MGB Technical Tips - Engine Cooling (Part 1):

Due to this in-depth investigation into the multiple areas of consideration in the MGB, and other car's cooling systems, this Technical Tips report will be presented over the course of three instalments.

As always, it's best to start with the basics, so I'll first discuss the MGB's cooling system, as it left the factory. This means that the car has been regularly maintained and is tuned correctly.

Coolant:

Don't use tap water in the radiator.

I could leave this article right here with that statement because it's an important message and it will go such a long way to rectify overheating issues, now and for the future health of your engine.

Delving into the many websites mentioning the cooling system in an MGB, there are many and varied theories that sometimes contradict themselves, and some are even just plain wacky.

Firstly, it must be said that a properly maintained "street" MGB shouldn't need any modifications for driving in a hot climate. All MGBs that were not destined for the UK domestic market were fitted with an oil cooler to assist with engine cooling in the 40°C weather temperatures that we experience here in South Australia, in South Africa and in the south-western states of the USA.

If you didn't pick up on the underlined word driving in that last sentence, I'll clarify my meaning.
A correctly maintained, standard MGB is capable of driving in hot weather, but it usually won't be able to handle extended periods of idling in traffic when the weather is extremely hot because of the limitations of the mechanical radiator fan. The engine driven mechanical fan spins rapidly at high engine RPM when it's not needed at all because of air being forced through the radiator when the car is at speed, and when the car is stationary and the engine is idling, the fan doesn't shift enough air through the radiator.

My daily-driver MGB of many years actually struggled to get enough heat into the engine to be able to operate efficiently (too much cooling), yet waiting for three cycles of the traffic lights at a busy intersection (junction) in summer often caused the temperature gauge needle to "top out", and the engine showed all of the nasty symptoms of over-heating. To exacerbate this, with an already dangerously hot engine, I had to drive up a long steep slope at slow speeds due to traffic congestion, then I'd have to idle for several cycles of the next traffic lights. There were occasions when I was forced to take an alternative route, just to drive at normal road speeds to get some cooling air through the radiator to allow the engine temperature to return back to normal. This condition was overcome by the fitment of an electric radiator fan.

Don't use tap water in the radiator as a coolant.

Avoid "oily" types of coolant because they don't contact well with the internal surfaces of the radiator and engine block. This is an extremely important message to convey, and I understand how some people are reluctant to change the habits of a lifetime, but I strongly recommend this one.
Unless you're concerned about your MGB block cracking due to sub-zero weather temperatures, then you don't need to use Ethyl Glycol in the red or green sludge that so many people use in their cars.

There are many brands available in the various automotive parts suppliers' shops of what they label as coolant. In fact, despite the label, the product is actually anti-freeze, which only transfers heat at about 60% of the efficiency of water, so if your car has marginal cooling capacity, purging the green sludge from your radiator and engine is the first thing that you need to do. Just make sure to dispose of it in a responsible manner due to how poisonous it is.

I'll repeat that; Ethyl Glycol transfers heat at only 60% of the efficiency of water.

Apart from this so-called coolant being toxic to you and your pets, it can stain your car and your driveway, it's also banned from use at some racetracks around the world because if it gets spilled onto the track it causes a slippery hazard.

At least it's not quite as bad as tap water in a car's radiator. NEVER use plain tap water, you're just asking for trouble.

If you or a Previous Owner have used Ethyl-Glycol in an MGB located in a mild or warm climate, the best option is to flush your MGB's cooling system and re-fill it with demineralised water which is available for about $1/litre at any supermarket,

AND you must use an anti-corrosion additive such as a dose of Penrite's "Classic Car Coolant", which also lubricates the water pump bearing.
Penrite state that this product "can lower running temperatures by 8-10°C cooler than glycol treatments". That is, the very Glycol treatments that they also sell as "coolant" are not as efficient, so why would anyone use the green sludge when even the manufacturer indicates that it's not the best product to keep your engine cool?

There's an American cooling system additive that many racers use, called Water Wetter. As its name suggests, it makes water have an enhanced water-like quality by breaking down its surface tension, to allow it to flow even more freely and to reach into engine block casting pores that the oily/sludgy type of anti-freeze products can't reach. By allowing for greater surface area contact, the water has a better capability to transfer heat from the engine block and cylinder head, and to transfer that heat out of the system as it passes through the radiator. The Penrite "Classic Car Coolant" also has this beneficial property and should be more than sufficient for a "street" MGB, but I'll continue to also use Water Wetter in a competition MGB as I've done for years.

Don't use tap water in the radiator.

Tap water will encourage the accumulation of silt and the formation of corrosion inside the engine's cooling system. These rust deposits will flake from the walls of the water-jacket and obstruct coolant passages inside the cylinder block and the cylinder head. The impurities circulating in the cooling system will also get trapped in the radiator cooling tubes, heater matrix and heater tap (if fitted) and can damage the water pump, which all increases the likelihood of the car over-heating. It's a horrifying exercise to turn over a bare engine block on an engine stand, even one that's been hot-tanked at a machine shop, and to see all of the Ferric Oxide flakes fall out of the block through the coolant holes to the cylinder head and through the water pump aperture.

That's enough of my references to the evils of using tap water in your MGB, or any car's, cooling system. I've laboured the point but it needs to be stressed most urgently.

Engine Block & Cylinder Head:

When getting an engine professionally rebuilt, before collecting the machined block, ask the workshop to "hot tank" the block for another 24 hours, even if they say it isn't needed. A bare minimum, over-night hot-tank session at a workshop won't be enough to remove decades of filth from the passageways inside the block.

Make sure that you remove the four core plugs from the side and rear of the block and replace them with new ones afterwards. I've read of someone who suggests that the core plugs should only be removed before the second hot-tank session, after the machining has been completed. I disagree with this because I've seen B-Series blocks that have corroded bosses in the block casting where the core plugs are fitted, such that it was only the build-up of corrosion that was plugging a leak. Thanks to previous owners not caring for their MGB, and using tap water in the radiator, new core plugs couldn't be fitted into the cylinder block because of the missing cast iron that had corroded away from inside.
It would be a shame to spend well over $1,000 on some engine machining, only to discover that the block was scrap when the core plugs were later removed.

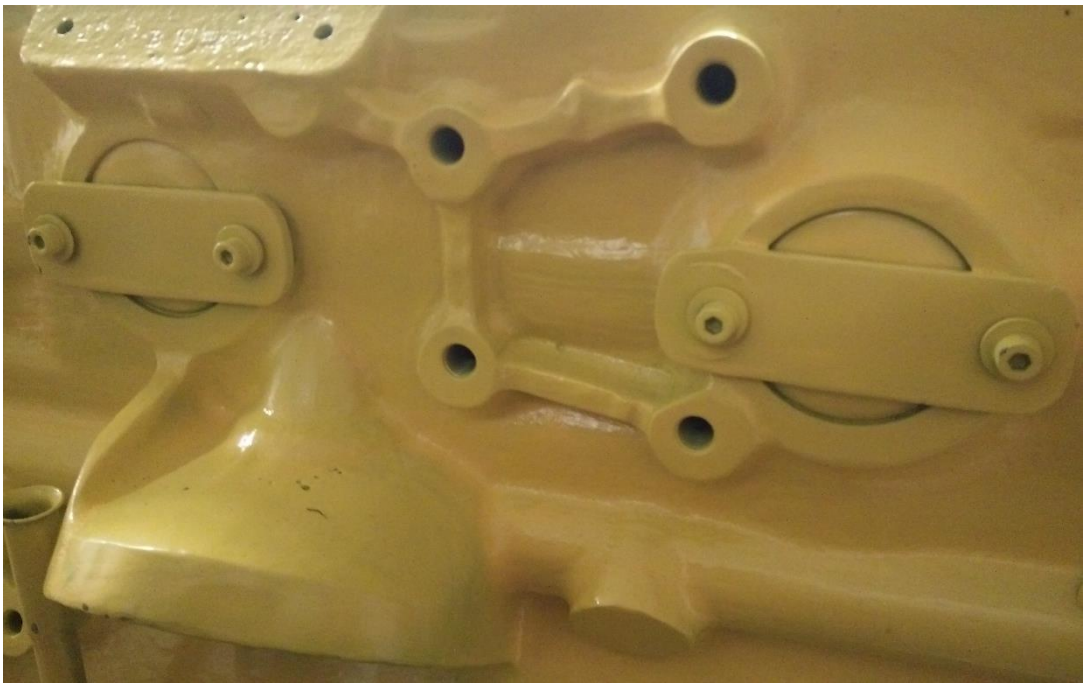
Note that core plugs are sometimes incorrectly referred to as "freeze" plugs, which some people think will pop out of the block if the water inside freezes and expands. This might happen in some rare cases but the core plugs are there to allow the hardened sand inside the engine casting to be broken down and removed through vibrations after the molten iron has chilled inside the sand mould. Most engines will have some sand residue left inside the engine when it's built, with the Triumph Stag engine being famously the worst example of this.

Another side note is a trick I learned while I raced my Yellow B in England. On a couple of occasions the engine experienced overheating issues caused by the core plugs coming out of the block and all of the coolant getting pumped out of the engine in a matter of seconds. Naturally the engine got extremely hot, but the temperature gauge on the dashboard didn't register anything but a normal reading. Without any coolant contacting the temperature gauge sender unit in the cylinder head, just fresh air, the gauge didn't warn me of the overheated condition of the engine, it was only the reduced engine performance that caused me to come into the pits early and thankfully save the engine.

At first I assumed that I hadn't fitted the core plugs correctly into the block but it was pointed out to me by friendly MGB competitors that it's a common occurrence for MGBs that are race-tuned more highly than perhaps they should be, that when the engine experiences "knocking" or pre-ignition from too much distributor advance, the shock waves through the block cause the core plugs to gradually "walk" out of their recess in the block, causing a massive coolant leak.

The solution to prevent this in highly tuned racing engines is to place a steel strap across the core plug by drilling into the core plug bosses and to cut a thread inside the drilled holes so that the straps can be screwed into place.

See the core plug straps in the photo below of the engine that I've just rebuilt.



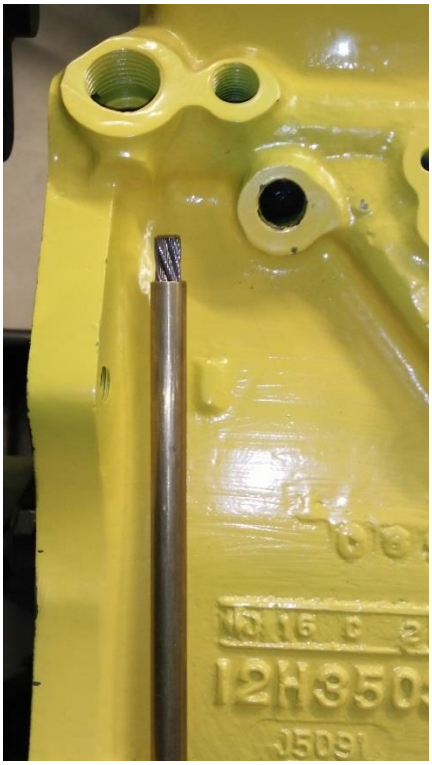
When I build a race-engine for my MGB, I collect the machined and “cleaned” engine block from the machine shop and lift it into a large tub of sudsy, warm water. Then I’ll spend hours and hours, continually scrubbing the block inside and out. When the water gets too contaminated I tip it out and refill the tub with fresh, clean water and I continue scrubbing the block until the water stops getting dirty from the swarf and general filth inside. Then, with some more fresh sudsy water, I’ll run engine cleaning brushes (see the photo below) through all of the oil and coolant passages. Usually they’re so blocked that I’ll have to attack the blockage with a probe to start breaking it up, to begin to clear it out, or to use other, almost brutal, methods to remove sediment which has turned to stone inside the engine.

I need an engine that I build for myself to be properly clean, not just machine shop hot-tanked because that falls far short of what I require for my engines but I understand that most people won’t want to pay for the hours of labour needed to get the engine block properly clean before assembly.

As a side-note, I also drill out the brass oil gallery plugs from the engine block to scrub out the galleries properly. Then I cut a tapered thread into the block and fit threaded Stainless Steel plugs to seal off the galleries again until the next rebuild when the plugs can be removed and the galleries cleaned again.

The worst location for sediment accumulation is behind the coolant drain, on the block between the oil pressure gauge union and the distributor. Early MGBs had a drain valve here but later, after I suppose that the factory realised that it always gets blocked up, they stopped fitting the pet-cock and instead just used a hex-head plug to blank off the hole in the block casting.

See in the photo below, the two threaded ports side-by-side in the block are for the oil cooler hose and the oil pressure gauge hose, with the lower threaded port being the drain tap port that I'm discussing. Standing upright in the photo is a copper rod with twisted Stainless Steel bristles that is an ideal tool to help remove the sediment that collects along the passageway in the block behind the tap.



The purpose of this drain was to allow owners and mechanics to drain coolant from the engine so that the cylinder head could be removed without coolant cascading down the sides of the engine, or inside the cylinders and oil galleries. Draining the radiator still leaves plenty of coolant inside the engine. A further benefit, in the days before anti-freeze was widely used, owners who were located in a cold, northern hemisphere country could easily drain the water from their engine to avoid it freezing overnight and risk it cracking the block.

Casting sand, plus sediment in tap water and corrosion caused by tap water inside the engine collects in the water passageway behind the drain tap / plug in this part of the MGB engine block. The passageway goes back into the block about 50mm before diverting upwards. This feature has started to intrigue me and I want to make further investigations into it, and into how I might possibly modify it to improve the cooling of my racing MGB engine.

There's a well-produced and informative video on YouTube (beware of most YouTube videos about MGBs), showing the preparation of an MGB GT racing car. In the video you see that he has removed the MGB heater tap (or blanking plate) from the cylinder head and fitted a modified blanking plate with a coolant take-off fitting. This then has a pipe and heater hose arrangement, taking the hot cylinder head coolant back to the heater hose take-off in the bottom radiator hose, which then joins with the cooler coolant coming from the radiator, back through the water pump and into the engine.

My concern with his modification is that coolant is being removed from the cylinder head before it has the chance to reach cylinder No.4, which is well-known for getting too hot because of sediment build-up at the back of the engine, and because the coolant coming from the radiator has to pass by the other three cylinders first and is already heated by the time it gets to the back of the engine.

I like the video presenter's thinking but I believe it's not executed well, and I suspect that the same modification can be made but by using the drain port instead, which is lower and further towards the rear of the block. Having coolant constantly flowing through this area of the water-jacket will prevent the usual accumulation of silt in this area. At a future date, I'll make this modification AND importantly I'll test the efficacy of the experiment and report on my findings. My two concerns are that; when recording localised temperatures on the operating engine, the modifications won't show a significant cooling of the engine or cylinder head, or it could even make the situation worse. The other concern is that the pressure of the coolant being drawn from the water pump might be so high that is doesn't draw coolant away from the tap outlet in the block, but could in fact force water back in. This in itself could prove to show better results, by sending cooled coolant from the radiator directly to the rear of the MGB block without it getting pre-heated by the front three cylinders.

I've done extensive research on my proposed modification and haven't found any information on it at all, and I haven't found anyone else who has reported doing this. Possibly it isn't done because my idea doesn't work, but I'll discover this for myself later in the year. The first thing that I want to discover is which direction the coolant will flow, so I'll get a pressure reading from the lower radiator hose heater take-off and from the drain plug port in the block.

I think it's great that by choosing to own a Classic car with such a broad popularity and racing pedigree as the MGB, that current owners can benefit from the people who are still trying to develop new improvements for this 60-year old sports car.

For the reasons just mentioned, about sediment and corrosion, it's important to occasionally back flush the radiator AND engine block. Be careful though, I recently was told by a local MGB owner that they went to a radiator "professional", who used so much water pressure through the radiator that they broke off the diffuser plate that sits inside the top tank of some MGB radiators, so that the loose metal plate dropped on top of the cooling tubes inside the radiator and prevented the coolant from circulating. When the MGB owner complained to the radiator "professional", he was told to go away because it wasn't their fault!!!

As always with my Technical Tips articles, the views expressed are opinions based on my own extensive knowledge of MGBs, racing an MGB and my research into the subject.

Nick Phillips