

MGF VVC Head Gasket Replacement

This guide was written during the head gasket replacement on my MGF Trophy 160 SE but similar procedures apply to all MGF VVC engines, especially the TF 160s. The guide includes the installation of the stiffer LR oil rail but does not go into reworking the head. It should not be too difficult to find guides helping with this. The items are listed in the order that I found best to keep the work in the same areas without constantly lifting and lowering the car but of course there will be other opinions and ways of doing things. You may experience minor differences in multiplug colours etc so watch out and note plugs, wire colours etc for your own particular car.

Whilst I have tried to get this as accurate as possible I cannot be held responsible for any errors. Whilst it is not intended as a substitute for a proper workshop manual, it will help stop you flicking forward and back between the various sections. If you do come across any errors, omissions or better ways of doing things, please let me know by posting on www.mg-rover.org forums. Please exchange this guide freely within the MG community but I retain copyright for any commercial use or reproduction.

Have fun; it's a tough job with difficult access.

Tim.

First Step - Be sure the Head Gasket has actually failed.

The Rover K series engine has a bad reputation for HGF and it is all too easy to jump to the conclusion that it has failed without first exploring the other possible causes. Before embarking on this expensive and time consuming work, lets first make sure the HG has indeed failed. The gasket seals the joint between the block and the head. At this joint there are four fluids, which need to be kept separate: lubricating oil, engine coolant, combustion gasses and lets not forget the atmosphere. It is most normal for the gasket to fail between the coolant ways and the oil ways but other failure types are known.

For the head gasket to have failed you must have one of these symptoms.

Coolant in the oil – The gasket has failed between one of the waterways and one of the oil drain ways. A sure sign of this is coolant loss together with murky dark coffee colour oil, with flecks of cream. You will also be losing a small amount of coolant. Don't confuse this with a little bit of mayonnaise on the dipstick above oil level which could just be condensation but in this case do watch keenly to see if this develops into something more serious. The picture shows my oil in the pan after it was drained. It had been changed one week before and I had lost only 1cm of coolant from the reservoir.



Oil in the coolant – The gasket has failed between the high pressure oil way feeding the camshafts and a water way. The oil is at a higher pressure than the water so escapes into the cooling system and finds its way into the coolant reservoir. Coolant should normally be sparkly clean. Again don't confuse this with dirt in a poorly maintained engine or residue from a previous failure. Flush the coolant system and monitor the condition to see if it gets worse.

Steam from coolant cap whilst there is still coolant in the reservoir – The gasket has failed between a cylinder and a waterway. High pressure combustion gasses are escaping into the coolant system and displacing water. The system will pressurise and the relief valve in the cap will blow. Don't confuse this with a typical overheat scenario caused by poor coolant circulation, dodgy radiator, stuck thermostat or blown radiator fan fuse. Check that your radiator fan is working and that there is no air in the radiator or heater circuits. Bleed the system, start the engine and rev it. After 1 minute, stop the engine and open the coolant cap. If there is an unexpected pressure, then that's the confirming symptom. Garages also have test kits to analyze the coolant to detect the presence of exhaust gasses. Well worth it if you are not sure.

Loss of coolant Only – This is the \$1000 question. It could be that the head gasket has failed between a waterway and atmosphere. This is most common along the front of the engine above the exhaust manifold. It should be possible to see some witness or staining from the leak above the heat shield. The more likely cause of water loss is a bad hose joint, leaking hose, under pan coolant pipes, water pump gland or the radiator. It should be possible to see some water dripping somewhere. Put the car onto a dry surface or some newspaper to see where it might be dropping. Exhaust all other possible causes before concluding it's the head gasket.

Following the four fluid logic you may conclude that it is possible for combustion gasses to escape to atmosphere or for oil to escape to atmosphere. If you look at the configuration of the gasket however, there is no interface between gasses and atmosphere or oil and atmosphere. If you have an oil leak in this area, it's not the HG, more likely the cambox.

Preparation

Its likely that this is going to take more than a day, certainly of the head needs machining, so get set up somewhere safe that you can safely leave it. If you're unfortunate enough to be doing it on tarmac, get some boards to sit the axle stand and jacks on or you will be digging them out of the ground later.

Get some pots to put the bolts etc in, plastic Chinese food containers are ideal, they have snap on lids and are stackable.

There is an issue with fuel running out when the fuel return line is disconnected, if you can arrange to have less than ¼ tank of fuel then so much the better.

You will need a fair range of tools to get into those awkward corners. Ratchet spanners with pivoting cranked ends are invaluable. Most of the work can be conveniently done with these and a good ¼" drive socket set but you will also need ½" drive with a long breaker bar for the tighter bolts. Universal joints or wobble bars are useful. A stick mirror will help you see what's going on; many of the bolts cannot be easily seen.

Make sure you have an E12 Torx socket for the head bolts and T?? for the side access cover and a camshaft locking tool.

The crankshaft pulley needs to be torqued to 205Nm, the head bolts to an accurate 20Nm, and if you're really fussy, the smaller bolts like timing belt cover to 9Nm. One torque wrench is unlikely to have sufficient scale range. Certainly don't rely on their accuracy in the bottom 10% of range.

You need good access both under the car and from the top. Unfortunately if the car is high enough to conveniently work under, then access through the top of the engine is getting a little difficult. The following guide has been worked out to minimise these problems, concentrating on underside jobs, then top access jobs but you will still need to raise and lower the car a few times so a good jack and axle stands is really useful. A stout box to stand on might save the day a couple of times. Ramps are really not an option for this job as the OSR wheel spends most of its time off but if you do use them make sure you have a jack capable of lifting the car off them.

You will need to order the parts, which should include gaskets for head, inlet manifold, inlet plenum, cambox cover and exhaust manifold. Note that the inlet manifold gasket is a rubber moulding for the plastic manifolds. The alloy manifold has a flat Klingerite type gasket. You will also need a little pot of liquid gasket (kit LVV000108EVA) if you are replacing the oil rail or stripping the head. One pot is just enough to do the oil rail and sump but you will need two pots if you are taking the cam caps off as well. Put these pots upside down in a jam jar or similar in a warm room to let the liquid drain towards the nozzle. You will also need some thread locking compound for some of the more important bolts like the cam tensioner cam pulley bolts. You should definitely consider a new cambelt, tensioner, water pump and head bolts. Don't forget to get the fluids and oil filter too. Whilst the MGR spring type hose clips seem to do the job they were intended for, many more fastidious owners have replaced them with stainless steel worm drive clips. Dieter has a most excellent page showing their sizes. http://www.mgfcars.de/hose_clamp/coolant.jpg You might also consider a 75mm hose clip for the air inlet to throttle body hose.

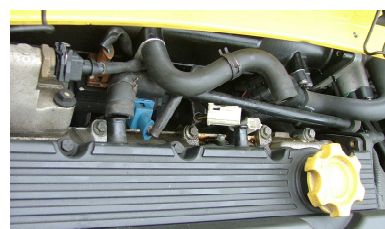
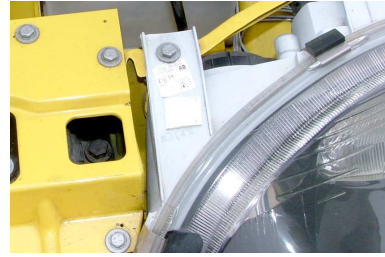
Going deep into the engine bay provides an opportunity to easily replace or check anything else that you might have been concerned about and do a bit of maintenance like lubricating the clutch arm, changing the clutch fluid and maybe even fixing that bit of rust on the subframe. If you ran out of coolant during your HGF episode, a low coolant alarm might seem like a good investment.

Consider flushing the lubrication system by putting in some cheap 10W40 oil and running for a couple of days after it;s all back together.

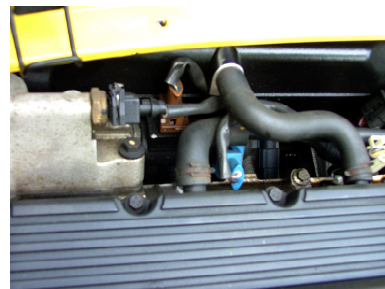
OK. Lets go for it

- Lift the front, yes the front, of car as high as possible onto axle stands.
- Turn the heater control to hot.
- Remove the pipe clips joining the under pan coolant pipes to the radiator hoses.
- Position a tray of at least 6 litres capacity to catch the coolant then break the joints of both pipes.
- Leave the pan under, lower the front of the car and raise the rear of the car as high as possible onto axle stands.

- ❑ Remove the coolant cap and store safely.
- ❑ Remove the plastic 13 AF radiator vent plug from the RH top of the radiator.
- ❑ Remove the front bulkhead plastic closing panel by taking off four 10 AF plastic nuts and one scrivet just above the brake servo. Put the scrivet back into its hole and the nuts back onto their threads. Store the panel.
- ❑ Open the heater bleed nipple which is located centre top of the bulkhead panel between the clutch master cylinder and the brake servo
- ❑ Disconnect the battery, earth terminal first, then positive. Move the +ve terminal away from the battery so that it cannot accidentally contact.
- ❑ Allow the coolant to drain.
- ❑ Lower the rear of car leaving the coolant catch tray in place.
- ❑ Loosen the 17AF sump plug and drain the oil. Note if you intend using flushing oil later do not remove the oil filter, best to change it after flushing and before you put the good stuff in. This might depend on how much mayo you had.
- ❑ Lower the car back onto four wheels.
- ❑ Loosely replace the radiator vent plug.
- ❑ Unclip the soft top at its rear and remove the parcel shelf carpet. Store safely
- ❑ Remove the tee bar and speakers noting the speaker multiplug in the centre
- ❑ Remove the access hatch, 10AF screws. Store the screws in a pot.
- ❑ Remove the dipstick
- ❑ Remove the vacuum pipe clip from the filler neck bracket and unclip the throttle cable
- ❑ Remove the 10 AF dipstick filler cap securing bolt from the plenum
- ❑ Remove the dipstick filler complete, pulling the bottom pipe collet clip at its base upward (its similar to fuel filter collet)
- ❑ Remove the vacuum servo pipe from the centre of the manifold (another one of those collet clips)
- ❑ Remove the evaporation canister hose from the inlet plenum
- ❑ Disconnect the evaporation canister multiplug
- ❑ Lift the canister out of the dovetail bracket and move to the left hand side of the engine bay with the remaining pipes still attached.
- ❑ Remove the throttle cable from the sheath anchor and disconnect it at the bullet joint with throttle quadrant.
- ❑ Remove the coolant reservoir top return pipe.
- ❑ Remove the coolant reservoir, two screws 8 AF and pop them back into their holes
- ❑ Remove the pipe from the coolant reservoir base.
- ❑ Remove the coolant pipe from the RH side of the manifold
- ❑ Disconnect the two cambox breather pipes and mark or label them to show which ends attach to the engine.



- ❑ Disconnect the white cam position sensor multiplug from the centre of the cambox rear.
- ❑ Remove the air inlet elbow from both filter box and throttle body
- ❑ Remove the fuel supply hose from filter (collet)
- ❑ Remove the air bypass hose from throttle body and valve
- ❑ Disconnect the air idle bypass valve multi plug
- ❑ Disconnect the small fuel pressure regulator vacuum hose from the inlet plenum.
- ❑ Disconnect the MAP sensor multiplug from the right hand side of the plenum
- ❑ Disconnect the throttle position sensor right angled multi plug from the throttle body
- ❑ Remove the throttle body, 4 screws 8 AF. The front lower one is a little tricky and best done first, so that you can work it out by hand. (Try loosening it standing at the right hand side of the car).
- ❑ Remove the VVC hydraulic control temperature, and two solenoid multiplugs, noting the colours and order (probably black, brown and blue) for future reassembly.
- ❑ Remove the 5 screws holding the plenum chamber to the inlet manifold
- ❑ Check to see there's nothing still attached to the plenum. Knock it with a bit of wood to break the seal and remove the plenum. Ah - now we can see the manifold bolts (well at least some of them)
- ❑ Disconnect the air inlet temperature sensor from the left hand side of the inlet manifold.
- ❑ Disconnect the large injector multiplug by pulling the slider fully out from the left hand piece.
- ❑ Remove the spark plug cover and put the screws back into their holes, noting that the centre one is shorter.
- ❑ Remove both coils with their secondary HT leads, putting the screws back into their holes.
- ❑ Remove the multiplugs from both coils.
- ❑ Store the coils safely. Note they are both the same but probably worth marking them left and right hand so you can put them back in the same place later.
- ❑ Carefully remove the coil supply loom from its clips and position it clear on the left hand side of the engine bay.
- ❑ Loosen the 13 AF screw at base of the manifold support bar
- ❑ Remove the 10 AF (M8) screw from top of manifold support bar, rotate the bar out of the way and replace the screw in its hole.
- ❑ Remove the two 8 AF screws holding return pipe to the underside of the manifold. These are a little fiddly but possible with a ratchet spanner.
- ❑ Remove the rubber fuel return pipe from the manifold pressure regulator.
- ❑ Rotate the manifold support bar to left, out of way
- ❑ The manual says to remove the other end of the fuel pipe (collet) but if you have more than ¼ or so full tank, fuel will run out by gravity. If this happens, reconnect the return line and manoeuvre



it from under the manifold, positioning it vertically above the fuel tank level on LHS of engine bay. If you don't have this problem then just remove and store the pipe.

- ❑ Check there's nothing still attached to the manifold
- ❑ Remove seven, 10 AF (M8) screws from the manifold to head joint (4 are under the inlet pipes) and two 13 AF nuts from top of manifold joint – Crack all the bolts and nuts but leave the nuts on till last
- ❑ Remove the inlet manifold complete with fuel rail, loom and injectors.



On to the Cambelt

It's difficult to take pictures of the cambelt assembly, difficult enough to actually see when it's in front of you. There is an excellent video made with the engine out on the bench, by one of our good MG friends. It's well worth watching. It can be viewed at <http://video.google.com/videoplay?docid=4217575705633360863>. Note that this video shows the automatic style tensioner whereas this guide deals with the manual tensioner found on the 160 engine.

- ❑ Remove 5 screws 8 AF from cambelt cover, noting the lengths (the 6th screw can be better accessed through the wheel arch)
- ❑ From the top, loosen alternator pivot bolt
- ❑ Lift the rear of car onto stands as high as possible.
- ❑ Remove the OS wheel
- ❑ Remove the Torx screw from the centre top of the side engine cover
- ❑ Carefully remove two soft plastic cross head scrivers from the bottom of the cover and remove the cover
- ❑ Grease the torx screw and put back in the hole tightening it so it won't fall out when you test drive.
- ❑ From under car loosen the bottom cambelt cover screw 10 AF, 3 approx turns.
- ❑ Remove the top cambelt cover
- ❑ Loosen both ends of the alternator tensioner brace.
- ❑ From under the car, feel for the little 8 AF tensioner screw on the front end of the tensioner bracket. Turn anticlockwise to untension the belt. Mine needed 20 full turns before I could get the belt off – a ratchet spanner is pretty useful here.
- ❑ Measure the height of a significant part of the engine block to a point on the body. You may need to move the engine up and down a little to get better access to some of the bolts so this will give you the engine's normal position for future reference and to make sure you are not moving it too far away from where it wants to be.
- ❑ Support the engine lightly from the sump and remove the 19 AF engine mounting nut – Quite tight.
- ❑ Remove two engine 18 AF mounting bolts - again very tight, probably needing a 36" breaker bar.
- ❑ Remove the front engine mounting tie bar nut and bolt
- ❑ Remove two 13 AF screws holding engine mount to subframe. – One of these is a bit of a struggle. You might have to spring the safety bar out of the way, lift and rotate the mounting bridge off and then remove it.

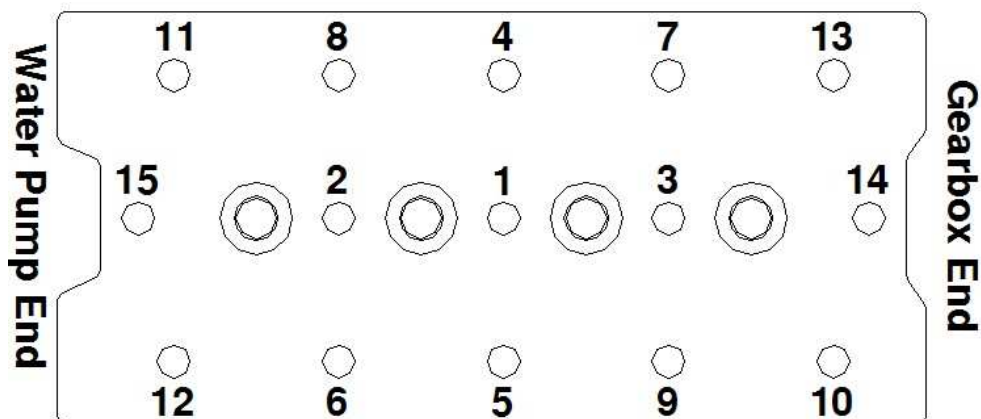
- ❑ Roughly align the engine into its service position aligning the crank pulley with the 90° ATDC mark on the belt cover.
- ❑ Loosen the crank pulley bolt. (I used a quality windy gun) and nip it up again. If you don't have an impact tool, you will need to lock the engine. The best way is with a locking tool that engages on the flywheel starter ring gear through the starter motor hole. You need to take the starter motor off to use this though. Others have trusted to luck, put the car into 4th gear and got someone to stand on the brakes whilst they attack the crankshaft pulley bolt with a breaker bar. I'm personally not especially in favour of this method; it puts a lot of strain through the system.
- ❑ Accurately position the engine to its service position.
- ❑ Check the cam pulley timing marks are pointing at each other. If they are pointing to the outside of the engine, rotate the bottom pulley 360 deg back to the mark.
- ❑ Check the cam pulley timing marks.
- ❑ Remove the crank bolt and pulley. You will see that there are two centre punch marks on the bottom cam pulley, which also indicate that the engine is in the service position. They also align with a rib on the oil pump when the cambelt cover is removed. Check that they are aligned and note for future reference.
- ❑ Don't rotate the engine bottom end after this.
- ❑ Loosen the cambelt tensioner bolt (8 AF hex socket screw) Its tight, an allen key is unlikely to do it. I used a 3/8" ratchet bar and hex key socket. You will need to torque this up later so think about how you are going to do this.
- ❑ Remove the 8AF manual tensioner slot screw and store it in a plastic pot.
- ❑ Rotate the tensioner to slacken belt
- ❑ Remove the cambelt starting from the bottom pulley
- ❑ Remove the cambelt tensioner and set it aside for comparison with the new one.
- ❑ Remove the inlet and exhaust cam pulleys from the camshafts – You will need something good to hold the pulleys whilst removing the bolts. I used a plumbers cranked tap spanner but it wasn't entirely satisfactory. There must be something better.
- ❑ Remove the rear cambelt cover. Note the inboard facing 8 AF screw behind the water pump flange, which you will need to access from the top of the engine.



Cam Cover

The coils and loom have already been removed

- ❑ Remove fifteen 8 AF bolts from the cam cover in the sequence shown. Crack them all first, then remove.



Cam Cover Bolt Loosening Sequence

- ❑ Store the bolts in a pot
- ❑ Remove the cam cover

Exhaust Manifold

- ❑ Remove one 13 AF nut and two 10AF self tapping screws from exhaust heat shield
- ❑ Store heat shield and put screws and nut back on.
- ❑ Remove two coolant outlet hoses from front left of the head
- ❑ Remove two temperature sensor multiplugs noting plug the colours and positions (blue on bottom, black on side)
- ❑ Rotate the lambda sensor multiplug on VVC belt cover 45 deg to release.
- ❑ Remove six, 15 AF nuts from the flexi joint to manifold flange. (A windy gun is good for this) Break the flange joint holding the lower flange up, so as not to strain the lambda sensor wires. Tie up to body with string.
- ❑ Remove five, 15 AF nuts from manifold to head joint. (an air ratchet will save time here) Remove shield bracket from RH side of engine.
- ❑ Store exhaust manifold and heat shield.

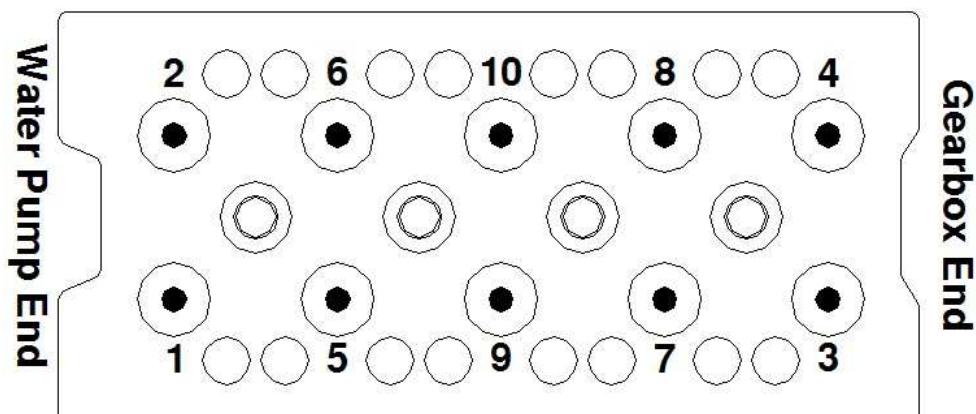


Water Pump

- ❑ Remove from water pump flange, three 8 AF and one special 13AF shoulder screw at the bottom (with tapped M5 hole in top for cambelt top cover.)
- ❑ Tap the water pump from top of engine to break seal.
- ❑ Remove the pump, compare with the new pump and discard.

The Head

- ❑ E12 Torx – Remove head bolts in the sequence shown below, in increments of 90 degree turns until they are loose. If re-using (maybe not a good idea unless you know then cars history) store in fitted order so that they can be assembled back into the places they came from.



Head Bolt Loosening Sequence

- ❑ Wiggle head and lift off – Store safely
- ❑ The cylinder liners are loose. Either clamp them in place using head bolts and soft spacers or make sure that you do not rotate the engine even one bit.

- ❑ Examine and re-build the head as necessary. (now there's a quick statement) You will find some good on line guides if you need them. Its well worth having a look at the water ways particularly on the exhaust side. Cooling flow is considered by some to be a bit marginal in this area and any bits of casting snot do not help one bit. Carefully fettle them away with a burr or Dremmel Be very careful not to touch the head face with the chuck or cutter. Blow the waterways through or flush with water to clean out the swarf.
- ❑ Check the head face for flatness. Using a good quality straight edge place it across the head. Check that it doesn't rock then try fitting a 2 thou feeler gauge anywhere between the head face and the straight edge. Repeat this process at various points across the head. Now turn the straight edge 90⁰ and check across the head. Check for twisting using two straight edges one across each end of the head. Eye up the bottoms, are they parallel.
- ❑ Clean all gasket surfaces thoroughly with a plastic scraper. Do not use metal tools, the alloy is very soft and easily damaged.
- ❑ Clean block mating face, again with a plastic scraper.
- ❑ If the block is fitted with plastic dowels, replace them with the steel dowels. Otherwise leave alone. When fitting the dowels it is a good idea to tap a thread into the hollow bore to allow easier extraction in the future.
- ❑ Check the cylinder liner heights. They must be between 0.05 and 0.10mm (2 to 4 thou) proud of the block face. If they are not then, sorry, you are in for trouble and may need the block skimmed.

VVC Belt

- ❑ Remove four 8 AF screws from VVC belt cover and remove
- ❑ Loosen pulley nuts but don't remove. (a windy gun is good here)
- ❑ Align the timing marks, remove bolts, then pulleys complete with belt
- ❑ Clean pulleys and inside cover, checking for any burrs in the teeth, which may damage the new belt.
- ❑ Reassemble the pulleys and the belt simultaneously.
- ❑ Rotate the camshafts slightly forward and back to check the timing marks still align.
- ❑ Fit new pulley bolts and washers using a little loctite on each thread.
- ❑ Torque to 65Nm for M10 bolts (or 33Nm for M8 bolts), holding the pulleys with a suitable tool (same as used for the right hand pulleys).
- ❑ Replace the belt cover, tightening screws to 9Nm.

Under Pan Coolant Pipes

This section is optional. The under pan coolant pipes are notorious for leaking due to rust, especially on the later TFs. Stainless steel replacements are available and this is a good opportunity to replace them whilst the coolant is drained. No photos are really necessary, just get under and it's all pretty obvious.

If you do not replace them, now is the time to reclip the hoses back onto the existing ones.

- ❑ Raise the front of car onto axle stands (the back being already lifted).
- ❑ Remove twenty-two, 12 AF screws from under pan guard, leaving 4 of them in the corners loosened only to support the plate . (An air ratchet is a real bonus here)

- ❑ Remove last 4 bolts and finally the tray.
- ❑ Unclip the radiator pipes from the rear of the under pan pipes and break the joints. You may get a splash or two of water here.
- ❑ Cut the cable ties from support brackets (the new pipes should come with new ties)
- ❑ Remove three 10 AF screws. (Consider replacing these with M8 x 35 Lg stainless bolts).
- ❑ Check the inside of the new pipes and blow through with an airline or hosepipe. They might be full of polystyrene chips from the packaging.
- ❑ Fit new coolant pipes and cable tie loom.
- ❑ Attach front and rear rubber pipes and hose clips
- ❑ Replace the under pan tray, tightening bolts to 25 Nm

Oil Rail

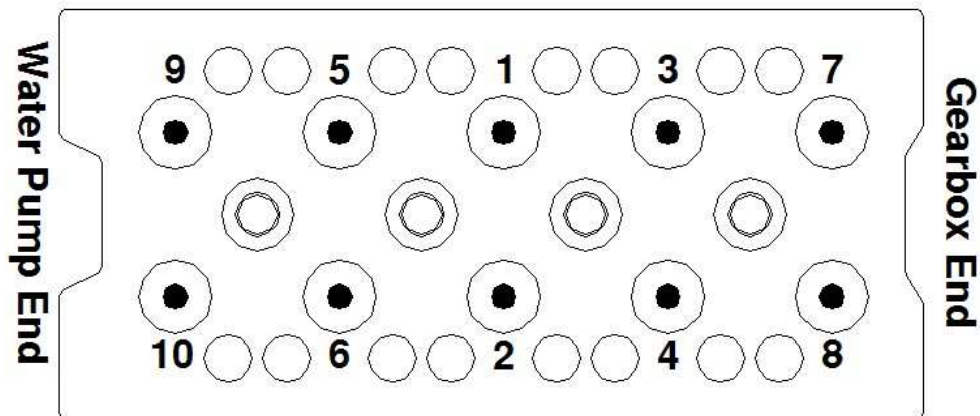
- ❑ Temporarily replace the RH top engine mounting (no need to do up tight) and remove sump jack.
- ❑ Disconnect the Lambda sensor multiplug and unclip loom.
- ❑ Remove three 15 AF nuts from catalytic converter inlet. (Replace with M10 SS or cat-saver nuts when re-assembling)
- ❑ Disconnect the flexi-pipe from rubber suspension hanger (WD40 might help here)
- ❑ Cut the string suspension from the exhaust pipe front flange
- ❑ Remove the flexi section and store.
- ❑ Loosen the 15 AF bolt securing the engine rear lower mount to the subframe.
- ❑ Wash down the lower end of engine. (We don't want any grit on the crankshaft thankyou)
- ❑ Remove four 15 AF bolts securing the engine mounting bracket to engine (breaker bar might be needed here)
- ❑ Remove two horizontal 13 AF bolts holding sump sideways to gear case.
- ❑ Crack fourteen 10 AF bolts securing sump and remove. Leave the corner screws engaged by a couple of threads until last. (Note that two are longer)
- ❑ Tap the sump with soft mallet to break seal.
- ❑ Remove the sump without sump tipping it. Despite draining the oil, there will still be some in here.
- ❑ Remove two 9 AF bolts and wiggle to remove oil pick up
- ❑ Remove two 11 AF nuts securing the oil rail.
- ❑ Tap to break the seal and remove oil rail (Expect to get dribbled on again)
- ❑ Clean the sump and oil rail flanges. Leave for a while to let last of oil drips clear. Then degrease. (Wynns carburettor cleaner does a pretty effective job of dissolving the gasket goo)



Back Together Again

- ❑ Thoroughly clean the head sealing faces and the sump faces.
- ❑ Lay the gasket on the head face and carefully locate the head on the two steel dowels without scratching it.
- ❑ Prepare the stretch bolts by oiling the threads and under the head. Lay cleanly to one side.

- ❑ Prepare torque wrench (20Nm) extension bar and torx socket together with a breaker bar for the final tightening.
- ❑ Follow instructions on liquid gasket kit (LVV000108EVA) running a fine bead around the sealing face and working it to a thinly coated flat surface with the brush. It is essential that you do not get any grit on the face at this stage.
- ❑ Re check for any oil drips from the block and assemble the oil rail, securing it with the two small nuts.
- ❑ Place the stretch bolts in the holes in the head without dropping them and screw down finger tight. (You will need to turn the camshaft slightly to get all the bolts in)
- ❑ Nip down stretch bolts in the sequence shown below in increments of 180 deg turns at a time with a torque wrench finally tightening to 20Nm. (The LR gasket compresses considerably so you will go round these 3 or 4 times)



Head Bolt Tightening Sequence

- ❑ Using a long breaker bar for better control, turn each stretch bolt in sequence 180 deg then again in sequence 180 deg.
- ❑ Recheck the tightness of the two small oil rail nuts underneath.

The head is on, time for a clean up of the bits that are going back on : Sump, Inlet manifold, Plenum, Carburettor, Timing belt covers, Leads, Connectors, Cam cover etc Now might also be a good time to bleed and replace the clutch fluid whilst access to the slave cylinder bleed nipple is easy. Also lubricate clutch arm with oil where it enters the gearbox bell housing and seal round the shaft with a finger full of waterproof grease. You might also want to clean down the inside of your engine bay with a good finishing spray of WD40 as a kind of polish. If you do this, probably best to refit the sump first.

- ❑ Coat the sump flange with liquid gasket.
- ❑ Assemble the sump to engine progressively tightening 14 bolts 10 AF to 25Nm and two 13 AF bolts sideways into the gearbox housing (45Nm) *There might be a tightening sequence for these bolts but I can't find one. Do it logically and take it easy, a little on each bolt at a time.*
- ❑ Replace the lower RH engine mounting to sump casing tightening the 4 bolts to 60Nm.
- ❑ Place a jack under the sump to loosely supporting the engine
- ❑ Remove the RH top engine mounting (again)

During installing the water pump and cambelt you can move the engine up and down a little to aid access, remembering your measured centre position so as not to go too far.

- ❑ Clean the water pump sealing face on the block and assemble water pump, 3 8 AF screws and one 13 AF shoulder screw at bottom (a couple of spots of silicone grease will help the O ring stay in place whilst you are assembling the pump.)
- ❑ Fit new exhaust gasket, noting the notch at one end to clear water outlet on LH side of engine
- ❑ Refit the exhaust manifold, not forgetting the little heat shield on the RH nut and tighten nuts to 45Nm.
- ❑ Refit the flexi pipe to the exhaust manifold, routing the lambda sensor wire to VVC belt cover and ensuring it is clipped clear of the downpipe.
- ❑ Replace the coolant temperature sensor multiplugs (usually blue at bottom)
- ❑ Reassemble and clip the two coolant outlet hoses to the front left of the head

Cambelt Replacement

- ❑ Replace the cambelt rear cover (2 short 8 AF screw at bottom and one longer one into rear of water pump flange) Look where the holes are in the cover before you assemble it; the upper one is difficult to see.
- ❑ Locate the cam pulleys onto camshafts, aligning them with the roll pins.
- ❑ Fit new camshaft pulley bolts and washers, applying a little loctite to each thread. Hold cam pulleys and tighten to 65Nm (33Nm for M8 bolts)
- ❑ Align the cam pulley timing marks and insert the locking tool.
- ❑ Loosely assemble cambelt tensioner with a new socket cap screw using a little loctite on its thread. Position the tensioner fully clockwise such that the roller is in its slackest position and just nip up the capscrew. (Leaving out the slot screw will enable you to move the roller back a little further and gain a touch more slack).
- ❑ Fit the new cam belt, starting at the crankshaft pulley. Only engage it a little less than half way onto the pulley. Slide an open ended spanner (around 17mm) between the cambelt and the short shroud on the oil pump to gently hold the belt onto the pulley. Next engage the belt just onto the exhaust cam pulley ensuring that the run from the crank is not slack. Continue the belt around the inlet cam pulley. Now, working clockwise from the crank, engage the belt onto the water pump and work it around the tensioner. Progressively work the belt back to its correct position on each pulley
- ❑ Insert a new screw with a stiff patch into the tensioner slot, move the tensioner in as far as possible by hand and nip up the tensioner cap screw and slot bolt.
- ❑ Remove the locking tool.
- ❑ Temporarily fit the crankshaft pulley nut and washer (but not the pulley so that you can still see the centre punched timing marks on the bottom pulley)
- ❑ Rotate the engine two turns clockwise using the bottom pulley bolt and realign the bottom pulley. The engine should turn easily with the plugs removed. If you feel any resistance at any point during turning, don't force it. Recheck the timing marks on both the main and VVC timing belts. Check that the belt is centralised on all pulleys.
- ❑ Check the camshaft timing marks have remained exactly aligned.
- ❑ Fit the tensioner spring post in the tapped hole just between the two cam pulleys and attach spring to tensioner. It will help to locate the spring into the tensioner hole if you open up the spring end by 45 deg. Also, put a bit of string

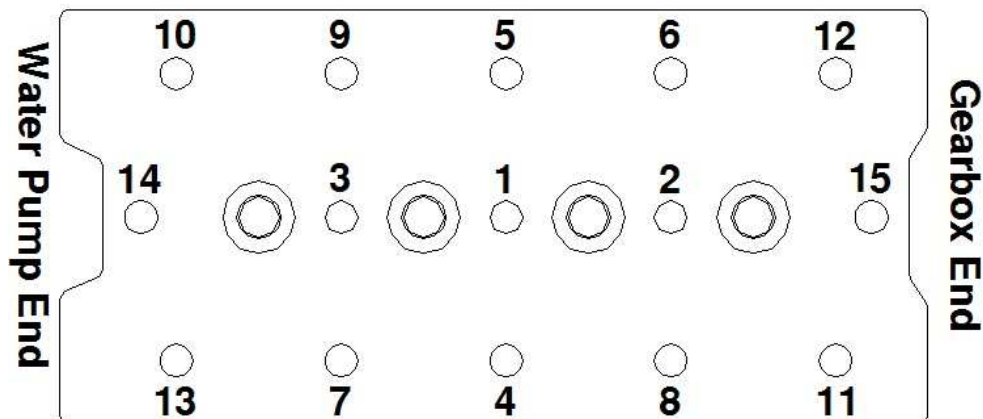
through the top spring hook and lead it to the top of the engine so that a helper can control the top of the spring.

- Using long nose cranked pliers fit the spring to the top tensioner post. (Sounds easy)
- Loosen both tensioner bolts by one turn.
- Rotate the engine two turns clockwise using the bottom pulley bolt and realign the bottom pulley to the timing mark.
- Tighten the tensioner back-plate slot bolt to 10Nm ensuring that the tensioner does not move. Tighten the centre tensioner cap screw to 45Nm.
- Remove the spring and spring post. Store for the next time ; if you get an OEM cambelt, its unlikely that these will be included.
- Remove the crankshaft pulley bolt.
- Fit the lower cambelt cover (three short 8 AF) leaving the top right hole empty. Tighten screws to 9Nm
- Fit upper cambelt cover making sure the slot in the bottom bottom rear, goes under the head of the water pump shoulder screw. Fit 3, 20mm long screws top outsides and rear lower, 36mm long screw centre top and 55mm long screw bottom front (and through lower cover). Tighten all screws to 9 Nm. Tighten the water pump shoulder screw to 12Nm.
- Refit the RH upper engine mounting lower rubber and safety hoop. Tighten to 45Nm
- Fit the mounting bridge over the stud and rotate it to lock finger under the safety hoop.
- Engage two top engine mounting bolts into engine bracket, moving the engine up and down on the jack to align them perfectly such that they can be screwed in by hand a few turns to ensure they are not cross threaded. Run bolts in and nip up.
- Fit the tie bar, tightening the bolts to 88Nm (Hats off if you can get a torque wrench on the rear one)
- Fit the top nut and tighten to 60Nm. Tighten two engine mounting bolts to 155Nm.
- Remove the jack from the sump
- Fit the crankshaft pulley and tighten to 205Nm (I used the windy gun on the basis that as it got it off, it will do it back up tight enough.
- Fit the exhaust flexi-pipe suspension rubber
- Connect the rear flange of the flexi-pipe to the catalytic converter (M10 nuts)
- Refit the sump plug and new sealing washer (17 AF)
- Fit a new alternator belt.
- Tension the belt by turning 8 AF adjuster clockwise viewed from the font of the car.
- Rotate the engine using the crankshaft pulley a couple of turns and recheck the belt tension. (Its always better to leave it a little loose to give the alternator bearings an easier life. If it squeals when you first start the engine, give it a bit more tension.)
- Tighten both ends of alternator adjuster brace
- Have a check for anything underneath that's still disconnected.
- Refit road wheel (70Nm)
- Lift car, and lower onto ground to give better access to the top of the engine
- From the top, tighten the alternator pivot bolt.

- ❑ Engage gear, apply handbrake and check the torque of crankshaft pulley bolt (205Nm)

Onto the top of the engine

- ❑ Refit the inlet manifold complete with fuel rail, loom and injectors.
- ❑ Fit two nuts to manifold top first, then seven, 10 AF (M8) screws
- ❑ Tighten all nuts and bolts to 25Nm (17Nm non VVC)
- ❑ Replace the evaporation canister into its dovetail slot
- ❑ Sort out the positions of the looms referring to previous photographs or you'll be taking stuff back off again later.
- ❑ Refit the fuel return pipe to the underside of the manifold (8mm cranked ratchet spanner)
- ❑ Refit and clip the fuel return rubber hose to the pressure regulator
- ❑ Refit the manifold support stay to the engine block, rotate and fit to manifold
- ❑ Refit fuel the supply hose to filter giving it a good tug to make sure it's secure.
- ❑ Replace the exhaust manifold heat shield checking the routing of lambda sensor wire
- ❑ Oil the cams with oil can and replace cam cover, fitting a new gasket
- ❑ Nip up all fifteen 8 AF bolts in the cam cover and torque in sequence shown below to 9Nm.



Cam Cover Bolt Tightening Sequence

- ❑ Replace the spark plugs (new or cleaned)
- ❑ Refit the coils and leads tighten screws to 8Nm
- ❑ Carefully re-clip the coil loom and HT leads into their sockets
- ❑ A spraying of WD40 over the leads never hurts, not does a squirt into each multiplug as you assemble them.
- ❑ Replace the spark plug cover, noting the shorter screw in the centre.
- ❑ Reconnect the multiplug to the air inlet temperature sensor (Black plug with yellow/white & purple/black wires, green sensor on LH side of inlet manifold).
- ❑ Reconnect the injector multiplug and push release clip in fully. Note the bracket fits to the throttle body screw, get the cables the right way round to suit this (plug horizontal at bottom with the bracket pointing up)
- ❑ Replace the VVC HCU temperature, and two solenoid multiplugs
- ❑ Reconnect the lambda sensor multiplug
- ❑ Reconnect the cam position sensor multiplug

- ❑ Have a look round for stuff under the inlet manifold that might still not be connected.
- ❑ Refit the air inlet plenum, fitting new gasket Tighten 5 screws to 25Nm
- ❑ Refit the throttle body ensuring rubber seal is correctly in place and not forgetting to secure the injector multiplug bracket to the lower front bolt - this one is a bit of a pig. Tighten 4 screws to 9Nm (but you won't be able to get a torque wrench on any but one).
- ❑ Reconnect the throttle position sensor right angled multi plug
- ❑ Reconnect the MAP sensor multiplug to the right hand side of the plenum
- ❑ Refit the vacuum servo pipe to the collet clip in the centre of the plenum
- ❑ Reconnect the small fuel pressure regulator vacuum sensing hose from to the RH end of the plenum.
- ❑ Reconnect the air idle bypass valve multi plug
- ❑ Fit the air bypass hose to the throttle body and valve
- ❑ Fit the two cam box breather pipes
- ❑ Refit the coolant pipe to the RH side of the inlet manifold
- ❑ Fit the pipe to the base of the coolant reservoir and fit the reservoir and top return pipe
- ❑ Engage the throttle cable into the quadrant and clip the sheath into holder. Ensure that the throttle quadrant fully returns to its stop without excessive slack in the cable.
- ❑ Fit the air inlet elbow to the filter box and throttle body
- ❑ Reconnect evaporation canister multiplug
- ❑ Refit the evaporation canister hose to the manifold
- ❑ Replace the dipstick filler, engaging onto collet clip at base. Tighten top bracket 10 AF screw to 10Nm
- ❑ Replace the dipstick
- ❑ Refit the vacuum pipe clip into hole in filler bracket and clip in throttle cable sheath

The reassembly is complete apart from a few panels. How many bits or bolts have you got left that you don't recognise - Hopefully none

- ❑ Fill engine with flushing oil to correct level (the sump plug is already in ??)
- ❑ Open the heater bleed nipple.
- ❑ Remove the bleed screw from radiator.
- ❑ Ensure that the heater control is still set to hot.
- ❑ Raise the rear of car as high as possible and fill cooling system slowly with water. Bleed thoroughly until no bubbles come from radiator vent. Close radiator vent and continue filling until a clear stream comes from the heater bleed nipple. Nip up bleed points. Overfill coolant reservoir by an inch or so. Fit the coolant reservoir cap.
- ❑

OK we're good to go. Have a good check round – any bits left apart from the side access cover, tee bar etc.

- ❑ Reconnect the battery positive, then negative terminal.
- ❑ Switch the ignition to position II. You should hear the immobiliser bleep as it handshakes with the fob and the fuel pump switch on for 2 seconds. Turn off and on again to fully flush air from the coolant rail.

- Check for any smell of fuel in the engine bay particularly at any joints you had disconnected.

You have already turned the engine over a few times by hand so we are sure there's nothing fouling.

Check neutral gear and start the engine.

It may be very clattery to start with as the oil re-fills the hydraulic tappets, this should go within the first two minutes, (not forgetting that you have the engine access panel off too) .Don't rev the engine during this time. Run for a few minutes checking for coolant and circulation by feeling for some temperature in the coolant pipes.

Depending how greasy your hands were when handling the exhaust system, you may get a little smoke from the manifold.

Watch for a return flow into the top of the coolant reservoir. Occasionally raise the revs for a few seconds to 3-4000 RPM.

Stop the engine when it starts to feel warm and bleed any air from the heater nipple, remove coolant cap and re-bleed from radiator.

Turn fan to speed 1, direction to face vents and close off all but one vent.

Restart the engine and allow to tick over for a few more minutes.

Check that there is some warmth coming from the heater vent.

Is the temperature gauge starting to move.

Stop the engine, carefully remove coolant cap, re-bleed and top up coolant level. Refit cap.

Bring engine up to full heat until the radiator fan switches on, checking for any leaks and that all pipes and radiator is getting hot.

Some people have added dishwasher detergent to the water temporarily in the system to help clear out any oil that may have contaminated the cooling system.

Check the coolant level and off for a short test drive. You can't put the top down unless you refit the access panel with a couple of screws. Keep the engine load light and at 2-3000 RPM.

On return, check for coolant leaks. The level will probably have gone down a bit due to residual air bubbles escaping. Top up.

Remove OSR road wheel, check the alternator belt tension and re-fit side access cover using two scrivenets and one torx screw.

Refit the engine access hatch, tee bar, speaker cables, parcel shelf carpet etc

Enjoy a good job well done, keeping an eye on coolant level and dipstick over the next couple of days. Expect to top up the coolant a few cm as residual small air bubbles purge from the system.

When you are sure the coolant system is stable, drain the water and replace with the good coolant, flushing through well and draining down a couple of times if you added any detergent.

Change the oil for the good stuff, replacing the filter as well.