Engine

Last updated 16-Dec-2011

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

New 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 enission 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.

The general rule of thumb is that anything more than 10% difference from the lowest to the highest warrants investigation, 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.

Crankcase Breathing *Added April 2008*

Description: Originally the MGB used the same breathing method as 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 hanging down from the timing chain cover (often called the 'road draught tube'). 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 a port on the front tappet chest cover, which 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.


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.

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 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. The filter is obvious, I'm not sure where the restriction is - possibly in the pipe on the back of the engine, but there definitely **is** a restriction as the engine note changes when I remove the oil filler cap (see below). *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**.

Added December 2009:

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.

NEW *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."

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 Dipstick! (and sump capacity) *Added September 2010*

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.

Later engines still used a different stick, still with a stop, the pressed-in tube, with the same sump as previously. Information about exactly when what part 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, whereas later versions of the Parts Catalogue and current parts lists may well show the later parts or the two (or more) 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

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 glovebox handbook AKD 7598 4th edition states:

> 18GG, GD (no oil cooler) 7.75 Imperial pints (4.26 litres, 9 US pints)

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. 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.

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*

Chrome bumper
Rubber bumper and V8

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 carb vent/overflow pipes. 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 doesn't have them, neither does a pals 72 GT, and it's 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've 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 possiblilty, 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.

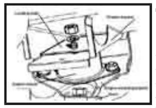
Rubber bumper and V8: The first thing to say is that the V8 didn't have restraint rods or control brackets at any time. The engine does move quite a bit, when my engine mounting plates were on the wrong sides and the engine was further forward than it should have been, the crank pulley would rub on the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

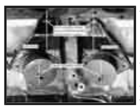


There is a square locating plate with an offset round hole for each side and this goes on the stud under the chassis bracket before the washer and nut. This locating plate must be fitted with the hole in in the **lower** of the two possible positions. It ensures the engine is installed in the correct 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.

Exhaust Clamps

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 nut, but with a square-shaped, low-profile head about 1/8" high instead of the more usual hex head. Moulded into the head are the characters "A", 2, 7, and "0", if that means anything to anyone (I found several charts on the web showing various bolt head markings similar to this one from Unified Engineering Inc. that show an "A490" bolt. This is **similar** to the one I found but with different digits in a different layout). 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 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 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.

Gold Seal Engines

Like most used cars it's always important to check to see what sort of variations yours (or one you're looking to purchase) might have. The MGB is no different, with varying factory color coded editions of their engines.

Updated October 2008:
'Gold Seal' engines are factory replacement complete engines painted gold instead of the usual maroon or black. They are **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! My roadster came to me with a Gold Seal engine of the correct type for its year, so either it was replaced under warranty or a PO had been very particular about fitting the correct replacement. There were also Silver Seal short engines, i.e. without heads or ancillaries. 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.
- *February 2010:* In practice Gold Seal engines 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. 'N' refers to an outright purchase i.e. no return of a faulty unit.
- *August 2010:* Clausager also mentions the existance 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.

Oil Filters *Updated February 2011*

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. 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 reknowned 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 on subsequent cars 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 capiliary, but it made little difference, neither does bleeding the capiliary 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 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 916/1 is 2.75" (the last two going inside the bypass valve spring). The Mann 917/1 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, so plenty of room even for the shorter Volvo and Mann 916, and 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? However for two out of three Volvo filters I got a burst of oil from the sealing ring when first starting the engine after the filter change, which has to be from a distorted sealing ring that only seats properly when oil pressure is developed. I can't believe it is the same batch over 3 years, or another faulty batch, let alone poor quality generally, so either I was just unlucky or I'm overtightening them. There is no tightening procedure unlike some filters I have had, so it would seem unwise to go beyond 1/3rd or a turn and maybe only 1/4 of a turn after the sealing ring contacts the filter head (Mann W916/1 and Unipart GFE 422 specify 3/4 turn). **Update June 2011:** Fitted a Mann 916/1, and got the same leakage! With the third occurrence I'm also pretty sure that it is always in the same direction (more forwards than anything given the mess) so it's pointing more to the filter head than the filter. I always oil the sealing ring on the new filter, but I don't bother wiping the seat on the head, so there may be a bit sticking up I haven't noticed, must remember to check next time. As the oil that is chucked out is dirty (i.e. from the cooler and pipes) it could just be the engine getting fastidious in its old age ...

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 at £2.60 plus VAT (making the others expensive rather than the Unipart cheap) with 19 branches across middle England in a sort of triangle between Birmingham, Norwich and Colchester). 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 peforated 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.

While I'm at it, 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 cartridge
18V 581, 582, 583 18V 672, 673 18V 779, 780	Oct 73 - Jan 74	12H4405	GFE148	Suspended 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 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.

Oil Pressure 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*

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 convertors. 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 claims 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 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 (see below), but these are also under review.

As to practicalities in the UK:

- MGOC Castrol XL20W-50 5 1/2 gallon drum is a good deal price-wise at the moment - equates to £16 per gallon 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 one gallon cans at £22, 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.
- Halfords 15W-40 enhanced Diesel oil is API CF-4 CF **SJ** (note it has the ideal petrol rating as well as the equivalent diesel) also at £17 for five litres, so all in all is probably the best bet taking into account protection, availability, storage and price, for both running-in and continued use. Halfords oils are reputedly produced by Comma (confirmed, see below).
- 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.

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, 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!! See here, enter 'oil' in the second search box and click Search, then select the PDF symbol for the required oil.

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 this 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 convertors 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 convertors. 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 have 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.

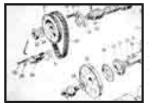
The Valvolene VR1 Racing product data sheet specifies zinc at 0.14 and phosphorus at 0.13, so the highest of all found so far, and the only one to reach the 'recommended' levels! Despite that it also specifies API SH/SJ/SL/SM and CD for 20W-50, and SH and CD for 10W-30, which again begs the question "how can it conform to SM if it has the higher levels of zinc and phosphorus?". However it is from a USA web site, and has a different container to the VR1 I have seen in the UK, and the UK can specifies API SL.

References:

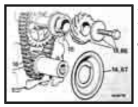
http://www.ttalk.info/Zddp.htm - ZDDP issues.
http://lnengineering.com/oil.html#Z13 - More ZDDP issues, with some info on typical levels.
http://www.opieoils.co.uk/pdfs/Is-there-a-flat-tappet-issue.doc - flat-tappet issues.

http://motorcycleinfo.calsci.com/API.html - API Service Categories.
http://www.acea.be/images/uploads/pub/070308_ACEA_sequences_2007_LD_and_HD.pdf - ACEA Service Categories.
http://www.api.org/certifications/engineoil/pubs/upload/150916thAdd10308forprint-2.pdf - API Specifications.
http://www.hcvs.co.uk/hcvsleg.htm - FBHCV and Castrol Classic Oils.
Castrol UK product data sheets (click on 'View Complete Technical Data Sheet List").
Castrol US product data sheets (click on "View all 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.

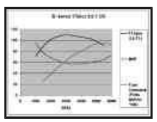


In spite of the foregoing V8 engines have the concave side of the thrower facing away from the engine.

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. Click the thumbnail for the big picture (the fuel consumption figures have been multiplied by 100 to fit the vertical axis).

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



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:*

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 I feel was originally intended to prevent over-tightening, by tightening down onto the top of the rocker gear 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) 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.

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 book 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 see that for other V8 engines only 3 ft lb is specified! Misprint? 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

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.

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.

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.

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*

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!

V8 Starter

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

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

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

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 ...



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 get 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. 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.

Valve Clearances

These are best adjusted cold for consistency (even though you might be tempted to adjust hot in the winter for your finger'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 Rule of Nine, 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. 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.

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.

Valve Timing

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.

Added January 2011
'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 Manuals gives the following timings:

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

For completeness it 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 (the latter being the logical answer in my mind, FWTW!) 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 it is critical.

I then found an MGA/MGB site which discusses valve timing and optional cams in some detail. It includes angles for peak lift and .050in lift which is helpful, 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, 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.

Finally the only other piece of information I have found so far 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." However he doesn't explain what he means by the last sentence. It could be a way of checking the TDC pointer and crank pulley but that would be dependant on the cam grind being standard and lobes unworn. There is a far better way of determining TDC here, in my opinion. However you could use both methods of course, and if the second TDC method is correct but the first not, then the valve timing is obviously off.