Engine

Last updated 16-Dec-2019

If you find the information here useful, you may like to make a small contribution to help offset the costs of providing it. Thank you.

The socket for the crankshaft pulley nut is 1 5/16" AF (same as for the Salisbury/tube axle hub nut).

Compression Testing *Added July 2010*

When performing a compression test the engine should be at normal working temperature, remove all the plugs, and wedge the throttle wide open, then test each cylinder 'dry' noting the results. From the Workshop Manual high-compression engines (8.8:1) should be 160psi and low compression (8.0:1) 130psi for 18G engines. 18V high compression are slightly higher at 9.0:1 and 170psi at 275rpm. However 18V engines to European emission control requirements ECE 15 are quoted as 170 to 190 or 195psi, although some have said that pressure can't be reached with 9.0:1 compression ratio. *June 2014* After 25 years I've done a compression test on Bee prior to changing the head gasket due to combustion gases in the radiator. 1, 3 and 4 were 160 to 173psi dry, 173 to

185psi wet (so maybe the WSM '170 to 190' refers to both dry and wet testing). No 2 was 127psi dry and 138psi wet. The dry to wet increase is pretty-much the same for all, 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. Compressed air forced into No.2 indicated it was the exhaust valve that was leaking, and head off with petrol poured into each combustion chamber confirmed it. No visible damage to valve or head seat, and mild lapping-in stopped the leak. However by the end of 2017 it was doing it again.

The general rule of thumb is that anything more than 10% difference from the lowest to the highest warrants investigation (or is it?), and in reality they should be closer than that under normal circumstances. 2 and 3 down relative to 1 and 4 could indicate a head gasket leak between 2 and 3, where the gasket width is very narrow. For engines where one or more cylinders are low go round the cylinders again putting a teaspoonful of oil into each immediately before testing it, this is a 'wet' test. If a low cylinder increases significantly from the dry to the wet test, i.e. goes up more than the others, that generally indicates worn bores or ring problems. If a low cylinder doesn't increase from the dry to the wet that indicates valve problems, although this is generally accompanied by a regular beat in the exhaust or intake, indicating an exhaust or intake valve respectively. Disconnecting each plug lead in turn should locate the faulty cylinder, when you get a double beat in the exhaust it's not that cylinder, when you get a single beat but more pronounced it will be that cylinder. A little more difficult to determine which inlet valve is at fault using this method though. This may seem a bit pointless if you are going to remove the head anyway, but if the problem is a sticking valve when hot you do need to know which valve it is likely to be first. Another neat way of diagnosing a sticking valve is with an adjustable timing light. In a dark garage, clipped to each plug lead in turn and pointed at the appropriate valve with the rocker cover removed, by turning the adjuster back and fore you should be able to freeze the valve anywhere from fully down to fully up and so see if it is sticking partly down or not. It will help to raise the back of the car relative to the front during this test, to put the engine fully horizontal, to reduce the amount of oil running down the back of the engine with the cover off.

One tip may be to disconnect the fuel pump and run the carbs dry before starting the test, i.e. once fully warmed. I say this because although I have had my Gunson's compression gauge for about fifteen years I can't have used it more than ten times in that period, and yet when I lent it to a neighbour recently it wouldn't hold the pressure, because the hose had perished right by the brass fitting that screws into the plug hole. It was fine just 1/2" back from there, so I trimmed it back and secured it with a clamp and it is working again, but it did make me wonder if it had sucked fuel in during the test (throttle wide open remember) and that had perished the hose. Emptying the carbs would prevent that, but if you do the wet test some oil is likely to get in anyway.

Funny figures? *April 2018* After having the head converted to unleaded the first thing I did after bolting it down was to do a compression check to make sure everything was OK, and that was before fitting the carbs or anything else. Consequently it was a 'cold' test, and with no carbs effectively 'throttle open', and all plugs out. I did the valve clearances very roughly, just making sure there was a gap at the 'Rule of Nine' (RON) point, but not bothering about the value ... and got some unexpected results - 104 136 110 132. Very low, and all over the place. Thinking it may be something to do with the random clearances I set them at the standard RON points and got 125 135 122 150. A bit more consistent, but not much, and still low. So I did them again but this time at the point of maximum gap and got 138 150 124 145. Generally a bit higher, but still quite variable.

By now I was wondering if it was down to the engine being cold, so carried on with the reassembly and got it running. The next tests were when hot and all plugs out - dry 157 157 152 162 and wet 170 170 156 165. Better again, and more consistent, but still quite a bit down on the book figure of 170 which I have always assumed was dry. Then I realised I had done them with the throttle closed, so after another run to get up to full temp I did them again this time with the throttle open, dry and plugs out and got 140 142 150 150. This was lower than the closed dry test, I had expected open to be higher. So on another occasion after a run yet another set of tests, this time doing closed followed immediately by open on each cylinder, all dry, plugs out, and got closed 149 open 152 closed 158 open 153 closed 151 open 153 closed 168 open 169. So some higher open than closed, some the other way round, and some with very little difference! After cylinder 2 I did 3, then back to 2 and got exactly the same result, which indicates to me that individual cylinders aren't varying from moment to moment, only from one round of tests to the next.

By now getting thoroughly confused I consulted Peter Burgess. He wrote back to say that he could never understand how the MGB pressures are as high as they are given the slow cranking speed, and also found that looking for the point of maximum gap was preferable from a tappet noise point of view to the standard RON point. He couldn't offer any suggestions as to the throttle open and closed variations.

Thinking about it and looking at how the valves operated I reckoned that as the inlet valve only closes part way into the compression stroke, the later the valve closes the bigger the effect on compression would be, and the smaller the gap just before it starts to close the later it will close. So I readjusted just the inlet valves, this time so that the clearance was 14 to 16 thou just before it started to move. Another hot dry test all plugs out, and I got 160 170 160 170! So finally up to the book values, and the least variation. However done like that the maximum gap on some of them was much bigger than book, and they clattered like billy-oh. Can't live with that, so spent a long time with a dial gauge on all eight valves determining the maximum gap and adjusted them there, noting the position of other valves to save time in the future, and going round three times to confirm I had the right points. A quick start-up showed the engine to be much quieter, and I await some dry weather to get it fully up to temperature for another compression check.

For interest the maximum gap points are as follows:

1 - 8 half-way down
2 - 1 half way up
3 - 4 fully down
4 - 5 half way down
5 - RON point
6 - Just before 5 fully down
7 - 8 just fully down
8 - 1 just started to go down

For No.5 the RON point is suitable as it was at max over a wide range of cam rotation including while No.4 was fully down. For the others, as well as being away from the strict RON point (some of them a long way off) they also needed to be done in a pretty precise location as they weren't at a max for very long. All I need to do now is to order these ideally so as to be able to have done them all in two revolutions, instead of a dozen or more!

Finally (this has to come to a stop sometime ...) another hot, dry, all plugs out, throttle open test gave 168 167 162 169! The highest and most consistent set yet, so I'll leave it at that!

Conclusions?: As 'funny' cams don't seem to be unique to my engine, doing them at the point of maximum gaps does have benefits for engine noise. The gap just before it starts to open has a significant effect on compression pressure, but setting them for maximum compression can result in a noisy engine. The oft-mentioned 'maximum 10% variation' is an ideal and may not be achievable in practice, without perfect matching of piston and bore, and a cam with a perfectly regular profile for each valve. Compression pressures aren't the be-all and end-all of engine condition unless one or more cylinders are way down, so doing compression testing as a 'routine' instead of just when there is an obvious problem when you need to locate the cylinder and/or valve is likely to cause more grief than useful information.

Another test is a leak-down test. On the pukka kit there are two pressure gauges, one either side of a restriction, with the 'inlet' gauge connected to a compressor via a control valve, and the 'outlet' gauge connected to the cylinder. Piston is set to TDC on the compression stroke i.e. both valves closed. You may have to lock the engine i.e. put it in 4th gear with the handbrake firmly applied to prevent the compressed air pushing the piston down. The control valve is adjusted to give, say, 100psi on the first gauge, and the second gauge indicates leakage from the cylinder. If that were 100psi also the cylinder would be perfect, which of course won't happen, it will always be lower. The bigger the difference between the two gauges the faster the air is leaking out of the cylinder. Having the piston at TDC basically checks the valves, head-gasket and the top of the bore, but if you rotate the crank to move the piston down the bore, and get a sudden decrease in pressure on the output gauge, then damage to the bore at that point is indicated.

Crankcase Breathing *Added April 2008*

Description:

Originally the MGB used a similar system to the MGA. This was a very basic non-positive system consisting of one hose between the top of the rocker cover and the front air cleaner, and another open-ended hose (often called the 'road draught tube') hanging down from the front tappet chest cover. A non-vented oil filler cap was used. There will be very slight suction on the rocker cover hose from the air cleaner, varying with throttle opening, and when under way there may also be slight suction on the open end of the timing cover hose from the effect of the air passing its open end. The effect from either is minimal, which way any air would flow is a matter of conjecture, and if there is more suction on the rocker cover hose it will be pulling unfiltered and potentially moisture-laden air into the crankcase from the timing cover hose - not ideal. At least any fumes pulled out of the crankcase in that direction would be burnt in the engine, if the flow is the other way they are just pumped out into the atmosphere.

In February 1964 with engine 18GA a positive crankcase ventilation (PCV) system was introduced. A PCV valve was fitted to the inlet manifold, and the purpose of this valve is to provide a source of a continuous low-level suction under varying engine operating conditions. The port on this valve is connected to the front tappet chest cover in place of the road draught tube, and contains a wire gauze mesh that acts as an oil-trap as well as a flame-trap. The oil filler cap was changed to the vented type, which lets fresh air into the crankcase via a wire gauze filter and a restriction. The purpose of the filter is obvious, the restriction further limits the flow of air through the engine and PCV valve into the inlet manifold to a low level. This has two purposes - one is to avoid excessive weakening of the mixture, and the other is to provide a slight negative pressure in the crankcase to ensure that under normal conditions i.e. a sound engine, fumes aren't lost to atmosphere from any other place like oil seals and gaskets, but are burnt in the engine. The PCV valve consists of a sprung diaphragm and valve. With the engine stopped the diaphragm is pulled back and the valve is fully open. With the engine running air flow causes a depression in the crankcase and under the diaphragm, which with atmospheric pressure on top or the diaphragm, tends to push the diaphragm down which closes the valve. This reduces the flow, which reduces the depression below the diaphragm and inside the crankcase, which tends to allow the diaphragm to move up again, which opens the valve to give more flow and a greater vacuum and so on. In practice the sprung diaphragm continually balances crankcase pressure with atmospheric pressure to result in the relatively constant flow rate through the valve, and hence the engine, with varying inlet manifold depressions. Clausager refers to this as a 'closed circuit' system but it isn't, it is a 'through-flow' system. A truly closed circuit system

would pull its air from after the air cleaner, so any fumes emitted from what is nominally the crankcase inlet, will also be burnt in the engine.

In October 1968 with the 18GG engine the system was changed again, replacing the PCV valve with a vacuum source taken from the twin SU carbs. The SU carbs are referred to as 'constant depression' carbs and this refers to the area between the butterfly and the piston. On a running engine as the butterfly is opened the depression in this area tends to increase, but as there is are passages between that area and the top of the piston the higher vacuum appears there also, which tends to lift the piston, which has the effect of lowering the vacuum again between the piston and the butterfly. In practice of course the piston moves up and down with the butterfly opening and closing, and the vacuum between the two remains at a relatively constant low level (see SU Carbs for more information on how the SU carbs work). Each carb has a port that taps into this area, and so provides the same sort of signal as the PCV valve, but with no moving parts (or any parts to fail other than possibly a blocked port) and even more importantly to the manufacturer at no cost! These ports are connected via a Y-pipe to a hose that goes to the front tappet chest cover as before. Both carbs are ported to retain the air-flow and mixture balance between them, and the later HIF carbs are the same as the earlier HS. Again the oil filler cap is of the vented type.

For UK cars the system remained like that until the end of production, but for North American cars the system changed in October 1969 with the 18GJ engine when the 'evaporative loss control system' was introduced (see North American Emissions Plumbing for more information on this system). The main additional component of this system is the large charcoal canister sitting in the right rear corner of the engine compartment with three ports on the top and one on the bottom. Two of the three ports on the top are connected to the fuel tank and carb float chamber vent ports, and any fumes from expansion of fuel or filling of tank or float chamber are pushed into the canister, adsorbed by the charcoal granules, and fume-free air is vented out of the port at the bottom of the canister. As the level in the fuel tank drops while driving air travels the other way through the canister to replace it. The third port on top of the canister is the important one as far as crankcase ventilation is concerned. On these engines the oil filler cap is replaced with a non-vented type, and a port with a restriction is provide on the back of the rocker cover, this port is connected to the third port on top of the canister. The restriction in the rocker cover port provides the same function as before i.e. preventing excessive weakening and to ensure a small negative pressure in the crankcase. Carb vacuum pulls fresh air through the port at the bottom of the canister, through the granules which purges them of any adsorbed fumes as well as filtering particles out of the drawn-in air, through the engine picking up any oil fumes, any fumes from either source being burned in the engine. When North American spec engines changed from twin SUs to the single Zenith/Stromberg in December 1974 for the 1975 model year the situation remained the same, this carb is also a 'constant depression' type the same as the SUs and has the same breather port, although in this case there is only the one and no Y-piece, of course. The only other change was to add a second charcoal canister to the inlet of the original in 1978, with the anti-runon valve between them. As this valve has a connection to the inlet manifold it allowed fumes there to escape to atmosphere from the valve. The second canister adsorbs those fumes, to be purged in the same way as the original canister.

V8 engines are slightly different. Each carb has its own hose, with an oil/flame trap, going to a port on its respective rocker cover. On the back of the block near the right-hand side there is a metal pipe with a restriction pointing upwards, on which is a short length of slightly kinked hose, on top of that a petrol filter held in a clip on the back of the air-cleaner box, and a U-shaped hose on top of the filter (to prevent debris dropping into the filter). In this case the airflow is in the opposite direction to 4-cylinder cars i.e. fresh air goes in via the filter to the crankcase, then up through the engine into the rocker covers, and from there into the carbs and engine. *September 2010:* There are occasional reports of a V8 valley gasket bulging. This is a thin metal gasket of a large surface area under the inlet manifold, only supported at the edges. Excessive pressure in the crankcase could cause this to bulge up quite easily. This could happen on modified engines from a backfire through the carb igniting petrol or even oil fumes in the crankcase, where there is no oil/flame trap as there is (should be!) on factory engines between each rocker cover and its adjacent carb. With the standard three ports on the crankcase i.e. one inlet and two outlets slight blow-by should not cause a problem with the valley gasket, but excessive blow-by may overwhelm the ports and allow pressure to go positive enough to bulge the gasket.

Problems: The original system has enough problems to begin with, drawing unfiltered and wet air in through the timing cover port, and being very haphazard as to whether crankcase fumes are burned in the engine or pumped straight out to the atmosphere. Apart from that all that can happen is either or both hoses get blocked. With either hose - and this is the same for any of the three ventilation systems - a blockage in one hose will prevent any ventilation. The main effect of this is to allow condensation to build up inside the engine, especially in cold conditions or where the engine is only used for short journeys, which will cause corrosion. This is usually visible as a creamy 'mayonnaise' in the oil filler hole and on the bottom of the cap. If **both** ports get blocked then there is no path for the relief of excess crankcase pressure, which can blow seals and gaskets, however this is more likely to occur on older engines with some blow-by. Note that contrary to often expressed opinion the blocking of **one** port, whilst it will stop through-flow ventilation, won't allow crankcase pressurisation to occur, as the other, still open, port will relieve that, whether it be via the PCV valve, carb ports, ventilated oil filler cap or charcoal canister. Blockage of one or both of the hoses is also about the only thing that can happen to the later carb ventilation systems. In theory North American spec cars with the canister could get a blockage in that or its fresh-air hose, but in practice this is likely to cause running problems (overflowing carbs and tank vacuum) before it is noticed elsewhere. On positive systems (PCV valve and carb ventilation) the suction-side hose can be checked very easily, as removing the oil filler cap should result in a weakening of the mixture and a slight increase in idle speed as effectively you have created a

vacuum leak. If you put the palm of your hand, or a sheet of paper over the oil filler hole, it should be sucked onto the hole with slight pressure. A blockage in hose between the rocker cover and the charcoal canister is more difficult to detect, removing it from the canister will show very little vacuum, although it should pull smoke through i.e. from a cigarette or other smoke source. A blocked ventilated oil filler cap is even more difficult to detect, but these are probably best replaced at 12k intervals anyway. The one that came with the roadster always tended to leak oil past the seal and down the side of the rocker cover, replacing it cured that. With V8s if one carb/rocker cover hose or flame/oil trap gets blocked the crankcase will still get ventilated via the other, but only the one rocker cover.

The PCV valve has a finite life, when it fails it is usually the diaphragm that ruptures, the effect of which is to apply full inlet manifold vacuum to the crankcase, which can pull significant amounts of oil into the combustion chambers fouling the plugs as we as resulting in high oil consumption and oil smoke pollution. If you have a PCV valve and experience stalling when the cap is removed, or a large vacuum is felt, then the valve has probably failed. That is if you haven't already noticed high oil consumption. Other problems can be oil and combustion sludge inside the valve restricting the movement of the diaphragm or blocking the valve. After-market valves and those used on other vehicles often have a plunger instead of a diaphragm which removes the main failure mode of the MGB valve, but they can still stick open or closed and get gunged-up. The advantage of this type over the MGB type is that under crankcase pressurisation from excessive blow-by the valve will close to prevent air being forced into the inlet manifold from this source so weakening the mixture. If this type of valve were used on the MGB the excess pressure would be vented to atmosphere (via the oil filler cap or charcoal canister), but systems with this type of valve tend to have the fresh-air intake inside the air cleaners, so any fumes emitted will still be burned in the engine. This type of system **is** a closed-circuit system, unlike the MGB, which is **through-flow**.

Modifications: These range from the simple, like removing the emissions kit from North American cars, to the more complex like replacing the SU or Zenith carbs with something else e.g. Weber. The first thing to say is that unlike the air-injection system (the removal of which isn't covered here) the 'vapour loss recovery system' (aka charcoal canister) has no detrimental effect on performance or economy, and does help to keep the atmosphere a little cleaner than it otherwise would be. The only reason for removing it is to free-up a little space in the engine compartment. And if you have a 73 model or later with the anti-runon valve, interfering with the canister and its plumbing disables the valve, which can be a positive disadvantage. If you **do** decide to go down that route there are a number of aspects which must be considered. The tank, float chamber and rocker cover vent pipes can be left dangling in that corner of the engine compartment. But if you remove the tank plumbing and separation chamber and seal its vent port you must fit a vented fuel filler cap in place of the standard unvented. **Don't** remove the pipework running to the front of the car but leave the separation chamber or vent port from the tank open in the boot or it will fill with fumes, and with the electrics in the boot particularly the sparking points of the rubber bumper fuel pump is an explosion hazard. If you remove the existing float chamber vent pipe that runs across the engine compartment you **must** fit alternatives that run down past the engine and exhaust for safety, neat petrol pouring onto a hot exhaust is not a good idea. With the charcoal canister removed you really ought to provide alternative filtration to prevent the crankcase breathing system pulling dust and moisture into the engine. The best way of doing this is to remove the hose from the rocker cover and fit a small filter to it instead. You could seal off that port and fit a vented oil filler cap instead, but subsequently someone may not realise and fit a non-vented cap again, which will disable the ventilation system resulting the aforementioned condensation and corrosion. Much better and more obvious to leave the cap as standard and fit the filter. If you do all that you might as well remove the anti-runon valve as well as it is no longer doing anything useful, and if you do that you must seal its port on the inlet manifold.

If you fit a fixed-jet carb like a Weber they do not have a PCV port as they have no source of a constant vacuum or air-flow so something else must be done. Some revert to the prehistoric non-positive system used on the first MGBs or just leave both rocker cover and front tappet chest cover ports open, but then you are back to condensation and dust in the engine and pumping out oil fumes. Much better to retro-fit a PCV valve and retain the positive ventilation. If use an after-market PCV valve or one intended for another application these are often smaller and neater than the MGB valve as well as being more robust not having the diaphragm and protect against mixture weakening from crankcase pressurisation. Whichever, plumb that to the rocker cover rear port. Weber air-cleaners often seem to have a breather port, in which case so you can connect the tappet chest cover port to the air-cleaner port. Then you will have a positive, closed-circuit system that protects the mixture against crankcase pressurisation and the environment against fumes.

NEW Cylinder Block *July 2019*

Pal driving down an Autoroute in France when he suddenly lost a lot of power with white and blue smoke pouring out of the back. A blown head gasket was diagnosed and a local place said they could replace it. The oil was contaminated and drained, and before they replaced the drain plug they started refilling the radiator only to find water dribbling out of the sump plug! Repatriation.

Back home there is a hole from the lower part of a bore to the water jacket, 1mm in the bore but 3-4mm in the jacket so punched through from the bore to the jacket? What on earth could cause that? Another theory is cavitation where the cylinder wall flexes at high frequency producing bubbles in the coolant, and when they collapse they do so very rapidly directing a jet of coolant at the cylinder walls so eroding them. But most discussions on this refer to Diesel engines, and it being a progressive thing rather than sudden and catastrophic as in this case.

I've asked if they can gauge the thickness of the casting at that point, they are going to sleeve that bore, but one can't help wondering if it is a weak point and there are more elsewhere. Peter Burgess told me that a number of Qualcast blocks

were found to be so porous that they had to be sleeved from the outset, these don't appear to be sleeved.

That was in No.1 cylinder, but No.2 piston is completely clean with the others lightly carboned, and is covered with tiny nicks. A clean piston usually means it's been 'steam cleaned' by a leaky head gasket - or cylinder wall porosity? And 10k ago they did find a chunk missing from No.2 exhaust valve so maybe the broken bit had been bouncing up and down inside - the pistons are to be replaced as well. A bit of a 'problem child' this engine as the cam and followers had to be replaced after 20k as they were badly worn and pitted, that quite possibly down to his workshop using 'modern' oil with a low ZDDP.

Cylinder Head *January 2018*

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.

Finally re-torquing - next day after first fitting the head before any running, and again after about 500 miles. The latter isn't necessary with the steel shim gasket on the V8, and neither should be done on modern engines where after reaching the final torque figure the nuts are tightened a further number of degrees. For the sandwich gasket on the 4-cylinder both are advisable. Each nut has to be slackened slightly before being tightened again with a torque wrench to break the thread stiction, but DO NOT do what I've seen suggested and undo each nut completely. 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. This is normal and is just the elasticity of the stud plus the effect of thread stiction. You need to turn the nut until it starts moving relative to the stud, and as soon as it does so you can then torque back to the correct figure. In practice as you will almost certainly be using a socket and won't be able to see the stud, a quarter-turn of slackening should be enough.

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 inflator 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 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 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 though 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, 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! 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.

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.

Dating the engine *February 2013*

Dating the block
Dating the head

Taking it to the pictures? Not in this case, rather taking pictures of it to work out when block and head might have been made and what type they are.

Dating the block:

Bill Etter from America has asked me about this date code when he lost his engine number plate and wondered whether it could indicate if it was the original engine or not. Originally I was under the impression that all blocks have a date code cast in, immediately below the oil filter, just above the sump mounting flange. However as time has gone by more and more have come to light without these date codes from throughout the production period, maybe they were cast in two locations with different methodologies. If you do have a date code, opinions vary greatly as to how to read it. Some refer to it as a 'clock', but clock codes have a set of numbers in a ring and an arrow pointing to one of them to indicate a single digit, where as these have three groups of characters arranged in a ring, and all three groups change from example to example. The slot in the middle is simply from the head of the screw used to attach the date code plate to the pattern used to create the sand mould for the casting.

There seems to be a one or two digit number at the top of the group at 12 o'clock, a letter at 8 o'clock, and a one or two digit code at 4 o'clock. Some say it is three groups of numbers representing day, month year, but UK factories generally use a week or fortnight number and a year for date coding. In an example with an 'L' at 8 o'clock some say this is a '7', but that would put it the other way round i.e. the base of the '7' towards the middle instead of towards the outside as with the digits at 4 o'clock, which offends symmetry. Others clearly have letters at 8 o'clock, and since many patterns would have been used to create the castings my contention is that this is the pattern number, for traceability. The number at 12 o'clock is probably a week number, definitely not a fortnight or a month number, as I have seen examples of 29 and 13. Any examples over 31 which would confirm it is not a day number? Any examples over 53? The number at 4 o'clock is interesting as early examples seem to be two digits in the 60s range, and later examples single digits. Almost certainly the year, and when they got to 1970 rather than having to make up new ones from 70 to 79, I'm betting someone had the bright idea of simply filling in the first digit! As production went on to October 1980, I wonder what they did then, any examples? However Bills block, which is from a 76 and the previous owner assured him is original to the car, doesn't have any codes in that position, so did they stop casting them in sometime after 1973?

October 2013: An engine from another 76 comes to light with '9' at the top, 'K' on the left and '5' on the right, plus another that could have a '6', so they were still

being used into 1975 at least. But to add to the confusion I've also found a 3-main block that **doesn't** have this code.

September 2014:

Graham Moore asked me about identifying the engine **type** i.e. 18Gx or 18V rather than dating it. It should be possible to do this from the casting numbers, even though they are pretty-well concealed by the starter motor. It seems that 18G/GA i.e. 3-bearing engines have a single 12H750 casting number, some 18GB/Gx i.e. 5-bearing engines have three nnHnnn numbers one above the other but late versions may only have a single 12H3243 number, and 18V ('most' of them according to one source) have a single 12H3503 number. But even the 18V can vary as some have the 12H above the 3503, and others have both in a line.

Grahams block seems to have the three rows of 'H' casting numbers, indicating it is an 18GB/D/G of October 64 to August 71, but like the early 3-bearing referred to above, does not have a dating clock. Graham's (like mine) is a Gold Seal engine, and his engine number prefix is 48G 739. According to Clausager this was a replacement for the 18GB High Compression manual gearbox engine of October 64 to November 67, but it is the third of three replacement types quoted for that engine. The first was only used for the 18GB, but the second was also used for the 18GD/GG of November 67 to August 71. This engine also had three replacement types, the latest of which was 48G 755. It seems to me that as the original engines developed, the rebuilt engines did so as well, using later components where that did not change the basic specification. The numerical part of Gold Seal suffixes appears to have been issued in numerical order over time, as did the numerical part of the 18V prefixes. And as 739 comes after 737 which was the first (and only) replacement for 18V 584/585 and 18V 672/673 engines produced between August 71 and September 74, it seems to me that 48G 739 could well date to some time between August 71 and September 74, and possibly after August 72 when the 18V 672/673 was introduced. The 48G 755 would have been even later, but presumably before the BHM 1074 which was the replacement for the 18V 836/837 of September 74 to December 74. Another thing to bear in mind is that Gold Seal engines were assembled from good returned blocks etc, which could have been at any time including many years after that block was used originally, so you could well have a 'late' rebuild on an 'early' block.

Another point of confusion concerns the blanking plate for the mechanical fuel pump. Some sources say this was 18V engines only, other sources indicate it was all five-bearing crank blocks i.e. 18GB onwards, yet more indicate that there was a 'lump' on the block of the same size and shape but not pierced, but with a tapped hole for a stud that was used to mount the carb overflow tubes. The Parts Catalogue would seem to be the best guide, and that indicates it was for 18V engines only. Graham's engine has the blanking plate, but the casting numbers indicate it is an 18GB/D/G. This block with a 66 date clock, 18GB/D/G casting numbers and an 18GB engine number doesn't have the blanking plate, or unpierced position for it, but another example of unknown date does. More examples required.

Cylinder heads:

Cylinder heads can be dated from a casting number and a date code cast into the upper surface, so easily seen by removing the rocker cover.

Dipstick! (and sumps) *Added September 2010*

Sumps and gaskets
Capacities

No, not the habitual imprecation invoked by Sheriff Rosco P Coltrane of Hazzard County on his deputies, but seemingly just as liable to cause chaos and confusion regarding engine oil quantity and level.

There were at least three sticks, three dipstick tubes and three sumps over the life of the MGB engine. Each changed at various times, and not all combinations are correct, the wrong ones giving incorrect oil level. Particularly cars with positive crankcase ventilation, where the crankcase is held at negative pressure, need the dipstick and tube to be sealed or the ventilation system will suck in dust and dirt.

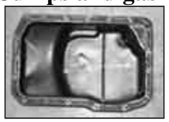
Early sticks dropped right into the sump, the end of the stick sitting on a raised (reinforced?) section at the bottom of the sump. There were two sumps in this period, the difference being associated with the rear main bearing between 3-bearing and 5-bearing, both having the drain plug on the right-hand side **near** the rear corner. The tube is screwed into the lower part of the block. On this type the stick plus the raised portion in the sump determines the oil level, the tube length is largely irrelevant. These sticks have a dust-cover sealing the top of the tube, which can be slid up and down the stick. It must not prevent the stick going all the way down or you will be putting more oil in the sump than there should be to reach the MAX mark.

Later sticks have a fixed 'stop' which wedges into the top of a different tube, first screwed then pressed into the block, meaning that both the stick **and the tube** determine the oil level. When first used the engines still had the sump with the raised portion, but the stick stopped short of it. These sticks do not have a dust-cover as such, the 'stop' seals the top of the tube. Later engines with this stick and tube had a sump without the raised portion below the stick, and the drain plug on these is in the right rear corner.

Engines after that used a different stick, with a stop, the pressed-in tube, and the same sump as previously. Information about exactly what combination of parts was used when is confusing, with different information in the Parts Catalogue to some web sites. I suspect that when looking at examples of original engines you will see when the actual changes took place (incorrect combinations excepted!), whereas later versions of the Parts Catalogue and current parts lists may well show the later of the two (or more) parts that can be used:

Engine	Stick	Tube	Sump
18G, 18GA	12H74 no stop	1B1063 screwed	12H395
18GB, 18GD, 18GF	12H74 no stop	1B1063 screwed	12H1426
18GG RWe H to 22059, 18GG RWe L to 20207 18GG We to 21267, 18GG Rc to 757 18GK RWe to 10072, 18GK We to 10951	12H2964 with stop	12H2966 screwed or 12H3351 pressed	12H1426 or 12H3541
18GG RWe H 22060 on, 18GG RWe L 20208 on 18GG We 21268 on, 18GG Rc 758 on 18GK RWe 10073 on, 18GK We 10952 on 18V581H to 1583, 18V581L to 1013 18V582H to 2592, 18V582L to 1207 18V583 to 257, 18V584/585/672/673	12H2964 with stop	12H3351 pressed	12H3541
18V581H 1584 on, 18V581L 1014 on 18V582H 2593 on, 18V582L 1208 on 18V583H 258 on, 18V779/780	12H3963 with stop	12H3351 pressed	12H3541

Sumps and gaskets:



5-bearing sumps 12H1426 and 12H3541 are interchangeable, the later sump has the corner by the drain plug cut away to give access to the torque converter bolts when used with the automatic gearbox. These have a different bolt pattern to the 3-bearing 12H395 so are not interchangeable with that sump (Chris at Octarine Services). Logically 12H3541 should always have been used with the automatic gearbox at least if not all engines from that time, but logic doesn't always apply with British 'engineering'. I'm sure I originally came across a reference somewhere that this sump was only provided with the 18GG engine whereas the automatic option arrived with the 18GD.

Also note that the 12H1976 part number specified by Moss for the early 5-bearing sump is not used by anyone else, and the change point to 12H3541 being for the 18V797 engine is completely wrong - the auto option was long gone by then. Other suppliers give a 1965 date i.e. all 5-bearing engines, which is correct for where they can be used, but does not indicate when they were originally used from.

Originally the gaskets were GEG503 for the 3-bearing and GEG504 for the 5-bearing, the part numbers from the usual suspects are now AJM503 for the 3-bearing and AJM504 for the 5-bearing. However the MGOC does not differentiate between the two in its online reference as parts for both types of engine are all listed on one page. Brown & Gammons and Moss Europe split the two types of engine over two pages making it clearer.

Capacities: I have seen claims from some quarters that later engines only take 3.4 litres/6 US pints for an oil and filter change, whereas the 18G engines took 4.25 litres/9 US pints. Web sites can't agree when the change took place - some state all 18V engines take the lesser quantity, others that it was 77 and later engines. The GHN4/5 GHD4/5 drivers handbook AKD 7598 4th edition states:

> 18GG, GD (no oil cooler) 7.75 Imperial pints (4.26 litres, 9 US pints)
> (but note 7.75 Imperial pints converts to 4.4 litres)
> 18GG, GD with oil cooler 8.25 Imperial pints (4.5 litres, 9.6 US pints)
> 18V engines (no oil cooler) 5.25 Imperial pints (3 litres, 6.3 US pints)
> 18V with oil cooler 6 Imperial pints (3.4 litres, 7.25 US pints)

In other words all 18V engines take less than the 18Gx engines, but this goes against the part numbers and change points stated in the Parts Catalogue which implies later 18Gx engines were the same as 18V, and earlier 18Gx could be either. Other than the change of sump to give access to the torque converter bolts on automatics which was used on all cars, and I can't see that small corner being responsible for 2.25 pints, maybe just the oil level changed, and hence its volume. The BL figures are for a dry engine, hence less will be required for an oil change, although you have to add in the amount required to initially fill a new oil filter. I'm surprised it is as low as 3.4 litres for an 18V with oil cooler, I would have said mine took more than that to be at the Max mark after running the engine after an oil change, then switching off and leaving a few moments before checking.

WSM AKD 4957 5th edition only states a capacity in the section on 18G/GA engines, usually when this changes for later engines in the same manual new figures are given in the appropriate section. The figures given are:

> No oil cooler 7.5 pints (4.26 litres, 9 US pints)
> Oil cooler 8.25 pints (4.68 litres, 9.9 US pints)

February 2013: For what it's worth my 48G 737 Gold Seal (equivalent to the 18V 673) has the following dimensions:

Top of tube to MAX	24cm
Top of tube to MIN	25cm
Top of tube to bottom of stick	28.5cm
Top of tube to bottom of sump	29.5cm
Length of exposed tube	12.2cm

A pal's 18V 582 is the same. Based on his serial number they should be, so either they are both right or they are both wrong, and in the same way, which seems unlikely!

V8: My V8 takes a full 5 litres to get back to the Max mark after an oil and filter change. Convenient, as I just chuck the whole container in then leave it to run through for a bit before double-checking. Whereas for the roadster it is a case of pouring in less than you think it needs, waiting for it to run through, then putting progressively smaller amounts in, waiting and checking, until it gradually comes up to the Max mark - takes 3 or 4 iterations.

Engine Mounts *Amended and updated January 2011*

<u>Chrome bumper</u>
<u>Rubber bumper and V8</u>

Chrome bumper: All chrome bumper cars have rectangular engine mounts, but the method of limiting engine movement varied considerably. The usual reason given for these restraints is that without it the engine could move forwards far enough for the fan to chew through the radiator, which would be a bit of a blow. However someone has said that it would be more of a blow if the crank pulley hit the rack bending that, or even worse bend the crankshaft, which may cause the owner to write off the car (surely not?). It's a valid point, as there is only about 3/8" clearance between pulley and rack, whereas there is about 1 3/4" between the fan blades and the nearest part of the radiator (header tank). But an impact large enough to bend rack or crankshaft is going to make a helluva mess of the front of the car anyway, and it is that which is more likely to result in a write-off as much as anything else.

Mk1 roadsters had a restraint rod between the gearbox and its cross-member to control fore and aft movement in particular, preventing the engine moving forwards far enough for the fan to destroy the radiator. Mk1 GTs didn't have this rod, but had a different arrangement between the gearbox and crossmember primarily to control **vertical** movement of the gearbox. This has little or no effect on of fore and aft movement so control brackets were added to both front mounts limiting how far the engine could move forwards. Mk2 cars had the same arrangement for both roadster and GT - dropping the restraint rod, having a similar arrangement to control vertical movement of the gearbox as the Mk1 GT (but using different components), and having control brackets on both front mounts. For non-North American cars the right-hand bracket was deleted for the 1972 model year to save a few coppers (in reality one is probably enough), North American cars continued with two. Another change is that when the carbs were changed from HS to HIF (18v export engines during 1971, not until November 1973 for UK cars) the left hand control bracket gained a threaded stud for mounting the clip that held the <u>carb vent/overflow pipes</u>. In Feb 74 a new restraint rod using different components to the Mk1 roadster was added to North American roadsters and GTs. But despite this very positive restraint to fore and aft movement being used again, the front mount control brackets were also apparently still provided. Other markets only got this restraint rod at the start of rubber bumpers production in September 1974, when the engine mounts changed from rectangular to round, the original restraint brackets were no longer relevant, and no alternative was provided.

If you have a Mk2 chrome bumper car without a restraint rod (i.e. all UK and most North American) the front mount control brackets are the only thing protecting your radiator from being chewed by the fan in a minor impact, or maybe just a jolt from a pot-hole. My 73 roadster came to me without them, and a pals 72 GT doesn't have them either, a situation that seems pretty common by many accounts. In this situation only the four rubber mounts are effectively controlling fore and aft movement, the additional bracketry between gearbox and cross-member will only prevent extreme movement, by which time your mechanical fan will have chewed into your radiator. I'd been aware these were missing on my roadster for some time, and was pretty sure I had looked but couldn't find anyone stocking them. But at the time of writing MG Parts UK (cheapest, item 14) and both Moss Europe (item 14) and Moss US (item 95) are showing them with a price indicating they are available. If you have the later restraint rod then the front control brackets are superfluous, little trouble to refit if you have them, but not worth retro-fitting. But for cars without the restraint rod they must be considered essential, and I have placed my order!

And yer 'tis. Hole in the side piece, quite possibly where the stud is welded for use on chrome-bumper cars with HIF carbs. Only takes a few minutes to fit after I have removed the vent/overflow pipes from one of the chassis mount bolts, then it's a case of working out where best to fit those. The mechanical fuel pump blanking plate bolts where the original bracket, and rubber bumper carb pipe clip was mounted are a possibility, but they prove pretty tight working from above and as I didn't want to start a leak from the gasket I decided to use the convenient hole in the new bracket instead. I just put a bolt through, but there wasn't quite enough room to get a spanner on the bolt head while I tightened the nut unless I removed the mount nuts again and lifted the bracket on the studs. I could have welded the bolt to the bracket a 'la chrome bumper HIF carbs, or put a nut on first to tighten the bolt to the bracket, before putting the pipe clip on with a second nut, but it was no big deal.

Rubber bumper and V8: The first thing to say is that the V8 didn't have restraint rods or control brackets at any time. The engine does move quite a bit, when my engine mounting plates were on the wrong sides and the engine was further forward than it should have been, the crank pulley would rub on the (uprated) anti-roll bar under braking.

When replacing the V8 mounts I found it easiest to undo the nuts securing them to the chassis brackets, then jack the engine up so the studs on the mounts cleared the chassis brackets (you will have to tilt the engine to remove first one then the other), then remove the mounts from the engine plates. The rubber mounts have the chassis plate stud offset from the centre, when attaching the rubber mount to the engine the stud must go in the **lower** of the two possible positions.

Undoing the nuts in the chassis brackets was extremely difficult on a friends car, and applies to 4-cylinder as well as V8. Even with copious use of PlusGas and working the spanner back and fore. Eventually we were using a rope on the spanner, running under the car, with my friend pulling on the rope with all his worth while I positioned the ring-spanner for each half flat. That got one side off, but the other side (pulling the other way) was even worse so much so that pulling on the rope was just twisting the rubber and backing plate, which sprung back when the rope was released, so I couldn't advance the spanner. In the end I drilled down through the rubber, its backing plate and the chassis plate with a 1/8" drill intending to put a steel pin in the hole to stop the backing plate twisting. But due to the angle and the sudden breaking through the drill actually broke off in the hole, doing the job, and rope and spanner eventually got the nut off. Copper-grease used on reinstallation!

Because the mounts are angled it is not possible to drop the engine with rubber mounts attached straight onto the chassis plates even though the chassis brackets are slotted. Tilt the engine to get one stud in then tilt it the other way so that stud is at the top of its slot and you should be able to get the other stud in. Before the stud goes all the way through fit the lock-washer and start the nut. When you lower the engine all the way aim to get the studs at the same position in their slots as each other to ensure the engine is correctly aligned.

The drivers side is tricky because access is severely limited by the steering shaft passing through the chassis bracket. I wedged the nut into an open-ended spanner and stuck the lock-washer to the nut with grease then offered the nut/washer up to the slot in the chassis bracket, then screwed the mount (with spacer) into the nut a few turns, then secured the mount to the engine plate. Very fiddly, now having had the rack out several times for exhaust manifold issues I'd just remove it to give the same access to the mount nuts both sides.

There is a square locating plate with an offset round hole for each side and this goes on the stud under the chassis bracket before the washer and nut. This locating plate must be fitted with the hole in the **lower** of the two possible positions. It ensures the engine is installed in the correct position as the locating plate can only be fitted over the stud when the stud is low enough in the slot in the chassis bracket. However the stud **must not** be right at the bottom of the slot as this puts the rubber mount under shear and tension stresses instead of compression which will cause premature failure. Sufficient spacers must be fitted above the chassis bracket to ensure the stud is clear of the bottom of the slot, but not so many that you cannot get the locating plate on the correct way round.

Bolting up the stud nuts is a long, slow job as you have to turn an open-ended spanner over twice for each flat, so be patient, to start with at least. Once the nut is on the stud enough you may find you can use a slim ring-spanner, and with 16-pointers you can turn the nut half a turn at a time without turning the spanner over each time. You may even be able to get a ratchet ring spanner on the nut and so avoid even having to remove it at all. But make sure you can remove the spanner once the nut is fully tightened (by seeing if you can fit it before you loosen it!) and the stud has been pulled all the way through. If not, and your ratchet spanner isn't reversible, it may be there for evermore!

Remember to reinstall any spacers on the appropriate side of the rubber mount. Many cars will have had a second spacer fitted on the drivers-side of V8s to stop the exhaust manifold hitting the steering shaft as the mounts age and compress. If you find you need to add one it is easier fitted between rubber mount and chassis bracket, the dimensions are given in the pictures accompanying this section. If you cut a slot in the spacer for the rubber mount stud instead of drilling a hole you will be able to slacken the nut, raise the engine slightly that side and slide in the spacer, rather than having to undo the nut completely and raise the engine enough for the stud to clear the chassis bracket.

One problem that seems to afflict 4-cylinder rubber bumper cars but none of the others, is fracturing of the bracket between the engine front-plate and the left-hand mount. My pal's relatively low mileage 78 showed this, but was relatively easy to weld in-situ.

Very important for V8s is that the engine is installed using three components each side - the rubber mounts as one might expect, spacers as required, but also a plate that fits between the mount and the block. **It is vital to be aware that these plates are handed but can be installed on either side.** If installed on the wrong side the engine and gearbox assembly is about 1/2" forward of where it should be, which means the crankshaft pulley can rub on the anti-roll bar under heavy braking; the sump can rest on the front cross-member and wear through; and the gearbox cross-member can only be installed by bolting it in the forward position on one side and the rearward position on the other. If you have occasion to remove and refit these plates, look carefully at the relationship between the holes that are used to bolt it up to the block and the holes that takes the rubber mounts. They should be installed such that the mount stud is **in front** of the centre-line between two holes that secure the plate to the block. This will ensure that the engine is installed in the rearmost of the two possible positions - the correct position.

Engine Removal *December 2019*

Relatively easy with the 4-cylinder engine as recounted here as part of a clutch change, and I'd always do it in two parts if I needed to get a gearbox out. When Vee's gearbox started whining about a year after getting back on the road after an engine rebuild - very annoying - I didn't want to send her away after the nightmare last time, but knew removing the V8 engine is nothing like as simple as the 4-cylinder for a variety of reasons. But one of my contacts put me onto a chap who knows these gearboxes, and has a V8, and he told me how it could be done on its own, then removing the gearbox afterwards.

Exhaust

Mounts/Clamps
V8 Manifolds

Several different designs over the years from separate components with welded end-plates on the boxes to one-piece with the boxes crimped onto the pipes. That type probably no longer supplied as it's easier to ship replacements in sections. CB and RB rear sections quite different - the exhaust passes under the rear axle so the CB just has a small dip there then passes along the side of the tank pointing straight back. On the RB the raised ride height means the pipe has to dip down lower to pass under the axle, which puts the box lower relative to the tank than the CB box. It then has to be angled upwards to reach the rear mounting point, and the tail-pipe then has to be angled downwards relative to the box for the tail pipe to point backwards (actually angled slightly down relative to the ground).

Originally mild-steel on a cast manifold, there are very many options for replacement, the main one probably being going to stainless for longevity. I did that for both cars as they needed replacement not long after they came to me. Bee was complicated by having an 'extractor' manifold i.e. complete with mild-steel down-pipes that turned to point backwards at the bottom. As I recall at the time the MGOC didn't have a system to match up with that so I had to obtain a cast manifold, which needed restudding, and get a full system from the manifold back. I remember being very disappointed with the sound of the new stainless system, and it was only after crushing the centre box a bit parking on rough ground at Chatsworth for the Kimber Run in the early days when it was run by Geoff Shirt that it started to get a bit of rasp and sound nicer. Since then it's been trouble-free.

Vee came to me with tubular manifolds and mild-steel back from there, minus a middle box, which used to shake the pointing out of the local railway bridge at a certain rpm. I can't remember how much I had to replace - quite possible only back from the Y-pipe. That has also been trouble-free, except that it started to look like it was rusting, unlike Bee's which is still smooth with just blueing, possibly because it was used in all weathers including much salt for the first few years, but hasn't got any worse. The biggest problem is the down-pipes on the manifold, which are a push-fit, with simple friction clamp, and has given me no-end of problems with them working loose although fortunately caught each time before it actually fell to the ground.

Incidentally it's a commonly held view that stainless steel is non-magnetic. I was under that impression until I had some so-called stainless V8 wheel nuts that rusted, and research showed that whether it is magnetic or not, and by how much, depends on the 'grade' which is associated with it's intended function and not an indication of it's quality. When someone repeated the 'non-magnetic' thing on a forum I replied with the foregoing, decided to check my exhaust out of interest and found they both exhibited some, less than mild-steel but more than enough to support a rare-earth magnet.

Mounts/Clamps:

- V8
- Middle, all models
- Rear, all models

As well as the middle and rear supports the 4-cylinder has strap GEX7194 (twin carbs, BHH1616 single carb) with clamp from just in front of the Y-pipe to a bell-housing bolt. Ironic, as with either system I've had there's not chance of the front falling to the ground, unlike the V8 which can do it all too easily with tubular manifolds but has no additional support in that position. The multi-piece systems are held together with one pipe sliding into the other which has slits either side, and a U-clamp. These are best fitted horizontally so the studs and nuts don't catch on anything.

V8:

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 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.

Middle, all models: *February 2019*

A bonded metal-rubber-metal sandwich bracket GEX7204 suspended from the body, with two fibre bushes GEX7182 in housing GEX7183 supporting U-strap GEX7191 under the exhaust between the middle and rear boxes, plus sundry hardware. On some boxes the U-strap is attached to the pipe, but on others it is loose. That's how it was on both Bee's and Vee's stainless systems which gave rise to some chattering, so I welded tabs to the U-brackets that I could then clamp onto the pipes with standard U-clamps. Some systems come with this U-strap already welded in place which solves that problem, but then again the 'legs' have been known to fracture meaning something else has to fit round the part that remains welded to the pipe.

The bonded sandwich can part which allows the pipe to drop and strain the remaining supports, as on the early rear clamp, so I have wondered whether the later rear clamp could be adapted to fit the middle. But given correct alignment and the later rear supports that cannot drop, the strain on it should be pretty minimal, and so far I've not had one fail in 30 years and 25 years.

Rear, all models: *Added April 2012*

There was a change in body bracket in Feb 69 (chassis number 167816), and again between chrome bumper and rubber bumper. The early bracket is bonded and if it fails can allow the exhaust to drag on the ground. The later CB and RB item still supports the exhaust even if the rubber mounts fail. The RB item is basically the same, just deeper. The catalogue lists four heat-insulating washers, and shows them as if they fit on the rubber mount studs. I can understand one between the mount and the bracket that supports the saddle-clips that go round the pipe, but the other side of the rubber mount is the body bracket which is cold. I've never had them on either of my cars, and apart from one occasion on the V8 when I did find both rubber mounts sheared have not had any other problems with them in 95k on the V8 and 55k on the roadster. I suppose the missing washers will alter the alignment of the two brackets and the rubber mounts to some extent. The six nuts have plain and spring washers. I've found the rubber mounts are available from Halfords, hanging on the racks with all the other small parts, so perhaps more easily obtainable for some than from the usual

MGB parts suppliers. The picture shows the arrangement of brackets and rubber mounts, which although shown assembled and in-situ should be good enough to work out what goes where.

Front/Timing Cover

4-cylinder

The timing cover and pulley changed three times, for timing pointer reasons at least. There was only one gasket so neither the cover shape nor hole pattern changed. 12H3317 used prior to the 18GG engine had the timing pointers underneath. The other two 12H3510 used on CB engines (18GG, GK and 18V prior to 18V797) and CAM1393 used on RB engines (18V797 on) had them 'on top' angled towards the alternator for ease of adjusting the distributor while watching a timing light. The pulleys changed with the covers (maybe more often for North America). Some sources indicate early MGBs had the same 12H773 pressed-steel i.e. undamped pulley as the MGA, but the Parts Catalogue lists 12H963 as the earliest type which suppliers show as cast and damped. The Parts Catalogue doesn't state 'damped' for 3-main bearing engines, but it does for the 5-main using the same part number. For the 18GG it changed to 12H3515 (damped) prior to 18V797 and 12H3516 (damped) for 18V797 on. Clausager states that the pulley increased in diameter from 5 1/8" diameter to 6" diameter for RB engines, hence the pointers would be further out for the bigger pulley. The depth of the later (at least) CB and RB covers seems to be the same to a mm or so at about 33mm. John Pinna measured an RB cover on the bench at 78mm from crank centre to pointers, and with everything in-situ I measured my CB pulley at 5 1/8" or 130mm, and half that i.e. 65mm plus a gap from pulley to pointers of 4mm makes 69mm from crank centre to pointers for a CB cover as opposed to 78mm for an RB, which chimes with the bigger RB pulley. My CB pointers overlap the circumference of the pulley with a clearance of about 4mm, whereas a fitted RB cover of John's has the pointers beside the pulley and if the points were any longer they would rub on the rear face of the pulley. His pointers are as far across the face of the cover as they can go, and even 'hang off the edge' a bit. A bigger pulley will make both the water pump/fan and alternator spin faster for a given engine speed, but Clausager says the RB engines had a smaller pump pulley as well, which will increase the pump/fan speed still further. Enhanced cooling for RBs with the reduced intake through the front bumper?

Removal: *January 2018:* While draining the coolant when replacing the head gasket I noticed the front cover was a bit oily around the pulley, so while I was part the way there (coolant drained) I decided to replace the gasket and pulley oil seal, and investigate the timing chain, gears and tensioner, as that seems to have been a bit noisy lately.

Really you need to remove the radiator, which means draining the coolant. Then remove the cooling fan, and its pulley, which means you can remove the fan-belt without having to move the alternator. Then the dog can see the rabbit.

Knock the crank pulley nut lock-tab back, and get a 1 5/16" socket on the bolt. This is tight as it has a tapered seat to the pulley and is done up to 70 lb ft. I found that with the handbrake pulled on as tight as I could get it, and the gearbox in 4th, leaning on a breaker bar still moved the car backwards without moving the bolt. And although I could just get my air-gun on it using a wobble extension that didn't move it either. In the end I put a sliding tommy-bar onto the socket, a couple of inches away from the near-side chassis rail, and flicked the starter - came undone a treat. The pulley slid forwards - but not enough to come free before fouling the rack tube. This is a chrome bumper, the engine is higher relative to the rack on rubber bumper cars, but the pulley may still foul. I have a couple of options - jack the engine up and see if I have enough movement, but I doubt there will be on a CB; Undo the engine mounts, but that seems an awful lot of work; So I settled for unbolting the rack from the crossmember, and I could pull it forwards far enough for the pulley to clear it, even with the wheels on the ground. I did remove the column UJ clamp bolt, but I don't think I needed to, it certainly didn't come far enough forwards to part the splines. With that out of the way I remove the nine front cover bolts (three different sizes), and the cover comes away quite easily. Despite the thick gasket there is white sealant both sides, which comes off the engine front plate easily enough, but needs a bit more encouragement in the recesses between the bolt holes. Remove the old pulley seal with the cover flange on a flat surface, using a hammer and drift, taking care not to distort the cover in any way. Check the flange of the cover for flatness, and that the parts between the holes are not bowed. The recesses are supposed to prevent that, but overtightening will still cause it, and leaks.

Drive a new seal into the cover using something to cover the whole seal to spread the impact evenly round if you don't have a seal drift. Put a **smear** - not great gobs - of non-setting sealant round the front plate, and the cover, put the gasket on the cover with a couple of the screws through the cover and the gasket to hold it in position, and offer the cover up, loosely fitting all the screws. Don't use silicone sealant as it skins very quickly and can result in harder lumps in some areas of the join. Before tightening any of the screws i.e. while the cover is free to move around, oil the seal and the pulley and refit the pulley to the crankshaft and the cover. This positions the cover by centralising the pulley in the oil-seal before you tighten any of the screws. In fact in the past I may have fitted the pulley to the cover before

applying sealant and gasket, using the pulley on the crank to position the cover on the front plate.

Timing cover screws: *August 2015*

There are nine bolts around the timing cover of three different sizes - 3-off 1/4" x 3/8", 4-off 5/16" x 3/4", and 2-off 1/4 8 3/4". The Leyland Workshop Manual makes no reference to this, Haynes tells us to note the different sizes and where they fit but doesn't tell us where that is. I've seen the question of where they all go raised several times but with no definitive answer, until Chris Wilson posted this picture taken when he dismantled his engine (forward thinking!).

However it is fairly self-explanatory - it's obvious the four 5/16" bolts will only go in the appropriate holes, the three shorter 1/4" bolts go at the top into the engine front plate where there is no block behind it, and the two longer ones go at the bottom through the front plate into the block.

Gold Seal Engines

Updated October 2008:
'Gold Seal' engines are factory replacement complete engines painted gold instead of the usual maroon or black. They are usually **remanufactured** engines i.e. ones that have been exchanged under warranty or for some other reason. They will have been completely dismantled and every component tested and measured to make sure they meet spec, and any that don't are replaced. As such it is probably better than an original engine, which are simply assembled from parts out of a box with the quality and 'correctness' of those parts assumed. I don't know whether replacement parts in a Gold Seal engine were similarly tested, but even if they weren't at least the original parts have been! Other info about Gold Seal is that they were automatically given the max rebore and max regrind to save messing about measuring wear and applying the next rebore/regrind up. Also that the blocks all had the core-plug recesses bored deeper to accept the cup-type plugs instead of the flat type, as the cup-type don't pop out on detonation like the flat type can. Thirdly, a load of blocks were manufactured by Qualcast, but when they started machining them they found the castings were porous, so rather than junk them they linered them.

My roadster came to me with a Gold Seal engine of the correct type for its year, so either it was replaced while that type were still in production, or someone had been very particular about fitting the correct replacement. Gold Seal engines have special prefixes which can be decoded to the original prefixes, see below:

Gold Seal Equivalents:

Engine Type	Compression	Gearbox	Gold Seal Prefix
18G	High	Manual	48G 279; later 48G 343

18G	Low	Manual	48G 280
18GA	High	Manual	48G 343
18GA	Low	Manual	48G 344
18GB	High	Manual	48G 392; later 48G528 48G 739
18GB	Low	Manual	48G 393
18GD/GG	Low	Manual	48G 527; later 48G 736
18GD/GG	High	Manual	48G 528; later 48G 702 48G 755
18GD/GG	Low	Auto	48G 529; later 48G 736
18GD/GG	High	Auto	48G 530; later 48G 755
18GF/GH	High	Manual	48G 539; later 48G 704
18GJ/GK	High	Manual	48G 704
18V581/582/583	High	Manual/Auto	48G 733
18V779/780	High	Manual	48G 733
18V581/582/583	Low	Manual/Auto	48G 736
18V584/585	Low	Manual	48G 737
18V672/673	Low	Manual	48G 737
18V836/837	Low	Manual	BHM 1074
18V797/798	Low	Manual	BHM 1105
18V801/802	Low	Manual	BHM 1105
18V846/847	High	Manual	BHM 1111

Notes:

- BHM 1105 thought to apply also to later North American 18V883/884 18V890/891 and 18V892/893 engines.
- *Updated October 2019:* In practice Gold Seal engines usually have an 'E' or 'N' suffix letter as in 48G733E nnnnnn. The 'E' refers to an exchange engine, either fitted by a dealer or an owner. I've also heard of 'ER' and 'ET' suffixes - distinction unknown. 'N' refers to an outright purchase i.e. no return of a faulty unit. Peter Burgess told me that some block castings from Qualcast turned out to be so porous they had to be sleeved, and may also have been built as Gold Seal i.e. 'brand-new' and not rebuilt as such. Nigel Brown reports that his has no suffix, what that means I have no idea, but looking at Gold Seal numbers for the Mini (of which there are far more than for the MGB) there are many examples both with and without suffix letters. At the bottom it states that BHM numbers with an 'N' suffix were brand-new and painted black, and another source states these may have had a gold stripe!
- Frequently the plates have additional characters, such as two-letter codes, not reverse-stamped. These may be the initials of the rebuilder.
- *August 2010:* Clausager also mentions the existence of engines in the USA with an 18S prefix, possibly 'general service engines' used to replace very early engines in dealer stocks where the pistons were found to be faulty.

Also an engine with an 18SV prefix followed by the usual MGB code numbers in a later UK MGB.

- *November 2018:* Steve Penkethman on the MGOC forum was enquiring about the 18SGB engine in his 1971 roadster, which seems to be outside the scope described by Clausager. It should have an 18GG if a 71 model or an 18V 581 if a 72 model.

There were also Silver Seal short engines, i.e. without heads or ancillaries. The only information I can find on engine number prefixes for these is that RKM was used for smaller capacities. However those engines used BHM for Gold Seal i.e. the same as for later MGB engines, so perhaps RKM applied to 1800cc engines as well, and Calver Special Tuning says that RKM engines were of Unipart origin when BL split its parts organisation off. This extract from Practical Classics in 1984 on the Morris Minor forum indicates that Silver Seal were never provided for the MGB, only Gold Seal.

Oil Cooler - *October 2016*

Great care is needed when undoing or tightening the oil hose unions on the cooler, or you can destroy the cooler. The safest way is with two spanners - typically 1" across the flats although hose unions can vary.

For undoing, position the spanners on the hexes such that both can be gripped with one hand and squeezed towards each other, with the hose union spanner positioned CLOCKWISE relative to the cooler spanner. When squeezing make sure little or no rotational force is applied to the cooler spanner, it must be the hose union spanner that moves - anti-clockwise - as they are squeezed together.

For tightening the hose union spanner must be positioned ANTI-clockwise relative to the cooler spanner, and only the hose union spanner moves - clockwise - as they are squeezed together.

For rubber-bumper oil coolers the four bolts attaching it to the underside of the apron will need to be removed first and the cooler pulled down a little to expose the hose unions.

Oil Filters

Filter types and quality
Filter not sealing
Decals

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

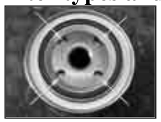
Note: An odd one this, only four months, it looks like someone at the factory had the bright idea of making oil changes cleaner, only to rediscover some major reason why they were inverted in the first place! *Updated September 2010:* In response to a query about owner conversion to suspended I had to 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 tray under that to catch what is running off, just using paper to grip the filter. With the inverted on the roadster I position the newspaper underneath formed into a shallow bowl, and once slackened can spin the old filter off and get it 'right way up' much quicker and easier than with the other two.

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.

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 valvesprings, 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 *March 2019:*

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.

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 to see how it was going to press against the brake pipes that are 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.

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.

Oil Gauge

Mechanical Gauge

4-cylinder cars always had a 100psi oil gauge. Initially V8s were 60psi, then from June 1974 they were 100psi, changing to 80psi shortly after.

Gauge flutter:

Quite a few people have commented that their oil pressure gauge moves up and down a bit at a constant engine speed, almost certainly caused by the oil pressure relief valve fluttering at a certain combination of oil grade, temperature and engine speed. Whilst fiddling with the valve or changing oil grade might stop it happening, it's equally likely to move it to a different combination of circumstances, or maybe not change it at all. Clausager mentions that in July 1966 at car 89549 a sintered plug was fitted to the oil gauge to reduce fluttering, obviously only partly successful. The part numbers changed to BHA4586 (Farenheit) and BHA4587 (Centigrade), as listed in the Parts Catalogue. This video from David Bolton shows a quite noticeable flutter when holding the engine at a specific rpm, Bee does almost exactly the same occasionally.

For those with an enquiring mind, what lies inside a mechanical pressure gauge, either oil or temperature, or indeed vacuum. The principle is a C-shaped, flattened tube known as a 'Bourden' tube, when pressurised with air, oil or any other fluid will try to straighten. If one end is anchored and the other attached to a mechanical linkage a pointer can be made to move round a dial. With the appropriate gearing a small movement of the tube of, say on eighth of an inch can be made to move a pointer some 270 degrees, in the case of a single movement gauge. With the dual gauge in the MGB there are two tubes and they are designed to move up to 180 degrees, although when I had the manifold steam pipe blocked on the V8 the temp gauge moved quite a bit more than that, round to 40psi on the oil gauge! A linear movement of the tube pulls one end of a lever at a position close to its pivot, and a series of teeth on the other end of the lever several times further away from the pivot rotates a spindle, to which is attached the pointer. The relative lengths of the two halves of the lever, and the gearing of the teeth on the lever and the spindle, deliver the required ratio of tube movement to pointer movement.

Pipes and hoses - 4-cylinder *January 2015:*
The 4-cylinder has a hose from an adapter on the block near the back-plate on the engine to a connector on the heater shelf under the heater motor, and a (originally steel) pipe from there to the gauge.

At least it should have. Bee came to me with a hose with a short length of pipe with fitting and a Jubilee-clip at the engine end, and nothing at the other. The pipe from the gauge - instead of being screwed to the connector on the heater shelf, had no fitting on the end and was simply pushed through the connector directly into the end of the hose, with a Jubilee-clip.

As failure of these is not unknown, and mine looked pretty original (apart from the odd arrangement at the gauge end, perhaps the result of a failure before my time), I was keen to replace it. But as the reputation of rubber parts is very poor these days I decided I wanted a) something a bit more substantial, and b) ideally incorporating a pressure switch for a light warning of low oil pressure. Most hoses seem to be braided these days, but what's inside? If it's rubber you can't keep an eye on any deterioration. Browsing came up with one from Stevson Motors with a Teflon core, which although intended for competition use (they do a non-Teflon a bit cheaper) was good enough for me.

Oil pressure warning

V8

Despite having more confidence in the new Teflon hose than the old rubber, I was still concerned about the possibility of loss of oil pressure for any reason and having to rely on occasional glances at the oil gauge to spot it, so investigated adding a low oil pressure switch. On the face of it a relatively easy job as 1972-on North American cars got a 3-port oil gauge connector BHH649 on the bulkhead in place of the UK 2-port, with a switch, although that was for the anti-runon system those cars had. However those 3-port connectors have been NLA for years, and only occasionally come up for sale with eBay sellers, but patient watching eventually came up with one, then more patient watching was needed to get a second one for Vee.

Since then I've investigated alternative adapters. I've not been able to find anything that will give the correct fittings at each of the three ports, not even by combining several fittings. Someone claimed they had on one of the fora but it ended up a right mish-mash and someone else reckoned it didn't give the correct fittings anyway. In the end patient research came up with a simple adapter that can be screwed into a suitably drilled and tapped standard connector AAA628. These can be made to order, price on application, which will depend on whether I supply the connector or you send me yours for modification, whether I supply the switch or not, and in that case the pressure of the switch.

I wanted to get as early a warning as possible of pressure failure, but switches are usually only 5 or 6 psi. But as Bee's pressure is never normally below 25psi, and there are 20psi switches, I purchased one of those - several times more expensive than the others! Subsequently I browsed some more and found a VW 1.4 bar/20psi switch for less than a fiver. Result - or so I thought. When testing I discovered that it is a normally open switch that closes with oil pressure, instead of the other way round. Apparently German car manufacturers switched (ho ho) to this type in the 80s, when electronics were taking over. More searching found plenty of low-pressure types, but no high pressure except the one found earlier. But pondering, the normally open type can still be used if your warning light is an LED with an external resistor. Wire one side of the external resistor to fused ignition (green), and the other side to one side of the LED, wiring the other side of the LED to earth. Then wire the pressure switch (which outputs an earth when it has oil pressure) to the junction of the resistor and LED. When you turn on the ignition the LED has 12v one side from the resistor and a wired earth on the other, and nothing from the switch, so lights as it should. When you have oil pressure the switch closes, connects an earth to the junction of the resistor and the LED, so the LED has an earth both sides and goes out, again as it should. The resistor is carrying current all the time the ignition is on so generating heat, and the wattage needs to be chosen accordingly. 220 ohms lighting a high-brightness LED generates about 0.5W, rising to about 0.75W when extinguished by oil pressure, so that is the wattage to select. This system requires three wires to the resistor/LED instead of two, but the benefit is that if the circuit from the switch should fail with the engine running the warning light will come on, even though you still have oil pressure. With the normally closed switch under the same circumstance you won't know about it unless you spot it hasn't come on when first turning on the ignition, and if the oil pressure should subsequently fail you won't know about that either!

That left the gauge pipe which didn't have the fitting for the heater shelf connector, so another purchase - copper now so easier to form to shape.

The gauge hose fitting came off the block adapter easily, as did the other end where the steel gauge pipe was pushed straight into the end of the hose. The other thing I wanted to change was the routing of the gauge pipe. This came out of the lower bulkhead hole that faces across the engine bay behind the engine, and then has to make several turns to line up with the connector. It's true that one image in Clausager is like that, but the others have the oil pipe through the upward facing hole nearest the master cylinders. I decide to move it there so it can have a straight run to the connector, but the problem is that the temp gauge capillary comes up there, with the heater tab cable coming up the one under the heater motor. I could have the connector turned round 180 degrees to line up with that hole, but that would put the switch very close to the fan motor, and the body of the connector very close to the TCSA solenoid that uses the same mounting bolt. So the temp gauge sensor has to be removed, the coil straightened and the gauge pulled right back out of the dash so the sensor can come out of the bulkhead hole without bending the capillary too much. Never mind, it's easier to replace the oil pipe with the gauge pulled forwards anyway. The last temp gauge I bought was outright, so I still have the one with the failed temp gauge, and quickly pop the sensor of that in the head to limit coolant loss and mess. So do all that, get the new oil pipe up the hole nearest the masters and the temp gauge and heater cable up the other one. Remove the old connector, fit the new pipe and hose to the new connector, and bolt it back down to the shelf, screw the switch in, and attach the new pipe to the gauge. The new pipe is copper rather than the steel of the old one, so much easier to bend. Just as well as it is several inches too long, which I have to 'lose' under the dash. No sealing washer on either old or new gauge fitting, so I make one with the Aldi hole punch kit I got for a few quid a month or so ago. Crank the engine again to check for leaks and all good, so refit everything including the cooler hose grommets and straps. The grommets were a real struggle until I smeared Vaseline round the hoses, grommets and holes in the diaphragm.

I installed the new hose, connector, gauge pipe and switch, together with correcting the routing of the cooler pipes, not without some fun and frolics with the latter as recounted here, but left the warning light for the moment as I was still pondering exactly what to do.

The problem with warning lights in a roadster is that top down, with low sun behind you, if the sun is shining on them they can easily became invisible. They can vanish under other circumstances as well. I well remember being at Prescott Hill Climb one year with a Scimitar GTE on the line, wondering what the big orange light - a classic Mini indicator - on his dash-top signified, then as he roared off the line it became immediately obvious from the large and spreading

pool of oil where he had been standing! His oil filter had come loose, but he was so focussed on his start he didn't notice the huge warning light on top of the dash. He must have gone a couple of hundred yards at full chat before he realised, but having fitted a new filter and refilled with oil on his next run he achieved Fastest Time of the Day in his class, surely proof that engines are not going to be destroyed the instant they lose oil pressure.

You can fit an audible warning as well, but that would be annoying coming on every time you started the car, particularly after standing a couple of weeks when oil pressure takes a few seconds to build. You could delay that, but it would need to be at initial switch-on only, a delay on subsequent oil pressure loss would rather defeat the object, and even then a failure in that circuit could stop the audible warning all together. Funnily enough back in the 60s with our first car I was for every fiddling and 'improving', and I did put an audible warning on both the ignition and oil pressure lights, but arranged such that when they were both on, there was no sound, only when one was lit and the other out. That was fine on the Mini as being a daily driver oil pressure built quickly, still not so good for the MGB. Another possibility is to use the brown/yellow to the ignition warning light as the voltage supply to the audible part, as that only goes up to 14v once the engine has started and the alternator is charging i.e. an automatic 'delay' after switch on, but still perhaps too short for the MGB. For the moment I'll leave an audible warning for some more pondering and just fit the light.

I had bought a couple of LED warning lights with lenses and bezels - one with an oil-can symbol on and the other with a brake symbol (for a low brake fluid level system I'm currently testing). But really in the roadster they needed to be up high i.e. close to my eye-line and shrouded to prevent them being obliterated by sunlight, and I couldn't find anywhere I was happy with. In the end I have used a super-bright 3mm LED which has a narrow-angle lens and is really dazzling, tucked neatly under the dash crash-rail. There is a gap there between the top of the dash and the underside of the dash-top just large enough to get a couple of wires that have been soldered to the LED legs though. A panel mounting bezel (even though the LED isn't in a panel) wedges it between the top of the instrument cowl and the underside of the crash-rail near the middle of the instrument panel. Dead-centre would have been preferable, but there is a mounting bracket just there, so it has to go to one side of that. I opted for the left as that is the direction the wire takes to go through the bulkhead to the switch. With the vertical and horizontal angles tweaked it points right at me while I'm seated, and is in shadow, so hopefully I won't miss it.

November 2016:

In an idle moment I had a look at the warning lights mentioned above, and found how to prise the lenses out without damage. Underneath is a standard orange LED (behind an orange lens, red behind red for the brake) with dropper resistor to operate off 12v. These old-style coloured LEDs are not very bright at all, and the lens reduces it still further. Interestingly the led/resistor legs had two fine springs pushed onto them, and they fitted onto two spikes which came up from the external terminals of the light unit, making removal and refitting very simple - no soldering. So it was a simple matter to take a super-bright white LED, add a resistor, and fit that instead. That was for the oil light, the brake warning module has the resistor as part of the module, so I removed that and fitted just the LED into the light unit i.e. without a resistor. With the corner of a bit of square, black plastic drain down-pipe I fabricated a mini-panel to hold both, which simply pushes into the gap between the dash and the crash-pad. Much brighter than before, it's only in full direct low-level winter sun that the oil light becomes less easy to see. Not a problem with the brake light as that has an audible warning as well and subsequently I fitted a cowl to shade them from direct sunlight and be more visible. I could fit audible warning to the oil as well, with suitable circuitry so it only sounds when the engine is running ... such as something that discriminated between 14v running and 12v not running (10v when cranking).

V8 *July 2018:*
Quite different to how the roadster should be, but ironically not that different to how Bee was. A short elbow of copper pipe with a 1/8" BSP conical fitting for an adapter on the V8 oil pump which is right at the front of the engine, going into a hose with a crimp clamp. The other end of that hose has a steel pipe also secured with a crimp clamp, which goes up to the bonnet channel then under that to just past the starter relay. Then another short length of hose, with the engine pipe pushed into it and clamped, and another length of steel pipe going through the bulkhead just above the main harness to the gauge. There are several pipe clips along the way - one with a spacer and harness clip just above the engine hose with a screw and nut securing it to the inner wing, two more using relay mounting screws, and a final one by the pedal box. I say final, I think there is another behind the dash and very well hidden.

I want to replace both hoses which means finding two connectors, and also fit a pressure switch which means one of them has to be the 3-port. I have kept Bee's original bulkhead connector, which could either be used at the hose end with the 3-port in the middle, or the other way round. But due to space limitations where the short hose is I opt to put Bee's old connector there, with a 3-port by the hose. Due to the low oil pressures of the V8 I have to use a standard low pressure switch of about 5-7psi or the light would be on all the time it was idling.

I find yet another 3-port connector online to take the pressure switch - but that is the easy bit. Emails with drawings and conversations with Stevson - complicated by me not knowing his terminology, but we get there in the end. He makes me up a conventional hose with a 1/8" BSP cone fitting at one end, and a short elbow of copper pipe with a similar fitting at the end. Again that's the easy bit. Now I need a length of pipe (A) with the same 1/8" BSP fittings at both ends from the hose to half-way back, plus another fitting for the pipe (B) going the rest of the way back to the gauge, which I have left in-situ. I'm pretty sure a new roadster gauge pipe won't be long enough for the V8, as it has to go right across the bulkhead inside the cabin, then forwards quite a few inches. But having kept Bee's old gauge pipe, that is long enough for the pipe 'A' (the original being too

short for the hose I have received), and with a small blowtorch remove the gauge fitting from it. I've also got both Bee's and Vee's original hose to engine fittings, plus I obtained a new V8 hose to engine fitting as a spare, which gives me the three conical fittings I require. It's then a case of removing the cones and nuts from the existing pipes, cleaning up and tinning both ends of pipe 'A', and the exposed end of pipe 'B', sliding on the nuts, and soldering the conical fittings. Fitted and tested a couple of the soldered joints are weeping (old steel not as easy to solder as copper) but removal, filing, tinning and refitting seems to do the job. So the mounting clips go back on, and holes are drilled in the inner wing for the two connectors.

That just leaves the electrics, which will be similar to Bee, although sun on the warning light will be less of an issue, and a simple high-brightness orange LED positioned above the column cowl does the job - to start with at least, over the winter of 2018/19 I combine it in a housing with brake fluid and coolant level warning lights.

Oil Cooler Hoses *January 2015*

Last spring I replaced the oil filter adapter as in recent years I had been having increasing problems getting new oil filters to seal, and discovered the adapter had warped. While investigating that had I noticed that the cooler hoses were in the wrong holes in the radiator diaphragm panel - Clausager shows the short one in the lower hole and the long one in the upper, whereas mine were the other way round. I wanted to correct that as I has wondered if it were a factor in the adapter warping, as well as replace the almost certainly original gauge hose. I had also been investigating the fitting of a 'low oil pressure' warning of sudden and total loss of pressure, which has been reported by others from time to time, and does rely on you looking at the gauge to spot. The seal between the new adapter and the block also had a very slight seepage, so in a brief warmer interlude it was time to look at all three jobs.

You have to be very careful removing these from the cooler, which is only alloy, and just spannering on the hose fitting will almost certainly fracture the cooler spigot. You need a spanner on the hex of the cooler spigot as well as the hose fitting, with a narrow angle between them, in such an orientation that squeezing the two handles together applies the force to undo the hose fitting. With nearly all of the force applied to the two spanners it's quite easy to keep the cooler spanner still and just move the fitting spanner, i.e. reduce the forces on the cooler spigot to a minimum. The same happens when tightening, but with the spanner handles on the other side of each other so squeezing them together tightens the fitting.

Hydraulic fittings can be very variable in size, I've found I needed different spanners to fit replacement hoses compared to removing old ones, on brake and clutch as well as oil. 9/16 Whitworth is a good fit on the original filter mount adapters, and two out of three of Vee's old hoses. This translates to 1.01" so a 1" may fit, if not a 26mm should. 24mm is OK (a bit loose) on the third hose, which may have been changed before my time. 23mm just fits Vee's cooler (replaced some years ago), can be forced onto Bee's cooler (not changed in my time) but really needs 15/16", 24mm is loose. 23mm is OK on Bee's new hoses. 24mm is needed for Vee's new hoses.

The first time I tried to undo the short hose from the adapter on the filter housing of course it was the adapter that came undone. But I have a 1 1/16" AF which with a 1p coin in one side of the jaws, was also a perfect fit. The block adapter on the long hose is in a very restricted area, and again on a pals car I found the adapter moved before the hose fitting. But wedging a flat-blade screwdriver between one of the flats on the adapter and the back-plate locked that in position and I could undo the hose fitting. But just to swap the hoses over in the radiator diaphragm holes I don't need to undo that. Tightening isn't an issue as long as you tighten the adapters before attaching the hoses. My cooler spigots are slightly smaller than the hose fittings, measuring 0.925". A 23mm spanner could just be wiggled on, really it needed the next size up i.e. 15/16", or 24mm which is a fraction bigger still. Slightly loose spanners are OK on the steel hose fittings and adapters, but can damage the corners of the flats on the alloy cooler.

With both hoses off the cooler and the short one off the filter adapter, I can remove the short hose altogether but have enough room and flexibility in the hose to pull the long one back out of the hole while still attached to the block. But first, the grommets. Bee came to me without grommets. I wanted to fit them, but didn't want to have to remove the hoses to do so. So I cut the grommets, then fed them in round the hose, finally positioning the cuts at the bottom for neatness. A bit of levering with a blunt flat-bladed screwdriver got them out again, and with the two rubber hose straps removed, I could remove the hoses and swap them over. At this stage I decided to refit them and check for leaks before going onto the next job of the gauge plumbing. Cranked with plugs out - took quite a long time to get pressure, probably because I had drained the short hose and some had come out of the long hose, the cooler and the filter adapter. Got it up to 60psi then had a look round, no leaks, so on to the next job, which was changing the gauge hose. That done, I drove the car out of the garage and put it back in nose first for an extended test to prevent fumes getting into the house ... and immediately spot oil spurting out of the short hose by the alternator!

Buggah! Now I've got to turn the car round and get it back in the garage without getting oil all over the drive. But I have loads of boards of various types and sizes, so can lay a 'path' all the way down the drive. Stuff loads of newspaper round the hose, roll it back, then start the engine and turn round and back in as quickly as I can. Dropped nothing on the boards, so nothing on the drive thankfully. So now it's two new cooler hoses as well as everything else, the irony being that with three new hoses I probably won't need the low oil pressure warning for another 45 years! The Pessimist might say "If I hadn't fiddled with

that hose it wouldn't have failed", but the Optimist says "If I hadn't done it now it would have failed on the road with worse consequences". Checking hose prices several of the usual suspects all have them at about £14 for the short one and £17 for the long. I check the supplier I will never use again out of interest, to see they are £12 each, but then check another one to see them at £8 each! There is no way I'd buy the £12 ones, let alone the £8, so settle for Moss, opting for original rubber rather than S/S braided.

In the end I decided to leave the thing that started all this last year - the filter adapter - as it was. It's been seeping less lately anyway, and when I checked the centre bolt it was hardly tight (which was how I found it when I removed it last year) and tightened by at least a flat. So I'll tighten it again sometime when it is hot, and if it still seeps, then I'll have to bite the bullet and replace the sealing ring. But I'm not looking forward to it with the engine in-situ, getting the groove completely clean with such an old seal could be tricky.

February:

Continuing cold weather around freezing so no incentive to spend time in the garage, especially as I wouldn't be using the cars anyway with salt continually going down and no rain. Finally in the second week of Feb still cold but a bright sunny day, and go for it. The hoses arrived from Moss and are stencilled 'Gates' which is a reputable supplier and SAE30 R6, which is something you wouldn't be able to see under braiding. One of the grommets is a pig to get out, even though it went in with Vaseline just a couple of weeks ago. Filter and cooler unions came undone again, but this time I have the long hose from the block to deal with. The new gauge hose has to be removed to make room to wield the spanner, and is a bit of a fiddle working round the cooler pipe even though I got it on before. With that out of the way the cooler hose union comes undone easily, leaving the adapter in the block, and both hoses can be withdrawn with some dripping. Can't see the split/hole in the old short hose, but time for that later.

Feed the new hoses through the panel - the correct way round - then a bit of wrestling curving them in a different direction to how they were in the poly bags, to get the unions lined up with the ports. You have to be very careful not to cross-thread, especially on the alloy cooler. But being new they are more pliable, and I also realise they are slightly thinner. And as soon as I start to use a spanner on the fittings I realise the hexes are smaller as well! So out of interest I take a set of measurements:

	Old	New
Hose dia	0.925"	0.775"
Nut across flats	1.01"	0.975"
Grommet ID	0.84"	Not changed
Nut across hex	1.18"	1.05"

Grommet groove OD	1.25"	Not changed
Panel ID	1.25"	Not changed

The old hose unions and cooler ports took a 9/16W (probably 1", the extra .01" above being surface corrosion), and I could just wiggle a 23mm onto the cooler ports. So I bought a 24mm for the cooler ports, but now find I need to use that on the new unions and still have to wiggle the 23mm onto the cooler ports! However the old hose was slightly bigger than the ID of the grommet but the grommet groove is only the same size as the hole in the diaphragm panel, hence the real struggle to get the grommets round the hose and in the panel even though they were split. In the past someone said they put the grommets in the panel then the hoses through the grommets, but these hoses stand no chance, they barely fit through the panel without the grommets - just 70 thou clearance! With the new hoses being slightly smaller the grommets are much easier to refit, but I still don't see a 1.05" nut going through a 0.84" even being able to compress the rubber a bit. However neither grommets nor straps will be fitted this time until I'm sure it's all leak-free. ***June 2017:*** When reinstalling Vee's engine with new oil hoses and grommet (one) I decided to try putting the grommet on the hose first. By pushing the nut on the hose down onto the grommet on a flat surface, and levering the grommet around the nut with a blunt screwdriver, which wasn't too difficult. Then levering the grommet into the panel - carefully! - with another blunt screwdriver. Once one part was in, twisting the grommet around the hose got the rest in relatively easily.

But before that I ponder how to angle the cooler hose at the block. Originally it was quite low down i.e. below the gauge hose, and I wondered if higher i.e. above the gauge hose it might give better access to the distributor cap. Decide to have a look at Clausager for a decision, to discover there isn't even a consensus, with three above and two below! Nevertheless I opt for above, and find that gives much better access to the gauge hose - which has to go on afterwards - as well as to the distributor cap. But now the hose goes above the filter instead of beside it, so you can't win them all. But being in the middle of a 'long' run it's going to be easy to hold it aside for filter replacement.

After that it's a series of leak tests again - plugs out and cranking to 60psi, then a short run in the garage to 80psi, then get it out, turn it round and nose in for an extended run. Continually looking around, a couple of times I see what initially looks like the glint of oil but realise with relief it is all the shiny fittings! Only after all that and I have driven round the (salt-free) block and put it back in the garage do I refit the grommets and straps. On which when I got Bee she only had one strap so I bought the other. And of course instead of the nut being welded to the bottom plate as on the remaining original so you only have five pieces to juggle, the new one has a free nut, and a slotted screw instead of a Phillips. The original strap is looking pretty ratty by now - and even the 'new' one is showing signs of cracking - so I got a new one with the hoses. Same free nut, but the screw now takes a Phillips as well as a flat blade so an improvement. Still need to wire up the warning light, more warmer weather required.

Subsequently examined the old hoses closely. There is a bead of oil where I recall the jet of oil coming from - I didn't stop to study it closely before switching off! - although wiping that away shows less marking than elsewhere on the surface, it must have been microscopic. Even elsewhere it's only very fine crazing, which certainly wasn't apparent without close examination. Cutting through by the source of the leak revealed two thick layers of rubber with some stout non-metallic braiding between them (modern hose seems to have two steel layers). No evidence of rotting or decomposition internally, until I slit a section lengthwise which then showed a lot of fine cracking when opened out. The interesting thing is that the long hose (not the failure) had the following printed on it every few inches - "SAE 100 R2AT 1/2" 9/87". Hydraulic hose to that standard is still apparently marketed, and the '9/87' could indicate that it was a replacement hose, i.e. manufactured in 1987 on a 1973 car. It was 1990 when I bought the car, and certainly not obvious as a 'recent' hose then i.e. the cooler fittings at least not shiny, although the PO did use it as a daily driver and the cooler fittings are very subject to rust and salt spray. No markings on the short hose i.e. the leaky one, so that may be original.

Oil Pressure Relief Valve

Important - V8 relief valve

A tip on refitting the cap to 4-cylinder cars more than anything else.

Bearing down against spring pressure whilst trying to get the threads engaged is one of those 'worst jobs' on the MGB. Refit the cap without the spring, slowly unscrew it, and mark the cap and block where the threads just disengage. Now you can refit the spring and position the cap just before the threads will engage and not only will you know where the threads will engage, but also that whilst fighting the spring you will only have to turn the cap a few degrees to do it.

Oils and ZDDP *Added March 2009*

Update April 2018

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. 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, 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 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.
- 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 Thrower *January 2010*

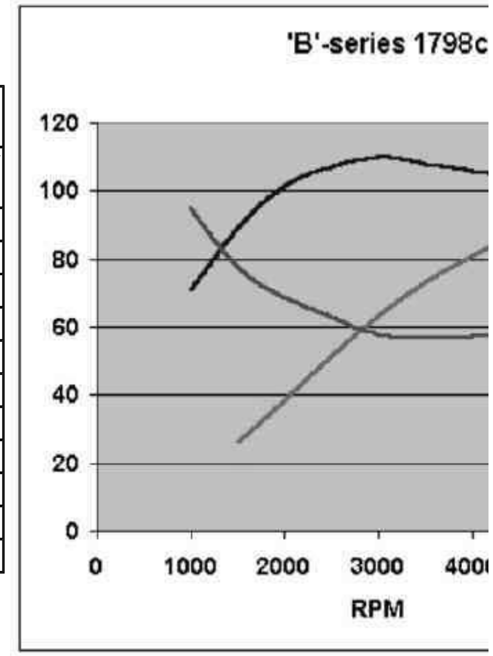
Confusion is possible over this as it can fit either way, it changed between early and late engines, and when on the wrong way the keyway can be disengaged. Early double-row timing chains had the concave or cupped side of the thrower facing away from the engine i.e. towards the front cover crankshaft oil seal. Later single-row timing chains had it facing the other way i.e. towards the engine. Facing away from the engine i.e. towards the oil seal may seem the logical direction, but it's purpose is not to aid the oil seal as many suppose but to throw oil over the chain and timing gears. The oil seal should be effective in preventing leaks by itself. Thus the concave side facing towards the engine i.e. gears and chain as in the later engine is actually the more logical direction. The Leyland Workshop Manual indicates that an 'F' for 'Front' i.e. facing away from the engine is stamped into both types of thrower on the appropriate side. Front covers and throwers are not interchangeable between engines.

In spite of the foregoing V8 engines have the concave side of the thrower facing away from the engine.

Power, Torque and Consumption curves

Data for the following BHP, Torque and fuel consumption curves cropped up on the MG mailing list recently, makes interesting reading. Originally published in 'The Motor' September 26th 1962, subsequently reprinted in a 'Brooklands' book - "MG Cars 1959-1962" - and posted to the mailing list by Blake (aka Bullwinkle). Note these figures were taken at full throttle with an engine brake to obtain the required rpm. The fuel consumption figures have been multiplied by 100 to fit the vertical axis.

RPM	Torque (Lb.Ft.)	BHP	Fuel Consumption	
			Pints/ BHP/hr	Pints/ min.
1000	71		0.95	
1500	89	26	0.78	0.338
2000	101	38	0.69	0.437
2500	107	51	0.63	0.536
3000	110	63	0.58	0.609
3500	108	73	0.57	0.694
4000	106	81	0.575	0.776
4500	104	88	0.59	0.865
5000	98	94	0.62	0.971
5500	91	95	0.65	1.029
6000		92	0.73	1.119



See also this table of North American MGB and Midget performance figures from Skye P Nott's 'MGB Experience'. Note that the reduction in MGB power and torque from 1973 onwards only applied to North American spec cars, UK cars retained full performance to the end.

Rocker Cover *Added September 2007:*

Decals

Lots of discussion on rocker cover oil leaks in the various fora. One frequent observation is that if the 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 unless everything else is present and of the correct thickness, including the rubber washer (between cup washer and top of the rocker cover, 12A1358) and the cork gasket, it limits how much pressure can be applied to the cover gasket, and insufficient pressure together with porosity of cork gaskets will cause leaks.

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 bush and rocker cover onto the long cylinder head studs used to secure the rocker gear. The rubber bush 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 rubber washers 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.

Rockers *December 2017*

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.

However later engines have a shim under each of the middle two pedestals, to move the shaft holes fractionally out of line, so when the front and rear pedestals are bolted down the shaft is gripped by the pedestals to prevent even the small amount of movement that the locking screw (on the rear pedestal under a locking plate) may still allow, and the shaft from fidgeting in the pedestals and causing wear there, and noise. That deliberate misalignment may be enough to stop the shaft moving at all, or you may be able to tap the shaft through so far, but then not get it back into all the pedestals. 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 whether they are needed, and even what they are for.

Tappet Chest Covers

Types, gaskets and seals *Updated July 2015* The rear cover always seems to have been of the same basic type, but changes from 12A1386 to 12H3366 in the 'September 76 on' Parts Catalogue. The only difference seems to be an external threaded bracket, probably for some other vehicle with this engine. However my 1973-spec Gold Seal has this later cover, which could well mean the two are interchangeable ... or maybe not, see the gasket info.

The front cover changed several times:

- 18G engines had a basic breathing system and used cover 12H950 - flat with an angled tube pointing up and back with a 'road draught' hose attached, and a hose from the rocker cover to the front air cleaner.
- 18GA to GF had a positive ventilation system using a PCV valve on the inlet manifold connected to cover 12H1399 - box-shaped with one corner 'flattened' and an internal oil separator/flame trap.
- The Parts Catalogue for 18GG to GK and pre-18V797 engines i.e. carburettor ventilation system shows cover 12H3684 - flat with an external oil separator/flame trap, although it has a note that it is not used on reconditioned engines. Googling that number came up with just a single reference to use the later cover.
- 18V797 onwards engines i.e. to the end of production, together with reconditioned 18GG to GK and early 18V engines, used cover 12H4395 - box-shaped with opposite corners 'flattened' which again has an internal oil separator/flame trap. This may be an 'improved' cover which is why it is used on reconditioned engines.

However the gasket situation is confusing. From the Leyland Parts Catalogues:

- For engines prior to 18GG two cork 12A1139 are listed.
- For 18GG to 18V672/673 the front cover is shown as using 12A1175 which is rubber, with a note saying 'Not fitted to reconditioned units'. That could mean both were still cork, or it could mean the later cover was used with the rubber gasket.
- For 18V797/798 to 18V846/847 a different front cover is shown using gasket 12A1175 i.e. rubber.
- For 18GG to 18V846/847 the rear cover is shown as using 12A1139 cork.
- For 18V883/884 on two 12A1175 rubber gaskets are listed.
- The MGOC causes great confusion by referring to 12A1139B 1/8" thick, 12A1175B 1/4" thick rubber, and 12A1175Z 1/4" thick in a printed catalogue, but online refers to 12A1139 'Vain' thick (MGB), 12A1139B cork (MGA), 12A1175 1/4" (MGB), 12A1175 rubber (MGA), 12A1175B (MGC), and nothing for 121175Z. Moss Europe has the 12A1139 cork, 296 -377 silicone rubber replacement for cork, and GUG5505GM rubber. The others seem to list just the 12A1139 cork and 12A1175 rubber.
- There has been comment on fora regarding two different thickness of cork although there is no reference in my catalogue to this. Moss Europe insists that the thicker 1/4" is correct, but two suppliers (ASAP Supplies and Rimmers) do list the thinner one, Rimmers specifically for all engines up to 18V672/673. However only a purist should be offended by the later thicker one, which may even seal better.
- Moss Europe (click on item 7 for the rear cover) is the only supplier I have found that does say which gasket goes with which cover. But even that is confusing as it says the rubber is for use with cover 12A1386, which was the one used from the beginning that the Parts Catalogue says takes cork, and it only lists two rear and two front covers when there are three and four respectively in the Parts Catalogue.

Having replaced both on my 18V581/582/5783-based Gold Seal the two gaskets are definitely different and one gasket would not fit both covers. But more importantly it's the front that needs the cork and the rear the rubber, which goes against the above. The front cover has a flat flange and the rear has a curved channel. The rubber gasket is smaller than the cork and I can't see any way of keeping it in position on the front cover short of gluing it. The channel in the rear cover is so deep that even with the 1/4" gasket the cover would hit the block before an adequate seal was obtained. I was (relatively) lucky in that I had ordered one of each expecting to fit them to the other covers.

The upshot is that you have to go by what covers you have, and fit the appropriate gasket. You can't go by what the catalogues say as they refer to how the engine was built originally - even if they are correct, and it may well have had parts changes over its life.

The bolts and bolt seals also changed - five different bolts for the two covers are shown over the life of the MGB, and three different methods of sealing. Looking at the pre-September 76 Parts Catalogue for 3-bearing engines originally two fibre washers 2K4958 were used, then for 18GA engines two copper washers 12B63. However for the 12A1386 rear cover a cup-washer 12A1177 and rubber seal 12A1176 was used. For five bearing engines two copper and two plain washers PWZ105 were used. The rubber bush fits in the cup washer, and as the bolt is tightened the cup compresses the rubber bush which as well as sealing against the back of the cover also seals the threads. The front cover is much thicker with inner and outer panels, and a tube between the two brazed to both covers. Thus oil would have to work its way along the (much longer) bolt through the tube before it reached the outside surface, and the copper washer is probably a good enough seal between the underside of the bolt head (as on the sump plug) and the end of the tube. Nevertheless, when I removed the covers on my 73-based Gold Seal I found cup washers and rubber seals on both! The September 76-on catalogue does show two of those items i.e. one for each cover, so I assume that was adopted for reconditioned engines as well, like the later front cover. It did mean I had to order another bush, but it arrived next day. Again the upshot is that you have to select the seals based on whether you have cup or flat washers.

Oil burning via the breather:

Even with carb suction instead of PCV some engines suffer from oil burning from the breather, even when the separator/flame trap wire wool is present and in good condition. You can prove whether this is the source and not worn valve guides, bores or general leaks by fitting a catch-bottle in the hose between the tappet chest and the carbs. This is only under slight suction so doesn't need to be anything special, you can pay a lot of money for fancy alloy tanks with external sight gauges and pretty blue or red fittings. If both ports go in the top and the outlet is right at the top but the inlet goes down an inch or so (to limit how much is transferred directly from inlet to outlet), then you can tell how much oil is coming from the breather by how fast the bottle fills up. But if the inlet is right at the bottom and the outlet at the top, then the bottle should drain back into the sump each time the engine is switched off. However you would need to establish just how fast it is filling first, if it fills in 30 miles then it is going to be overflowing i.e. going into the engine as before on any longer journeys. You would also need to ensure it wasn't blow-by pushing oil out, by having the bottle connected just to the crankcase and not the suction. If it still fills then it is blow-by. A long while ago someone reported that the only way he solved it was to change the front tappet chest cover, even though both old and new appeared to be the same and in good condition. More recently Adam P reported that he swapped his, for a different style, probably from an 18G engine. Later covers seem to have

a large square hole on the inside of the rear half of the cover, through which can be seen the wire wool. The replacement has a solid plate on the inside, with the exception of a series of relatively small holes drilled along the bottom edge and a shield covering more holes at the top left. It's early days yet, but it seems to have solved the problem.

Added September 2010:

Peter Donlan had a problem of oil smoke apparently from the exhaust at higher speeds. I suggested diagnosing it by simply disconnecting the suction hose from the front tappet cover and sealing the hose, but he was concerned about oil spraying over the engine compartment so opted for a catch-bottle right away. A test run showed 20 ml of oil had been deposited in the bottle, so it is certainly being burnt by that route. However it is still unknown as to whether it is excess pressure in the crankcase blowing it out, giving rise to concerns about the health of the engine, or simply whether it is excess oil running past the breather port and simply being sucked up by normal carb suction. Disconnecting and sealing the carb pipe from the bottle should reveal that cleanly - if oil still gets into the bottle it must be blow-by, but (hopefully!) won't be sprayed over the engine compartment. Peter fabricated his catch-bottle as follows:

> "The piping is 7.6mm fuel grade, the 'T' piece a copper 8mm with small 8mm extensions to give the pipe something on which to grip, and the connection to the tappet chest steel pipe is the original 90 rubber bend with an adapter from 13mm to 8mm which I turned on the lathe. The two 8mm fittings at the catch 'bottle' are also turned using a pieces of 10mm screwed rod bored out but leaving enough thread in the centre for nuts on each side of the catch bottle lid thus forming a reasonable seal. I left one of these adapters long enough inside the bottle to attach copper pipe to go to the bottom of the bottle and maybe suck back the oil. I will do this at a later stage."

Replacing the gaskets: It's a shame I didn't think about these gaskets when I changed the head gasket last year, but then the drip wasn't bad enough to investigate. Now it is, so I have to remove the carbs again, when it would have been a five-minute job before. When I refitted them then I used non-setting flange sealer on both faces of all three gaskets for each carb - a mistake, as of course they all ripped when removing the carbs, spacer blocks and heat-shield. So six new gaskets ordered as well, and scraping all the faces. I did think I'd have to remove the manifold as well, so started by slackening the rear and middle clamps. But once I had the carbs and heat shield out of the way I could get at the cover bolts, and the covers came out with the manifolds still in place with just a little fiddling.

As mentioned above the covers, gaskets and seals vary quite a bit and the rubber gasket is smaller than the cork one. The cork one would be no good for the rear cover being too big to sit in the groove, nor the rubber one for the front cover being way too small and no groove to hold it in position. Added to that the rubber gasket was slightly too small for the rear cover as well, and although it stretched into the groove in the cover easy enough, when released it popped straight out again. So I lightly clamped it in position for a few hours, then removed the clamps ... and it stayed there. Even better when lifted it out and pressed it back into the groove, it stayed there again. So I left it clamped, while I refitted the front cover, and waited overnight for the second rubber bush for the fixing bolt.

I used a smear of non-setting flange sealer to stick the cork gasket to the front cover, and on the front of the gasket where it would butt up against the block. On a test fit I found that the face of the gasket just touched the rib in the block below the aperture while manoeuvring it into position, so made sure that was cleaned of all oil and muck. The rubber bush is a friction grip on the bolt even before it is pushed into the cup or compressed, so you have to push that all the way up the bolt before you start fitting. It's also a very long bolt with the head covered by an exhaust manifold down-pipe, so the bolt has to be pushed most of the way into the cover as well. Even with the down-pipes in the way it was easy to position and get the bolt started, then tightened. Don't overdo it in an attempt to get a seal, it may well distort the cover, and check the flanges are flat before you start.

Next morning the second rubber bush and the carb gaskets arrived. On removing the clamps the rubber gasket stayed in the groove in the rear cover as before, and when removed and pressed back into place it again stayed in place. However while leaving it unclamped for a while I cleaned up the carb flanges (having forgotten to do them yesterday when I cleaned the manifold, heat-shield and spacer block faces), it popped out - obviously determined to get back to its original size. So clamped it again for a bit longer. I obviously had to unclamp it to trial fit as with the front cover, to work out the best way or orientating it around the back of the down-pipes, and it kept popping out. But once I had found the best route I could be fairly quick, holding the corners in with my fingers for most of the time, and got it into position. I did need a couple of goes as when I thought it was in position I could hear metal on metal while I was moving it round, and wasn't prepared to bolt it in position while I could hear that. This bolt is shorter and more accessible, and can be fitted after the cover and gasket have been offered up to the block. For whatever reason it took longer to get this bolt started than the one for the front cover. When just nipped up I carefully examined all the way round with a mirror and light, to make sure the gasket went right to all four corners of the cover, and so was 'in the groove'.

Finally tightened, it was just a matter of refitting the heatshield, spacer blocks and carbs - with new gaskets that I only put grease on this time round. With everything but the air cleaners back on I ran it up and checked round and under the covers with mirror and torch to see if there were any gross leaks - so far not, so refitted the air cleaners. Time will tell if this does anything for the leak. If not it will have to stay, as anything else would almost certainly need the engine and perhaps the gearbox to come out. The trouble is that oil runs down and back, so may be dripping off a point some distance from the actual source. Really it needs a full degrease underneath on a ramp, and close inspection while running.
Update: It seems to have worked.

Timing Covers

4-cylinder
V8

When replacing these oil the crank pulley seal and pulley, fit the pulley to the cover, and ideally fit the pulley already in the cover to the crank, and only then fit the cover screws/nuts. Remember to fit the oil thrower, and the right way round! However with the 4-cylinder engine in-situ the rack is in the way, but you can still fit the cover to the engine with one loose bolt at the top, then fit the pulley, and only then fit the rest of the bolts. That way you can be sure that the crank pulley is correctly aligned i.e. concentric with the oil seal. Put a thin smear of non -setting sealant such as Loctite Flange Sealant to all surfaces i.e. the cover, the block, and both sides of the gasket. This takes days to harden - unlike silicone sealants - so you have plenty of time to cover all the surfaces and fit. Smearing it on both surfaces sticks it well to those, then when the surfaces are brought together the two will stick to each other, and being thin smears it won't ooze out all over the place.

Timing Marks *March 2017*

4-cylinder engines:

Always on the front cover, below the crank pulley on earlier cars, above and towards the alternator on later engines. The crank pulley has a single notch, and the front cover has multiple pointers indicating TDC and various degrees before it. There are three part numbers for covers in the Parts Catalogue - one (12H 3317) for engines before 18GG, one for the remaining 18Gx engines and 18V engines before 18V 797 (12H 3510), and one for 18V 797 and later (CAM 1393). It's almost certainly the case that the pointers moved for the second cover, the third cover seems to have had an improved seal crank pulley seal.

The Leyland Workshop Manual only shows one pointer arrangement for the lower marks, whereas Haynes shows two. The first for 'early' cars only has three pointers at TDC, 5 and 10 degrees BTDC, the second is the same as the WSM with pointers at TDC, 5, 10, 15 and 20 degrees BTDC. The WSM doesn't show the upper marks at all, Haynes shows them but without giving the intervals, however there are five pointers at TDC, 5, 10, 15 and 20 degrees as on the immediately preceding cover. The crank pulley rotates in a clockwise direction when looking at the front of the engine, and the TDC pointer - the one the notch on the crank pulley passes last - is usually bigger than the others.

V8 engines:

These engines have a single (adjustable) pointer on the front cover, and a series of engraved marks on the pulley both before and after TDC.

All engines: The pulleys incorporate a 'harmonic damping' function which consists of a metal-rubber-metal sandwich, the rubber layer being between the part that bolts onto the crankshaft and the part that carries the belt groove. The timing notch or marks are on the outer layer, so if the bonding between the three layers fails the outer layer can slip round, putting the timing marks out of line. If you suspect this has happened, or to set up the timing pointer on V8 front covers, carry out the following procedure:

- Make up a probe that can be inserted into No.1 spark plug hole to a known depth, such that the piston crown will contact it shortly before it reaches the top of the cylinder.
- With the probe inserted, and the piston down, turn the crank forwards (it doesn't matter if the piston is on its compression or its exhaust stroke) until the piston just contacts the bottom of the probe, and make a mark on the pulley in line with the TDC pointer.
- With the probe still in position, turn the crank in the other direction, so that the piston goes down and comes back up again, until it just touches the probe. Make a second mark on the pulley in line with the TDC pointer.
- True TDC is exactly between the two marks. If this does not line up with the TDC pointer on the front cover, then the pulley is delaminating, or possibly on V8 engines the pointer has not been set correctly.

On 4-cylinder engines you have no option but to replace the pulley. Using the new TDC (i.e. between the two marks) immediately will allow you to set the timing, but it will almost certainly move again.

On V8 engines, if it is only slightly out then reset the pointer, and check again after a few hundred miles. If it has moved again, then again a replacement pulley will be required.

To set the V8 pointer keep turning the crank back and fore, and making small adjustments to the pointer position on the front cover, until wound first one way then the other the pointer is the same number of degrees (as marked on the pulley) BTDC and ATDC. The TDC mark on the pulley will then be true TDC.

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, and although oil pressure is fine the 4-cylinder manual does advise changing them at 30k (big-ends) and 50k (mains, but who would go to the bother of changing them at different intervals?) for best crank life, I've been thinking for some time 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 holts 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 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.

V8 Exhaust Manifolds

Exhaust Clamps and Mounts
Heat Damage to Inner Wings

I've had continual problems with these since I bought the car. It came with tubular, and I found they 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 forward, 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!

Another problem concerns the gaskets - I have tried three different types so far. Originally they were single, thick, metal-faced sandwich gaskets, which have quite a good ability to cope with a small amount of the flanges not being flush with the head. 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 (picture, click to expand) come in pairs i.e. one gasket covers two exhaust ports and whilst they are a metal sandwich again they are quite thin. *June 2019:* Discovered yet another type that are a thicker three-layer corrugated sandwich so capable of sealing better than any of the others, as well as being a better fit to the ports.

All have similar sized holes, which are up to 3/16" bigger on each edge than the head ports (picture). I suppose there is an element of not covering up some of the port in this oversize, and also perhaps variations from head to head. But if the holes were quite a bit smaller it would significantly increase the amount of overlap which would reduce the chance of them blowing.

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

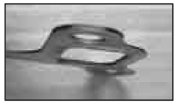
supplies the MGOC anyway, they simply charge even more for them (subsequently Clive abandoned the idea).

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 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 compressible rings around the ports so in theory capable of sealing up to a 38 thou difference in gap comparing one port to another. *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. The front is now silent, but there may be the faintest tick from the rear somewhere

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 *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. 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 ...

V8 Inlet Manifold *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.

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*

Important 1 - relief valve
Important 2 - gasket

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?!".

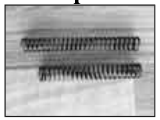
On the V8 the camshaft drives the distributor shaft directly via a skew gear and the distributor drives the oil pump via a tongue and slot. Up to 1976 all Rover V8 engines had the tongue on the distributor and the slot in the oil pump shaft. With the introduction of the SD1 the engines for that car had 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!

NEW **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.

NEW **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 oportunity 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.

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 Locktite 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 are available but there are some differences to the original that are worthy of mention.

1. <u>The cover has two additional bolt holes on the outboard sides of the water passages from block to pump</u>. 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. <u>There is an additional tapped hole immediately to the rear of the distributor</u>. 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. <u>The oil pump gears are deeper than the original</u>, and I'm told they are deeper than the SD1 gears as well. 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. <u>There is no provision for mounting the original timing pointer</u>, 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. <u>The distributor clamp required is noticeably different</u>. 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.

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!

Valve Clearances

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 using the then rotate the crankshaft again to recheck them 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 same point for each valve each time they would vary considerably 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 and 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. That may be the case for some cams, or in an ideal world, but as I (and others) have found it can't be guaranteed. So finding the position of largest gap while the partner valve is open remains the way to go.

4-cylinder Valve Timing

Cam/crank alignment
Tensioner
Measuring valve timing
Timing covers

Cam/crank alignment: I've read a couple of times about something in the various manuals being 180 degrees out but never been sure what it was. Recently there has been a long and sorry thread in the BBS about problems with poor running of a particular engine and valve timing issues, during which this issue was raised and bottomed out. The bottom line is that whilst the Leyland manual is confusing, Haynes is actually incorrect.

Both the Leyland Workshop Manual and Haynes show and describe, prior to fitting, the gear set inserted into the chain with the dimple in each gear being **opposite** (Leyland) or **adjacent** (Haynes) and **in line with the**

centre of each gear as shown on the left (click to enlarge) - this is correct.

Both also show the keyway in the crankshaft being at the top, which coincides with TDC for pistons 1 and 4 - and the camshaft keyway at approximately 1 o'clock and this is also correct.

However this places the cam and valves in such a position that it is **No.4** piston that is at TDC on its compression stroke, and not No.1. The problem arises when it's time to insert the distributor drive dog. Both manuals say that the engine must have **No.1** piston at TDC on its compression stroke, which is also correct. But the Leyland Manual goes on to say the dimples have to be **in line**, leaving out the word 'opposite' but omitting to mention that the cam gear now has to have its dimple at top-right i.e. **remote** from the crank gear dimple i.e. the crank has to be turned through 360 degrees, and this is where the confusion arises. However Haynes still specifies that the dimples should be **adjacent as well as in line** and this is the bit that is incorrect.

I suspect that whoever originally did the drawing and spec for the cam gear got the dimple 180 degrees out and it was never corrected, there seems no justification whatever for fitting the gears with No.4 piston at TDC on its compression stroke. See also John Twist's advice on correcting the distributor drive gear position.

Tensioner: *January 2018* *Updated October 2018* The tensioner is covered in the Leyland Workshop Manual and Haynes, but it is a bit confusing. They show two types - one ostensibly for duplex chains and one for single, but the two are interchangeable, and the Parts Catalogue indicates that both types are alternatives for both 3-main and 5-main engines. The only **installed** difference seems to be that for the single chain there is a spacer plate as well as a gasket between the tensioner and the engine front plate, whereas the duplex only has the gasket. Whilst this seems to be to alter the alignment of the tensioner slipper to the chain, on the single chain it looks like more centralised alignment would be obtained **without** the spacer plate, but there we are.

The two types differ both physically, and how they are 'primed' for installation.

- The one shown for the duplex chain has a screwed plug on the opposite face to the slipper, and during installation this is removed and an Allen key used to position the slipper in the retracted position. Once installed the Allen key is turned (details in the manuals) to release the slipper under spring pressure to press against the chain.
- The one shown for the single chain does not have the plug, but it should be supplied with a packing piece that fits behind the slipper head, to prevent it being pushed all the way back into the tensioner. Once installed this packing piece is removed and the slipper pushed fully back, and on release again the slipper is pushed out under spring pressure to bear on the chain.

However the operation in use seems to be exactly the same, that is as the chain stretches and slackens, the slipper head will move out bit by bit, and as the chain goes round inevitable it will tend to whip and the slipper head will be pushed back and fore. Internally there is a cylinder with a toothed helical slot, which engages with a peg. As the slipper head moves back and fore the peg slides back and fore in the slot, but it can only travel back as far as the next notch back. When enough stretch occurs in the chain for the peg to drop in the next notch forwards, that becomes the furthest the slipper can be pushed back - rather like a self-adjusting handbrake system. In this way it is continually limiting how much the chain can whip - between two adjacent notches, regardless (up to a point) of how much it has stretched. There is an oil passage from the engine front plate into the body of the tensioner, which passes up the shaft of the slipper and through to the face of the slipper pad to lubricate the chain.

The Renold item without the Allen key hole has a notch at the far end of the helix that the peg drops into and retains the mechanism and spring while the tensioner is being assembled and fitted to the engine. This holds the slipper almost fully inserted into the tensioner body, and once fitted you push the slipper back that last bit and release at, and it will move out to tension the chain. Note that of you do this before fitting the tensioner to the engine, or without a chain in place

While Bee's head was removed for unleaded conversion, and I had noticed the front cover was oily around the pulley, so I removed the cover to change the gasket and pulley seal. And while **that** was off, I had a look at the chain, gears and tensioner - which is of the type without the Allen key plug. No visible wear on the rubber slipper pad, very slight wear on the thrust face of the gear teeth, but I discovered the slipper could be pushed back further against spring pressure than I was expecting. If the mechanism has failed it could explain why there is so little wear on the slipper pad - whip in the chain has been pushing it back rather than the slipper resisting it, and also why I though I could hear a rattle as I blipped the throttle. But removed - **keep the slipper pressed into the tensioner body by hand as far as it will go, then release slowly once on the bench, or the slipper, spring and mechanism will fly out**, dismantled, cleaned, inspected and reassembled all worked as it should i.e. by releasing carefully it stepped out as it should (unfortunately I didn't measure the travel of the slipper before removal), so it went back on in preference to a replacement.

As far as replacement goes, a while ago Stephen Strange on the MG Enthusiasts forum wrote:

> The Original Equipment chain tensioner was manufactured by Renold in France, as was the camshaft drive chain. However, they no longer manufacture them for the BMC B-Series engine. Currently, there seems to be only one remaining manufacturer of this item, Rolon in India. However, the quality control of Rolon has been known to occasionally slip.

> Regrettably, the Indian-made Rolon unit has a stronger spring than that of the Original Equipment MGB unit, which can cause faster wear of the slipper pad. Fortunately, Renold of France still manufactures the chain tensioner for the Jaguar XKE DOHC six-cylinder engine (Jaguar Part # EAC 3629 or C10332), and, with the exception of an easily modified minor detail, it is identical to the one that it produced for the BMC B-Series engine. The oiling passageway inside of the body of the chain tensioner of the French-made Renold Jaguar XKE DOHC six-cylinder engine has a diameter of approximately 1/32". Simply enlarge the diameter of this single oiling passageway to a diameter of 1/8" (0.125" / 3.175mm).

And for identification - the two types have the manufacturers name in the casting; the slipper pad is the same length as the slipper plate on the Rolon item whereas on the Renold it is longer than the slipper plate and goes down past the ends as well - the Rolon slipper pad has become detached in several reports, a number of failures listed here; and the Rolon item is flat on the back with a large hole for oil to pass into the tensioner whereas the Renold item has a drilled dowel which locates into the engine front plate, and reduces the size of the oil passageway. This last difference means that the Rolon item tends to over-oil the chain and under-oil the front camshaft bearing. At one point the Rolon parts seem to have had the Allen key plug, whereas new Renold parts have a red plastic spacer between the slipper and the tensioner body.

October 2018: Another failure mode is where the slipper has come off the backing pad, and the whole plunger and backing has come out. Unfortunately this one looks like a Renold item.

Despite the recommendation for the Jaguar item you have to be careful: Most suppliers of these I looked at in January 2018 had the Rolon item with the Allen key plug. Others had the spacer release mechanism instead of the Allen key plug, but still show they are made by Rolon. Another source of the Renold item is said to be for Massey Ferguson tractors - part no. 826113M1. These parts can vary hugely in price - from £7 for Rolon from an MG parts supplier I refuse to use, up to £60 for the Massey Ferguson part. Along the way other MGB and Jaguar suppliers have the Rolon item at £17 to £20, I could only find one Jaguar supplier with what looks like the Renold part at £17, and a Ferguson supplier at £30. But ring and confirm before ordering if you specifically want the Renold part.

October 2018: Michael Nunn came up with another version on the MGOC forum which shows the rubber slipper pad overlapping the ends of the backing plate but in a slightly different way (angled instead of 'square'), for about £30, from Robsport (no vehicle info) and this eBay listing. The eBay item has the slightly offputting supplier as 'numpty9', does specify it is NOT ROLON, and says it is for Jaguar and Triumph Dolomite, but not (if you ask the page) for the MGB. However both those sites describe it as part No. C36617A, and if you Google that you get back to the Jaguar EAC3629 which is said to be suitable for the MGB. Whichever part No. you use, you have to be careful as Rimmers shows C36617A with the suspect design at £18 for Dolomite and Sprint, and Robsport itself lists another version for £9 but not a good enough quality picture to see the overlap.

Measuring valve timing: *Updated January 2017* 'Surfbeat64' asked a question on valve timing angles, specifically "Are the valve timing specifications (intake valve opens, closes, etc) that are listed in the shop manual's general data section, performed with zero lash or .015in?". A very good question and one that none of the many responses answered! The Workshop Manual gives the following timings:

Inlet valve:	Opens	16 degrees BTDC
	Closes	56 degrees ABDC
Exhaust valve:	Opens	51 degrees BBDC
	Closes	21 degrees ATDC

Jump to here for a relatively easy way to make the measurements using just feeler gauges and a degree wheel.

The standard cam gives a duration of 252 degrees for each valve. Most places that give a diagrammatic representation of valve timing do so on a circle of 360 degrees i.e. one crank rotation, which means superimposing the exhaust timing over the inlet, which can be confusing. Being a four-stroke engine even though the crank makes two full rotations for the full valve sequence the camshaft, which is what controls the valves, only turns through 360 degrees. So I think showing the valve timing relative to the camshaft and not the crankshaft (even though that results in two TDCs and two BTDCs) makes things easier to visualise and understand. The only thing you have to remember when calculating duration from the diagram is that each quadrant represents 180 degrees and not 90 degrees.

For comparison Piper has the following cams available:

- Mild road 255 degrees
- Fast road 270 degrees
- Ultimate road/track day 285 degrees
- Rally/race 300 degrees
- Race 320 degrees

> The more duration you go for the better the performance will be at the top of the rev range, but it will idle poorly needing a much higher idle speed than normal (which is why F1 cars 'idle' at typically 7k to 10k), and slow-speed i.e. manoeuvring will be difficult. Someone I know had a mad cam in a Renault 5 and the only way he could pull onto his drive was by spinning the wheels, below that it just had no torque at all.

For completeness the Manual also gives the valve lift for both valves as 0.3654in (9.25mm).

However it doesn't say anything else on valve timing other than how to set up the gears and chain as above, certainly not how these measurements are made. This lack of information may be because there is no scope for tweaking the valve timing on a standard engine, but there are certainly offset keys and after-market vernier cam gears that allow this. Also a PO may well have fitted a non-standard cam or you could have a badly worn standard cam, both of which can cause significant running problems needing careful measurement of valve timing for diagnostic purposes.

I found a Midget site that stated the clearances have to be increased to measure valve timing, and gave no less than three different values depending on engine size! Obviously no help to the MGB owner, but certainly casting doubt on it being either zero clearance or the running value. Other non-MGB sites talked about timing angles being measured when there was 0.050in of valve lift, which should be easier to assess and hence more accurate than trying to judge when the valve just starts to open and when it is just fully closed. However none of these said what the valve clearance must be set to, and of course that is critical.

I then found an MGA/MGB site which discusses valve timing and optional cams in some detail, but the only mention of rocker clearances are 'hot' values. These must surely be for normal running and not when checking detailed valve angles as the engine would surely go cold during the process if not be only partially assembled, and the lack of any mention of clearances for angle checking is frustrating. For peak lift angles the clearance is irrelevant of course, but that is no good for assessing starting and finishing angles which may be an issue on a bad grind or lobe wear. It also causes further confusion by quoting valve lift as 0.375in for 63 to 71 and 75 to 80, and .400in for 72 to 74 1/2 i.e. different from the Leyland figures. It mentions ".050in lifter rise" several times, which is confusing, but then it mentions "Duration 214 degrees @ .050in lifter rise".

Another piece of information is from John Twist: "Check your valve timing: With #7 fully open, set #2 at 0.055in. Rotate the engine until the #2 rocker just contacts the #2 valve stem (use a piece of paper). You will find your timing mark on the front pulley at TDC." The Workshop Manual gives a figure of 0.055 in. for "Rocker clearance: Timing" but doesn't explain what that results in.

*May 2015:*Paul Walbran in NZ writes: "The standard MGA/B/C cam gives 0.055" valve lift at TDC (no 1 inlet)." But this doesn't compute with the info from John Twist. The rocker will already have taken up .015" of clearance before it starts to lift the valve, so if it then proceeds to lift the valve .055" at TDC, then the total movement of the rocker has been .070". So on that basis in order for the statements in the Workshop Manual and by John Twist to be correct, one would need to set No.2 clearance to .070" in order for the rocker to just touch the valve at TDC. Unless I'm missing something (perfectly possible), one of the statements must be incorrect. I contacted Paul, and he agrees that the 0.055" is total lift in the valve gear, not just the valve at normal running clearance, and has amended his wording to read "The standard MGA/B/C cam gives 0.055" inlet valve lift off the base circle at TDC, while the standard Midget cam gives between 0.025" and 0.030". ("Off the base circle" is the same as zero tappet clearance.)".

So that makes three different references to .055", and at least two for what it actually means.

January 2017: Paul's info gives methods of measuring the valve timing using either feeler gauges or a dial gauge, but I'll paraphrase the feeler gauge method here as it is much easier. With both you will need a degree wheel mounted on the crank pulley, but there are any number that can be printed out from web sources and stuck to a piece of card which should be accurate enough. Select a thin feeler blade, such as 0.003". Add the relevant timing clearance at the valve (0.023" for the MGB) to the feeler thickness and set the tappet clearance of the lobe being measured to this figure. Insert just the thin the feeler gauge and detect when the engine just nips (valve opening) or releases (valve closing) the gauge. Measure off these opening and closing points from the degree wheel. Don't forget to re-set the tappets to normal running clearance afterwards! The only fly in this ointment is if your clearance varies as the back of the lobe passes under the follower, as some of mine do, in which case find the one that is the most consistent. However the 'timing clearance' of 0.025" here is very different to the 0.055" in the WSM. From everything I have read I can only think that 0.055" is used to check the TDC mark, and 0.025" is used to measure the valve timing. But I'm only guessing, and both are dependant on the profile of the cam at the back of the lobe as well as on the lobe.