behind the air-box, and the temp gauge sender. Next the alternator and fan-belt.

The beauty of the V8 is that with the distributor out you can get a drill on the end of the oil pump shaft and spin it to fully prime the system. But the question is always, how do you know when you have spun it enough to get oil pressure? Previously I got an old mirror and positioned it in the seat where I could see the gauge from by the distributor, but don't have that any more. So I propped up my camera where it could see the gauge, switched it to video, started recording, then went round to the front to start drilling! In the end I didn't really need the video. Initially the drill spun fairly quickly, then I could tell when it had picked up oil and started circulating it as the drill slowed a bit. Short bursts of drilling after that were accompanied by all sorts of noises which initially I thought was oil pouring out of all the orifices in the engine. But then that stopped, so it must have been the purging of the air from all the galleries, rockers, bearings, tappets etc. After that when I stopped the drill it slowly turned backwards for a couple of seconds, which I now know was good oil pressure forcing the pump and hence the drill backwards until it had bled away. I know all this from watching the video and listening to the sounds of the drill afterwards, and it was good to see oil pressure on the gauge.

Now the distributor can go back in. I turn the engine to TDC on No.1 cylinder as indicated by the timing marks, carefully position the rotor in its post-withdrawal position as indicated in the second photo I took, and check the position of the drive dog below the gear. This is inline with the rotor, so I position the oil pump slot accordingly. Feed the distributor back in and it seats nicely, and the rotor is in its pre-removal position as per the first photo. Some years ago I spent some time helping a neighbour get his distributor back in correctly as he had just removed it regardless, and it was quite a fiddle. Replace the spark plugs - greasing the threads with copper-grease again, and refit the distributor cap and leads. The last job - I think! - is refilling with coolant. I'd saved the old, and although I had lost a couple of litres, that and my 'spare' was more than enough to refill.

Is that it? Heart in mouth I go for a start, and it fires right up, on all cylinders - so far so good. A quick look round underneath and nothing pouring out anywhere. So switch off, get the car off the full-length ramps, out of the garage and back in nose first. I want to run it up to temperature over the garage floor in case of leaks, don't want them on the drive, but I don't want the exhaust in the garage as the fumes permeate the house. Leave it running while I search over, round and under, and spot a coolant drip-drip-drip near the front of the engine. This turns out to be one of the short hoses on the water pump, access to the clip is quite limited, and it's only a slotted screw so I cant get a small hex socket on it. Stop the engine and with a screwdriver bit in a 1/4" socket adapter and small wrench can tighten it quite a bit. Restart, no leak. Keep it running watching the gauge as well as everything else. This is the big test, normally it would start to tap when the gauge got mid-way from C to H. It creeps above that, and just when I'm beginning to think six days of work have been justified, I start to hear a very faint tick from the left-hand side. Then while localising that, I start to get the familiar tap-tap-tap. No swearing, kicking things or anything else. I'm quite calm, no massive sense of disappointment or failure, in fact I'm not really surprised at all.

Leave it running, and tapping, and the interesting thing is that the right side that originally had the tapping is completely quiet, this noise is from the left, which certainly didn't have it when the right started. So I think I have been partly vindicated, in that now the right bank pistons are running on 'new' bearing surfaces they aren't tapping, so it must have been the little ends as I first thought all those years ago. But because the left side is now doing it, the right side tapping can't just have been from the incorrectly orientated pistons. Something else must have caused wear to both sides, but maybe the problem on the right caused that side to wear faster. So there must be some problem that has affected both sides. Talking to others these engines have done 300k without any problems, so what is causing the problem in mine? And what do I do about it now? A number of options are available, from 'do nothing', to take the engine out, fully dismantle it, and have it rebored, reground, new pistons, gudgeon pins and goodness knows what else. But the rebuilder all those years ago said he couldn't guarantee to get rid of the noise.

After pondering a while, it's been doing it for years and the engine hasn't gone bang yet. The clutch has done at least 100k, and I think is coming near to the end of its life, so I'm going to leave things until the engine has to come out for that. Then I'm thinking in terms of completely stripping it and taking everything to a rebuilder for checking. At the very least I'll replace the pistons and gudgeon pins, and maybe the con-rods if for example the bush in those is out of line. Anything else that needs doing I'll probably have done, although a rebore could be problematical. The pistons are already plus 20, and the manual indicates that only standard and plus 20 pistons were available. Real Steel also only have standard and plus 20, albeit at 9.75:1 compression (but who minds more power?). Rimmer have plus 40s at 8.13:1, but they are twice the price of Real Steel. Is relinering an option? Then going back to standards? On the other hand if simply altering the position of the gudgeon pin in the pistons of the right bank is enough to stop their noise, maybe the minimum option again of replacing pistons and gudgeon pins like for like will stop the left as well. But it depends on what has caused the problem in the first place. If it was incorrect assembly of pistons and con-rods somehow, then that should fix it for good. But if some other problem in the engine has caused it, then the new pistons and gudgeon pins are likely to go the same way. If **that** problem is stable then it should last another 150k or so before it starts happening again. But if it's getting worse then it could be significantly sooner.

V8 Front/Timing Cover *July 2017*

A special for the MGB, no longer available. Rover covers are available but have the oil filter mounting as part of the oil pump, for which there is no room in the MGB. Modified ones (Buick) are available but there are some differences to the original that are worthy of mention.

1. The cover has two additional bolt holes on the outboard sides of the water passages from block to pump. As all the other bolt holes are present, these are extra, and can be ignored. Another change is that at the bottom right (when facing the cover), where there was a long bolt on the MGB, this only needs a short bolt.
2. There is an additional tapped hole immediately to the rear of the distributor. It has the same thread as the distributor clamp bolt, and needs a blanking screw. I used a low-profile Allen-socket button-bolt with thread-lock, rather than a grub-screw, so it can't screw itself into the timing gear.
3. The oil pump gears are deeper than the original. Vee's old gears measure 0.872", Arthur Johnson has measured his old SD1 gears at 1.047" and the new Clive Wheatley ones at 1.123" making the new ones 8% larger than the SD1 and almost 30% larger than the originals. This should maintain the oil pressure at hot idle, but it does mean the oil hoses come off the cover lower down and closer to the chassis rail, and there is only about 1/8" clearance to the front hose. I've seen a roadster conversion with the lip on the chassis rail ground away and the top recessed, but one person's opinion on a forum was that it wasn't needed. I'm installing Clive Wheatley's engine steady-bar, but in any case battered the lip of the chassis rail over and now have about 1/2" clearance.
4. There is no provision for mounting the original timing pointer, and a new one has to be fabricated, attached by two of the water-pump bolts.
5. I found the distributor shaft was a tight fit in the cover, and started to jam - not enough clearance for the shaft. It had to be levered out with a crow-bar while I put all my effort into twisting it, and the surface of the shaft and the front cover had started to 'ruck up'. I couldn't do anything about the cover now it is installed to the engine, so I had to file round the parts of the shaft that showed the effects of binding, as well as greasing it before I could get it fully inserted and adequately manoeuvre it to set the timing. So the moral of the story is, check the fit of distributor to cover before installing the cover to the engine. If the distributor is being reused and that didn't bind in the old cover, then it is the new cover that needs relieving. If both are new then see if you can measure both distributor shafts to see if it is the new shaft or the new cover that is at fault.
6. The distributor clamp required is noticeably different. I mislaid the original distributor clamp for a while so had to get one off eBay. I found that would not fit as there is a bulge on the back of the new cover that interferes with the clamp positioning, and had to grind back that side of the clamp. In addition the tapped hole in the cover is about 1/4" closer to the distributor than the hole in the clamp, so the clamp had to be slotted before the bolt could be inserted. I couldn't be certain if the problem was with the cover or this replacement clamp, but careful comparison of photos taken at different times indicated that it was the cover. Subsequently I discovered the original clamp and bolt and was able to compare them directly, and it is indeed the cover that is the problem.
7. The oil pressure is no higher with the deeper pump gears but that is set by the relief valve which is part of the pump cover. But far from having a faster rise time as one might expect, it's slower than before, with slight tappet rattle for

a few seconds until it starts building, which is also a new 'feature'. Hot running is OK, but hot idle is only 15 after a fast motorway run, dropping still further as the idle continues and before the fans cut in for the first time, at which point it is about 10 (ambient cool at about 14C). But the worst was noticing it during the MOT where they keep the engine idling for some time, and it was barely off the stop! I did think that this 30 weight running-in oil may be a contributory factor and could expect an improvement with 20W/50, and Roger Parker concurred. However he also said he had seen a new front cover with similar issues and that turned out to be the relief valve (which is actually in the pump cover) not seating correctly. Made a note to check that when I change the oil. Again the moral of the story is to check the valve - especially for a new pump cover - before fitting. Another factor could have been I had weakened the mixture as usual to pass emissions - but had over-done it as CO was 0.2! This would probably contribute to running hotter than normal as the fans didn't cut out the whole time. Idle speed was also a bit low. Yet another factor could be cover gasket thickness as there are several different ones, and an overly thick gasket will allow oil to recirculate within the pump instead of being sent out to cooler, filter and engine. Mind an under-sized one can be even more damaging if it causes the pump gears to bind when hot and snaps the timing chain. Subsequently took the pump cover off to check the clearance and the gasket to find it had the correct clearance, but by that time not happy with how long the gauge took to start rising at a hot start about 20 mins after switch-off I fitted an oil pressure switch and warning light which goes off first and does at least confirm that the pressure is rising!

August 2020: Arthur Johnson writes:

"I have very recently purchased a replacement timing cover for my upgraded MGB GT V8 engine and thought I may be able to add a little to the relevant section on your web page.

"My V8 had an SD1 cover - the original oil pump gears measure 1.047" deep (a "used" gear); the replacement gears are 1.123" deep (new gears), about 8% larger than the SD1.

"I was expecting a new SD1 type oil pump male shaft would be supplied but, an original length MGB V8 female shaft arrived from the UK (less than a week after being ordered!). Clive Wheatley subsequently advised he supplies the MG version only; something buyers need to be aware of.

"Luckily, I have an unused SD1 male version shaft/gear and have entrusted a local engineering shop with the task of swapping the shafts.

"The engineer noted that the new gears are constructed of sintered material and therefore would be self-lubricating. I imagine the gears should be soaked in engine oil before being assembled and packed with Vaseline.

"The cover and base came with 2 gaskets, both about .011" thick, one being of composite composition. I already had a .005" gasket. The .005" gasket is very close to being too tight and the thicker ones, rather too loose. A Land-Rover w/shop manual gives a spec of a minimum clearance of .002" (only); an early Buick manual copy on the internet indicates a clearance of .002"-.006". The thicker gasket would probably give a clearance of at least .006" and probably more.

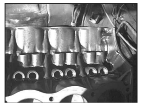
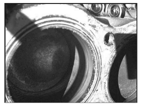
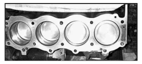
"I seem to remember reading somewhere that a change to metric threads was found in a replacement cover. Mine has imperial threads throughout, but the relevant bolts are tightish on the deeper threads, especially on blind holes. When threaded through they turn more easily. A local bolt supplier suggested they might be Whitworth rather than UNC threads. I don't expect any problems, however.

"Hope the above may be of use to other MG V8 enthusiasts."

V8 Top-end Rebuild

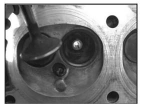
I had been getting tappet rattle when hot for quite a while but putting off their replacement. But then early in 2002 I discovered that coolant was being pumped out of the overflow over time, being replaced with air in the top of the radiator, and the cooling system always seemed to be pressurised even when stone-cold. First thought was a head gasket, but a chemical tester repeatedly came up negative for combustion gases in the coolant so either I was getting localised boiling due to a hot-spot or the action of the pump was sucking in air somewhere despite the positive pressure (15psi with the standard cap, 20psi with an alternative cap that reduced the problem a little). I used lots of diagnostics before diving in, including a coolant pressure gauge and a level probe, and a catch-tank on the expansion tank overflow. I still went to Le Mans and back in it that year, but had to stop about half-a-dozen times to push coolant back from the expansion tank into the rad when the level dropped too far, I only lost about a pint on the whole trip. I had also had some very odd compression readings during my ownership, wet and dry tests were inconclusive, some readings were lower than normal and some much higher. About 2 days after returning from Le Mans the bottom hose exploded due to the effects of the 20lb cap - fortunately whilst parked on my drive after a run. I was going to have to do something about it sometime, and March 2003 was it. The big question being was I going to find the cause of the coolant problem and was it going to be the block i.e. a scrap engine? I have broken down the story into the following sections:

Dismantling ...

... went fairly well, it's a good job it was the GT and not the roadster - plenty of room to lay all the engine parts out in the back out of the way leaving the bench clear for whatever I was working on at the time. The block has a water tap on the left near the rear and a bolt at the front on the right and unless you can open/remove both these (the bolt only after removal of the right-hand exhaust manifold) you cannot empty the block so removing the heads allows water to pour into the cylinders. I could undo the tap but the bolt was no-go, it was well rounded so it looks like a previous attempt had failed. (Many year later it strikes me that If had lowered the front and raised the **rear** of the car while draining - the engine slopes down from front to back remember - I would certainly have got a lot more out, possibly enough not to run into the cylinders). I was amazed at the internal condition of the engine. It was a light golden colour with no sludge anywhere equating to 'low mileage' according to the RPI web site. I reckon it had done 80-100k miles since the last time any work was done, 65k of that in my ownership. I always change the oil and filter every 3k, using a pre-change flush treatment as often as not, looks like it pays dividends. I could still see the honing marks over most of the bore surfaces indicating bores/rings were unlikely to be the cause of the low compression readings. 20 thou oversize pistons fitted so obviously a rebore at the very least sometime in the past. The manual says +10 and +20 pistons are available, so does this mean it was rebored twice in its first 100k? Or something happened that was so bad they had to go straight to +20s? Either way unless there are +30s available it looks like it will have to be resleeved next time. When not actually working on the block I kept it covered with a clean cloth. I poured a little petrol into each inlet and exhaust port on the heads and only one inlet showed any seepage, the others all being 'gas-tight', again not a cause of low compression readings. The heads looked to be level and flat with just a trace of gasket burning on the edge that faces into the combustion chamber. The rockers and shafts showed no wear ridges at all, just polish marks. Three of the inlet valves had wear ridges and discolouration where the rocker contacts them so I replaced these as a precaution. The hydraulic tappets came out swimming in oil and just showed circular polishing marks on the base indicating they had been rotating properly, negligible indentation. The camshaft looked fine although it is difficult to judge by eye. The timing chain had quite a bit of slack. The oil pump pressure relief valve spring was 1/8" shorter than spec, the clearances of the gears and pocket being in spec. So my order went in to Clive Wheatley for a top gasket set, front cover gasket and rope seal for the crank pulley, oil pump gasket, three inlet valves, timing chain and gears, tappets, camshaft and oil pressure relief spring. Also a set of rocker cover screws as mine came with some incorrect ones, a head bolt as one of mine was an odd-ball with a very deep head with a tapped hole in the middle, and two inlet manifold bolts - I had broken one and the other front one was not as long as it should be, the casting being deeper for those than the rest. While awaiting the parts from Clive I had ample opportunity to deal with the inlet and exhaust manifolds and clean and where appropriate repaint all the parts I had removed.

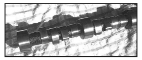
Heads and valves



Replaced the three inlet valves and removed and lapped all the others (used the stick with rubber suckers on each end, had to glue the suckers onto the stick). All the seats were in very good condition and they and the new valves needed very little work to grind them in. Checked them by pouring a little petrol into each port and none showed any signs of leakage. Made sure I could screw all the head bolts right in by hand then put the heads on using a coating of Wellseal first on the block then on top of the gasket and torqued them down. I used the original type of tin shim gaskets, there are composite types available but these reduce the compression ratio due to the greater thickness.

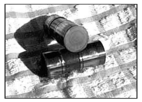
All Rover V8 engines have a head bolt 'at each corner' of each cylinder which gives nice balanced pressure to the gasket. However those made before 1996 have an additional row of four bolts on the outside of the Vee - 11 to 14 in the tightening sequence - that are said to cause a problem. Because they are putting additional loads on one side of the head it is claimed they cause warpage of the head and leakage of the gasket. Whilst an unbalanced force is not desirable I'm pretty sure that a correctly assembled engine won't suffer from the problems described in this article unless perhaps it has been modified for much greater power outputs, if there were any major problem with gasket leakage and oil breakdown in the tens if not hundreds of thousands of units produced it would be well known. After 1996 the engines were produced without those bolts, also demonstrating by now that they aren't required. Probably not a good idea to leave these bolts out altogether and the holes open in earlier engines, so just torque them up to about 25 ft lb, with thread lock as per all the others, to stop them coming loose.

Camshaft and timing gear



The camshaft is surprisingly heavy and the book warns against damaging the block bearings as they are not replaceable. I put its gear back on to give me more purchase, got it most of the way out then it started to foul the fans and oil cooler hose, but by that time I was able to angle it to one side and got it the rest of the way out. Being a rubber-bumper with the underslung cooler I could leave that in-situ, unlike the chrome bumper. When fitting the new shaft I didn't put the gear wheel on first but rested the shaft on the block bearings just before the last section was due to go in to give me a breather. The new one went in easier than the old one came out. Put on the new timing chain and gears, this was more difficult than removal because of the lack of slack in the new items, it is a matter of sliding each gear onto its shaft a fraction at a time, keeping one directly above the other as much as possible. Put the distributor/oil pump drive gear and spacer back on the camshaft, the big washer and the fixing nut. Put the oil thrower on the crank, this time concave side outwards (it was inwards on removal).

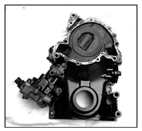
Tappets, push-rods and rocker assemblies



I fitted the tappets dry to check the pre-load. There has been discussion in various places about this recently, and a figure of 20-60 thou has been bandied about and is quoted on the RPI site. I was a bit taken aback to find mine were 110-120 on the right and 40-110 on the left. Spoke to Clive and the MGOC and their opinion is that unless the engine is highly modified there shouldn't be a problem as the whole purpose of hydraulic tappets is to cope with a wide tolerance in the rest of the valve gear. Spoke to someone at RPI, who despite what is written on their site said "you wouldn't want to go as low as 20 thou and 120 thou should be fine". So I left it at that. Put a drill on the oil pump (made a driving spindle out of an old box-spanner tommy bar and used a length of appropriately sized hose to fit snugly over that and the oil pump driving shaft to keep the two together). Started off very slowly with much slurping from the oil pump and in no time at all oil was pumping out of the front tappet sockets, I kept going until oil came out of all of them and from all the rockers. Immediately before fitting the inlet manifold I squirted oil liberally over all the camshaft lobes.

Distributor. When refitting I realised with horror that I had got the spacer and drive gear on the end of the camshaft the wrong way round! So off came the front cover again and I was able to leave it hanging on the oil pipes while I swapped the gear and spacer round. Fortunately the dodgy sealant I mention above hadn't stuck very well and I was able to scrape this off the crankcase, front cover and even the gasket. Not only did it dry very rapidly but it also went very hard and splintered off - not good for a sealant I would have thought. Reverted to good old Hermetite Red which stays soft for ages and doesn't fully harden at all (remember to do the top of the sump gasket as well), and back goes the cover. Follow the instructions in the book on getting the distributor in with the correct orientation, as unlike the 4-cylinder car where the distributor only engages with the drive in one position the V8 can fit in many positions. Now I could crank the engine (plugs out) and confirm I still had oil pressure, and oil flow from tappets and rockers.

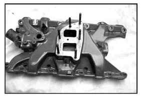
Front cover and oil pump



I could only get the one oil pump hose undone from its adapter, with the other (Sod's Law dictated that it was the long one to the cooler) the adapter came out of the body which meant I had to remove the oil pump cover and unscrew that from the hose rather than the other way round. The front cover was a bit tricky - although most of the fittings were long bolts there was a short stud and a long stud on the right-hand side, above and below the oil pump. These had become well stuck to the cover so a bit of judicious levering was called for. Even a couple of the long studs were difficult to get out having partially seized in the cover. Make sure you have removed all the bolts and stud nuts, including the two up through the sump, before levering the cover, I heard of one chap with one fixing lost in the gunge and he wrecked his front cover trying to lever it off. BTW, loosening/tightening the crankshaft pulley nut and camshaft nut are easy if the engine is in-situ and the rear wheels are on the ground by putting the gearbox into 4th. It looked like a chisel had been used to undo the pulley nut at some time. You have to undo the anti-roll bar mounts from the front apron and push the bar down to get the pulley off the crank. Very little paint left on the cover, came off easily with a small axial wire brush, repainted it satin black. Put the new rope seal in its holder which I left in the cover, didn't seem any point in removing it only to have to secure it again. I was surprised how easily it went in, but there was about 1" left over. I thought about cutting it off by decided to try pushing the rope into the holder rather than just laying it in. The second attempt left me with just 1/2" left over, the third got the whole length in, so don't be tempted to cut it short, persevere and push it all in. Made sure I could fit the crank pulley now with the cover off, rather than leaving it until the cover was bolted up then discovering it won't fit. Checked all the front cover bolts and studs would screw in all the way by hand then fitted the front cover. A word here about gasket sealant: I bought some from Halfords in a dark blue squeezy plastic container shaped like a bellows as

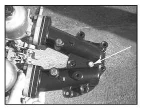
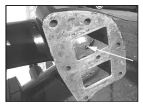
I thought it would be easy to use, but I found it skinned and started hardening far too quickly for my liking given the size and complexity of the front cover gasket - more later. Packed the oil pump cavity with Vaseline which was a bit awkward from underneath, attached the oil pump cover to the hose (remember the adapter came out off the pump instead of the hose off the adapter) and then to the front cover. Fit a new water pump (I thought the old one was failing some time ago but it turned out to be a squeaky fan belt, but as the pumping-up problem could be the pump sucking in air it seems as good a time as any to use the new one) and gasket - sealed with Hermetite Red.

Inlet manifold



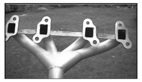
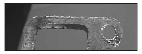
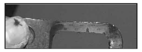
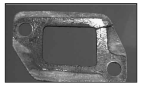
Managed to snap off the left-front inlet manifold bolt, the shank of which was heavily corroded. I was able to drill and retap the head, but nearly gave myself a heart attack when laying a ruler across the inlet manifold bolts to find that the one I had just drilled and tapped was 1/4" or so out of line with the others. Before doing myself too much damage I then checked the other side, to find that it was the same i.e. they were supposed to be that way! The corroded bolt indicated a leak from the water passage immediately adjacent to that bolt, and is immediately above the only place where I had seen any coolant leakage - down the side of the front cover gasket. I had assumed it was the gasket that was leaking, but it was only occasional and had been doing it for much longer than I had had the problem. It could be the source of the air in my 'pumping up' problem. One of the carb adapter stud holes has been stripped for as long as I have had the car and was loose, also one of the fan switch screw holes which had had a larger screw of the wrong thread forced in. With difficulty I found someone locally who said he could helicoil the two stripped threads in the inlet manifold with UNC, I was not pleased to find he did them in metric. I also snapped off one of the heater valve adapter pipe bolts in the inlet manifold but again drilled and tapped this myself. I discovered that the thermostat bypass pipe that is internal to the manifold (not the heater return pipe bolted underneath) was choked with scale which I rodded out with a long masonry drill. I decided to paint the inlet manifold grey as originally (mine was heavily flaking black) but ordinary paint would have a very rough finish on the casting and I didn't want the hassle of sending it away to be powder coated. I have used something called PlastiKote on household items in the past and it gives a finish similar to powder coating, but obviously isn't as tough. It is good for 150 degrees C, and they do it in mid-grey, looks good freshly painted (and after a couple of hundred miles), time will tell if it lasts (six years and 15k miles later it is still as good). Fitted a new core plug to the bottom of the inlet manifold while it was off as a precaution. Before refitting I checked I could screw the bolts all the way in to the heads by hand, cleaning out any oil, water and other detritus. The book says to put sealant round each water passage - four in all as although there aren't any rear passages on the manifold there are on the head and in the gasket so these must be sealed too - on both sides of the gasket. Because of the earlier problems with the blue Halfords sealant I compared it with another 'instant gasket' translucent blue sealant also from Halfords and a clear one from elsewhere. Squirted out an inch or so onto a piece of cardboard and left it in the sun. The clear stayed tacky and soft much longer than the other two so that was the one I used. Now the gasket is fairly stiff metal that starts off flat but has to be deformed into a curve when fitted, and I reckoned if I put sealant on then just pushed the gasket into place it would disturb the sealant before everything was in place. I could have fitted the gasket first then put sealant under it but I didn't want to risk buckling the gasket by pulling it up too high. So I fitted the rubber seals to the crankcase with sealant both sides, then put sealant on the heads round the water passages. I laid the gasket flat across the space between the heads and this allowed me to loosely insert a couple of the bolts on one side just to hold that side of the gasket in position. Then I carefully bent the gasket into position keeping it away from the sealant on the other head, until I could insert a couple of bolts that side too. This also ensures that when you have the inlet manifold in position you know the holes in the gasket are in the right places. Then I fitted the curved plates that clamp the gasket to the rubber seals and crankcase in the centre of the valley (most of the way but not tightened), which allowed me to remove the bolts that had been holding the gasket in position. More sealant on top of the gasket round the water passages and lower the inlet manifold into position - only to realise in the nick of time I had forgotten to refit the heater return pipe (repainted satin black) underneath, fortunately only a moments work. A little wiggling and I get all the bolts in and torque them down. Install the Otter switch using Hermetite red and fit the P-clip for the vacuum pipe.

Carbs, adapter and air-box

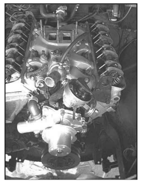
I removed these as a single unit. Removing the adapter for repainting (satin black) from the carbs while the carbs were still attached to the air box avoids disturbing the linkages, even though these are simpler than on the 4-cylinder car. My adapter has an additional bolt on top near the fork of the Vee. I started unscrewing this but realised it had been stuck into the hole and there wasn't a thread, the bolt was a UNF in any case when it should have been UNC if the hole had been threaded. The hole is almost (but not quite) above what appears to be a casting passage between the two throats of the adapter, possibly as a balance pipe, but it is extremely narrow in the order of a couple of mm. Other people have this passage but not the hole and bolt on top, maybe this was a POs attempt to fit a vacuum gauge. Thought about stripping and repainting the air-box which is currently in what looks like Hammerite silver, but by now the parts had arrived and I wanted to get on with rebuilding, I can do the airbox anytime and it isn't that bad anyway. On refitting I used a little clear sealant around each port on top of the inlet manifold (no gasket) then fit the adapter and carbs, leaving the airbox off until I had balanced the carb airflow. Sealed the mystery bolt back into its hole and refitted the choke and accelerator cables and the fuel pipe. Leave the carb overflow pipes off for the time being so if one leaks I can easily see which. Set the mixture to the starting point of the top of the jet being flush with the bridge then two full rotations clockwise (being HIFs) ready for a full setup later on.

Exhaust manifolds

Although the book says you can leave them in-situ and move them to one side or the other to remove the head bolts it is a false economy. Remove the down pipes (slackening the rear mounting right off makes this much easier) and the manifolds altogether and get them right out of the way, but to get the right-hand one off you have to pull the steering rack. The manifolds have always been a pain on this car - they are tubular and warp in use which means when you take them off you can't get them back on without filing out the holes, but then the flanges are at different angles and distances from the head reducing still further the likelihood of a good seal. I noticed that the ports in the manifold were much bigger than the ports in the head, meaning that although the centres might be off-line you could still avoid any overlap which would tend to choke the port. I welded bars in between each flange to push them back to where they should have been and stop them warping any more, put wooden blocks in the head ports and could fit the manifold over these blocks showing there was no mis-match in the ports. I left them with the same person who 'did' the inlet manifold to go on a belt sander and flat all the flanges, he did but one flange on each was still not aligned with the rest. Shan't be going there again. It was about 15 thou out which was too much to ignore but not enough for an extra gasket, the thinnest of which was about double that. So I took an old gasket constructed with metal facings both sides and a compressible core and split it into two halves. This gave me just about the correct extra thickness for the one flange on each manifold. The usual struggle to get the down pipes on the manifolds and engaged with the Y-piece on the main exhaust. The gaskets were of a type I hadn't used before being one gasket per port with black composition both sides and an inner metal core. As you will read below although these sealed initially they were blowing after a short motorway run. Removing them showed that although the ports in the head were not mis-matched with those in the manifold, because the centres were not aligned some of the gaskets were only clamped over a very narrow area and this had allowed the composition to be blown out. Fortunately I had two pairs of double gaskets left over from a previous go at sealing the manifolds and these have the metal facings with an inner compressible core and are much stronger. Even so the manifold is **still** blowing slightly, and I think this is due to the very narrow overlaps on some ports rather than the faces not being flat or flush. I'm thinking now that the only thing left is to remove it again, build up the flange on the **inside** of the port with weld to thicken the overlap, making sure it doesn't go so far as to start restricting the flow.

Final refitting



Loosely refit the radiator - just in case I have to take it out again. I used new hoses all round, all except the bottom hose having been on the car since I bought it eight years and 65k miles ago, being careful to position the clamps so I could remove or tighten them without any dismantling. The clamp on the rear of the heater return pipe under the inlet manifold is the trickiest, but it is possible to angle it so as to reach it with a set of 3/8" extension bars. Using clamps with hex heads instead of screwdriver slots - even cross-heads - makes life much easier. Fill up with plain water and leave it overnight for leaks. No leaks so I fit a tyre pump adapter to the expansion tank hose and pump the system up to the cap pressure of 15psi. The only immediate leak is where the bottom hose goes on the pump, which stops on retightening. Three days later (banned from the garage for family visits) no more leaks and plenty of pressure left in the system. Fit the alternator and fan belt - a new one as I noticed a crack on the inner face when removing the old one. The alt has always had a spacer washer fitted to each of the head adapter castings, and this seemed to me to move its pulley forward of the pump pulley, and the belt often emitted a rhythmic squeak. Careful measurements using a straight edge showed this to be the case and removing the washers seemed to put them right in line. However I then discovered that the adjustment bracket fouled the clamp on the new heater return hose where it joins the pump, and had to put spacer washers both here and on the alternator lug. Fit the distributor cap, and notice that the distributor must previously have been incorrectly installed as all the plug leads are now one position out, so correct them. (*March 2015:* Or so I thought, I've just realised they are one position out now, so were probably correct now, but the difference is marginal). Spin the engine on the starter, plugs out, till I get oil pressure. Install plugs, fit HT leads.

Nothing for it now but to start up. Turn on the ignition, pull the choke on by hand (air-box removed) and use a jumper lead to apply 12v to the starter relay winding, whereupon it starts almost straight away. Two things are immediately apparent - no tappet clatter but it sounds rough. I had been warned that fitting new tappets, even if they had been soaked in oil for two or three days beforehand, could result in them all clattering with a terrible din for up to 20 mins. As mine didn't I can only assume that putting a drill on the oil pump until oil was visibly pumping out from every tappet and then leaving it for a few days did a better job of priming them than leaving them in a bath of oil off the engine. As for the roughness I rechecked the plug leads on the distributor cap and found I had a pair of them reversed. Restarted the engine and it sounds much smoother, but keeps cutting out then won't start at all. Then I realise that I had removed my fuel pump fuse as a precaution and forgot to replace it. Refit that, wait for the pump to stop chattering, fire it up and run it at 2k or so while the cam beds in, then leave it at a fast idle with no choke while looking over, under and round for oil and water leaks - thankfully none. Some smoke off the manifolds and down-pipes but that is to be expected. Check and

adjust the carb airflow balance, both on and off idle, and the timing. Timing needs a little adjustment but the pointer is rock-steady whereas it used to move about a bit before - obviously the effect of the new timing chain and gears. Then switch off and refit the airbox, filters and carb overflow pipes, then run again and adjust the mixtures to the lifting pins. All seems well, engine gets up to temp and the fans cut in, the temp drops, and the fans cut out again. Fix the rad properly, fit the fan grill, reinstall the steering rack and anti-roll bar, refit the road wheels, remove the axle stands, and take it for a short test-drive and all seems well. Exhaust manifolds not blowing for the first time in years. Next day take it for a longer run down the motorway and back through the lanes, when I get back the left-hand manifold is blowing again (see above)! After a couple of days I drain out the plain water and refill with a 33% mixture of antifreeze and check for leaks, seems fine so far.

In conclusion the prospect of doing this job seemed pretty daunting but I thought about it for a long time and read the manual through several times making notes about order of actions, torque figures etc. In the event apart from a couple of snapped bolts it went quite well. The pumping-up seems to have been fixed, the pressure gets up to about 11psi just as the fan cuts in and drops to about 6 when it cuts back out. Running in free air on the motorway reduces it to about 3.5psi. Beforehand it would get up to radiator cap pressure fairly rapidly. The coolant level probe showed a little fluttering on the first day but rock-steady thereafter, I am assuming the initial fluttering was the system purging itself of air. Beforehand it would start fluttering within a few miles and get worse and worse until eventually it indicated that the coolant level had dropped below the bottom of the probe. The disappointing thing is that the tappets still rattle when hot. Opinion now is that the bores in the block are worn and will have to be sleeved. Well, for now they will just have to rattle. One interesting difference to before is that when warming up the needle had **always** oscillated slightly about 'N' before settling down, not to be confused with the wild oscillations that can occur - I have seen the temp gauge at 60psi on the oil gauge! - when the steam pipe is blocked. Now it rises slowly, possibly slower than before, then slows and comes to a stop on 'N', no oscillation at all. This could be as a result of clearing the bypass pipe inside the inlet manifold. As the (4-cylinder) roadster has also always done the same thing I took no notice of the V8 doing it.

Update October 2003. Something continued to clatter, and very badly during the hot weather. I tried adding a viscosity improver but apart from a slight increase in pressure there was no change in the noise. I took the rocker covers off when hot and rattling and inserted a 20 thou feeler gauge under each rocker, one at a time, to see what happened. All rockers seemed equally difficult to push the feeler gauge in and pull it out, and there was no change in the sound when doing so, so I can't really see how it can be tappets. An engine rebuilder opined "It doesn't look or sound like bearings, it could be pistons, I can't guarantee to clear it, and it sounds 'orrible". I left it that I would take my spare short engine over to him some time in the future for him to give me a price on rebuilding that, and left it at that. Come the V8 Register Tour of Cornwall, and after 70 miles of M5 on the way down the noise seems to be quieter even when stuck in traffic. Seemed to go back to 'normal' after climbing Porlock and Lynton/Lynmouth, but then over the remainder of the tour it just got quieter and quieter, even on the very steep and narrow 'roads' through some of the coastal villages. After the mainly fast A30 and M5 trip back home it seemed to have stopped altogether, and after a couple of weeks back on mainly local and short journeys it is **still** very quiet, only making the slightest tapping at very low revs after a hot start. It is so much nicer to drive without all that noise, time will tell whether it remains quiet.

Update Summer 2005. Just a faint ticking occasionally now, with a louder tick after a hot start even more infrequently. I've been communicating with Nik Henville this year as his V8 had a similar coolant problem to mine. However in his case he found the bottom hose clip loose. It started dripping as soon as he touched it even though it hadn't been leaking before. There could well be negative pressure in the bottom hose from the action of the pump, and this negative pressure could also suck air in past bad pump seals (which was one of the reasons I changed my pump at the same time). Just tightening the bottom hose cured Nik's problem. Mine wasn't loose so I don't think my problem was that, but a good example of why you should think, think, think and go for the easy things first.

November 2018: It took the rebuild (and full repaint) in 2016/17 to discover that the hot tapping was caused by a slipping liner! With a different block all is now blissfully quiet ... so far!