Antifreeze, coolant and their use in MGBGTV8 engines

Concerns over the effects new types of antifreeze have on older engines have been raised and here Tony Lake provides a useful comprehensive note.

Antifreeze has a pre-war origin, until it was first marketed commercially in 1937 it was normal in cold weather to drain off cooling water from the engine or allow ice to form and suffer the consequences of a cracked block and cylinder head or radiator or all three. If one was extremely lucky a freeze plug would pop out to relieve the pressure on the block. Antifreeze became very popular but also carried with it the risk of internal corrosion which prompted the development of inhibitors to protect the water side of an engine from attack. Anti-foaming additives and scale reducing chemicals followed which created a product which we use pretty well universally today.

Coolant is the description of the antifreeze/water mixture present in the radiator, engine and cabin heater, it is designed to be used all year round. The mixture prevents freezing in cold temperatures, has a higher boiling point than raw water and also contains corrosion inhibitors to protect components on the wet side of the engine.

Coolant circulation: Coolant is circulated round an engine by a water pump to control temperatures in critical components that become very hot; like the cylinder bore, piston, rings and cylinder head, particularly around the exhaust valve and spark plug. After a cold start coolant circulates through passages in the engine water jacket. With time and as engine load increases so coolant temperature increases until a thermostat opens and hot coolant exits the engine. It then passes through a radiator before re-entering the water pump. At low ambient temperature some coolant can be selected to bypass the radiator and go straight to the cabin heater before returning to the suction side of the water pump. It is important that the correct physical and chemical properties are maintained for coolant to fulfil its heat transfer and corrosion inhibiting functions at extremes of low and high ambient temperature.

Coolant temperature: Coolant temperature gauges do not tell the full story. The V8 sensor is located close to the thermostat housing where coolant leaves the engine having circulated round the block and heads and been thoroughly mixed, average temperature is measured. Adjacent to the exhaust valves in the cylinder head the coolant will be considerably hotter depending on load and engine speed. When the engine is stopped and coolant flow ceases local overheating occurs and in high ambient temperature local after-boil can occur. The MGBGTV8 temperature gauge is linear and shows exactly what is going on in the coolant outlet hose. Coolant drops in temperature quite quickly on a hot day if the engine is left to idle until the fans have done their job. MGBGTV8 owners are familiar with temperature gauge excursions above normal in slow speed traffic and when at rest on a hot day, the cooling fans deal very well with this condition, the coolant temperature cycles between the fan trip temperature of 90C and somewhere above thermostat opening temperature of 82C during warm weather. High temperature properties of coolant are listed below. During low winter temperatures coolant temperatures can remain stubbornly low.

How much heat? Combustion of a petrol/air mixture produces horsepower at the flywheel along with exhaust gas and heat that is absorbed by coolant; all in approximately equal amounts. So cruising at say 60mph let's assume it takes 50bhp at the flywheel to maintain that speed on a level road whilst 50bhp disappears down the exhaust pipe and the remaining 50bhp in the form of heat is absorbed by the coolant. That equates to 37kw or a dozen 3KW electric fires all on together, so it is pretty important to have a robust cooling system. It's equally important to have clear airflow to the radiator - a badly positioned number plate, badge bar, auxiliary lights and even a large rally plaque can all contribute to restricted air flow, so overheating follows and even with a sound pressure cap coolant is rapidly dumped.

V8 cooling system features. The factory engine cylinder head is provided with a vent line adjacent to no3 cylinder that connects via a small diameter hose to the radiator side of the thermostat housing. This allows air to vent during fill and steam to escape when the coolant is very hot. The horizontally mounted thermostat must be provided with a jiggle pin or small vent hole which are then located vertically at 12 o'clock. The top hose from the thermostat housing must be no higher than the radiator inlet pipe otherwise an airlock can form during initial coolant fill. An incompletely filled cooling system doesn't perform very well.

Types of corrosion

Atmospheric Corrosion or Oxidation can occur in the presence of moisture and air, typically a coolant leak onto an aluminium surface adjacent to a hose. One can see a white deposit which is formed when aluminium, oxygen and water get together. **Galvanic Corrosion** occurs where dissimilar metals like aluminium and steel in contact with each other are covered by an electrolyte and effectively become a battery. This occurs in an engine where the electrolyte is coolant which by neglect has been allowed to become acidic, current flows and aluminium will be corroded. **Crevice Corrosion** can occur where bolts, gaskets, hoses, clips and crevices which can be described as dead ends combine to create a local spot where coolant may be static so the beneficial properties are consumed and not replaced as they are where normal coolant flow takes place. Typically between a hose and its connection.

Cavitation Corrosion (sometimes called Erosion) occurs where the coolant operating pressure is below its vapour pressure causing bubbles to form, local boiling is actually occurring. In a higher pressure area the bubbles then collapse or implode and recombine with the fluid. This can be quite violent, it is a mechanical process that will erode affected areas. It can occur at the water pump impellor if coolant level is low or the pressure cap is ineffective. The analogy is a kettle where the water being boiled lets you know it is at the right temperature when it forms bubbles, this is because at sea level and 100C water is at or very near its vapour pressure when it starts to boil.

Antifreeze properties. The traditional antifreeze (A/F) feature is provided by mono ethylene glycol (MEG); when mixed with water at a concentration of 10% the freezing point is -4OC falling to -35OC at a 50% concentration. A 50/50 mixture is recommended for the V8. Typical MEG concentration in undiluted A/F is 95%. The remaining 5% consists of inhibitors that provide corrosion protection for aluminium alloys, cast iron, steel, brass, copper and lead solder.

Those same chemicals are compatible with non metallic materials like the hoses and gaskets found in our engines. More chemicals reduce foaming which prevents aerated water entering the water pump. Other chemicals minimize the effect of hard water by preventing scale formation which affects heat transfer between very hot surfaces and coolant. Traditional A/F formulations are also known as Inorganic Additive Technology or IAT. The same coolant provides enhanced summer time performance.

Effect of the radiator pressure cap. At a 50% A/F concentration with a 15psi radiator pressure cap boiling point is 129O C at sea level, raw water boils at 121OC at sea level with a 15psi pressure cap. The effect of altitude is to reduce boiling point. See table below. The importance of correct A/F concentration and a sound 15 psi pressure cap cannot be overstated.

	Freezing	Boiling	Point deg C		Boiling	Point deg C	
	Point deg C	No Pressure Cap			15psi Pressure Cap		
		Sea Level	5000ft	10,000ft	Sea Level	5000ft	10000ft
Raw Water	0	100	95	90	121	116	111
50/50 A/F	-35	109	103	97	129	123	117

Branded products will comply with BS (British Standard) 6580-1992 which states all the values for physical properties. Its full title is: “Specification for: Corrosion inhibiting, engine coolant (‘antifreeze’)”. BS 6580-2010 has an identical technical specification and in addition requires a bittering agent where MEG exceeds 25%, and a child proof container closure. MEG is poisonous if ingested hence it is made to taste awful. AFNOR (Association Francaise de Normalisation) NFR 15-601 states similar properties as does ASTM (American Society for Testing Materials) D3306-1. Coolant has a finite life, just like lubricating oil or brake fluid. The inhibitors deplete because they attach to engine components to limit corrosion. The other main causes of additive depletion are leaks and associated top up practice. It is vital to top up with a coolant mixture of the same concentration that was used for the initial fill. Keep a can of 50/50 A/F and water in the car; don’t use raw water for top-up as that simply dilutes the beneficial chemicals in the basic antifreeze as well as raising freezing point and lowering boiling point. It is possible to buy fully formulated coolant where the A/F has already been diluted with de-ionised water, just tip into the radiator, expensive but trouble free. The A/F container might also list an array of engine manufacturers whose test standards are also met by the formulation.

IAT Antifreeze is also available with **mono propylene glycol** (MPG) which is listed as safe in food products and is also widely used in the cosmetics industry. Mono Ethylene Glycol is poisonous to small animals. Mono Propylene Glycol is not as widely used in industrial products, is more expensive and is not as widely used as MEG. Both forms of IAT A/F have a life of 2 years or 30,000 miles.

Traditional IAT antifreeze formulations contain chemicals that whilst not outlawed are not bio-degradable. They will contain some or all of the following; borates, nitrites, nitrates, amines, molybdates, phosphates and silicates, don’t discard used coolant down a domestic or surface water drain. Sometimes data sheets will declare what is present. There is a trend for use of low silicate concentration and some are nitrite, phosphate and amine free, nonetheless IAT products that vary in formulation still provide the level of corrosion protection demanded by BS 6580.

All brands universally state that their product should not be mixed with any other brand. In the absence of detailed knowledge about formulation this advice should be followed.

Water properties. Water properties vary depending where one lives in the UK, east of a line roughly from Dorset to Northumberland water is classed as hard; or above 200 ppm calcium carbonate combined. Your electric kettle element might give you an idea of scale deposits arising from your water supply. A/F does contain anti-scale formation additives to deal with hard water but if you know that your water is particularly hard then it probably pays to dilute with de-ionised water which is free of all carbonates. Alternatively one can purchase fully formulated coolant which is already diluted with de-ionised water. Scale deposits can impair heat transfer particularly in the cylinder head.

The alkaline properties of coolant are important for it to work successfully to prevent galvanic attack. Alkalinity is reported as ph, 7 is neutral, new coolant is typically alkaline in the range 8.5-10.5. An old coolant might be lower than ph 7 making it acidic or an electrolyte which supports galvanic corrosion described earlier, not desirable.

Organic Acid Technology. Modern coolants using Organic Acid Technology or OAT are regarded as less toxic than traditional A/F because their active corrosion inhibiting ingredients are bio-degradable. OAT formulations were the industry response to match engine design improvements that allowed longer service intervals as spark plugs and lubricating oils became more durable. Then fuel injection equipment and electronic ignition systems became largely maintenance free so OAT antifreeze followed as a long life alternative, claims are made for 150,000 miles or 5 year change intervals. OAT products meet BS6580. The first US patents for OAT formulations were granted in 1955 and a British patent was issued in 1982, so the technology is not new. This product is aimed at modern engines and extended service intervals and does not seem necessary for MGB GT V8s.

Hybrid Organic Acid Technology or HOAT is also available and combines selected features of both IAT and OAT, marketed as long or extended life, they are already diluted with deionized water and ready to use straight out of the container. Aimed at extended service intervals.

Antifreeze brands have not [been] mentioned or recommended by name because there are so many on the market, whatever you choose to use must meet BS6580 to be sure of good performance. It should say so on the container or in a data sheet. If you can’t find a reference to BS 6580 then don’t use it. If you want to avoid OAT or HOAT formulation then don’t use products that call themselves Long Life or Extended Life.

Corrosion inhibiting mechanism. Both kinds of A/F mixture depend on MEG or MPG for their low and high temperature properties but the corrosion inhibiting mechanism is quite different. Traditional IAT antifreeze coolant mixtures deposit their inhibitors on all cooling system surfaces so the depletion rate is faster than OAT which is believed to inhibit a corrosion site in the engine after the corrosion has begun, hence its depletion takes longer. The rate of corrosion of a given engine material is dependent on temperature, pressure, vibration, surface finish, turbulence in the coolant flow and tendency to galvanic reaction with adjacent materials. Both IAT and OAT coolants are designed to minimize the effects of these adverse conditions found in the wet side of engines.

The Oat Debate. There is a debate about the merit or otherwise of OAT based coolant in V8 engines, does it protect well enough and does it cause coolant leakage? The fact is that modern engines do use OAT coolant very successfully, MG V8 engines use the same engine materials. It is also a fact that premature engine failure is usually a toss-up between running out of coolant or lubricating oil, it all depends on maintenance and service practice and how long it takes to find and fix a coolant or oil leak. Regular visual inspection of coolant connections is important, don't wait until a cracked or perished hose fails, replace it immediately with a new one. There is plenty of anecdotal evidence of the effect of OAT coolant on older engines, not necessarily MG, it is cited as the root cause of leakage and other disasters. It has never been clear to me that the root cause is OAT, retightening a joint, fitting a new gasket or connection or replacing a hose is never discussed, nor is the usage pattern, laid up cars invariably need work to make them fully serviceable. There is a lack of data. I can't think of a good reason why one coolant that consists of essentially the same fluids, water 50%, one or other of the glycols 47.5% and 2.5% of additives should have a greater propensity to leak than another with the same water and glycol and a different set of chemicals when used in the same well assembled engine. OAT A/F manufacturers say that older gaskets, seals and hoses can be affected but are vague about what materials are at risk. The fact is that hoses, gaskets and seals do not last for ever, it seems pretty unlikely that their demise invariably coincides with the use of a new coolant.

Silicon hoses have been cited as being susceptible to attack by OAT coolant. A well respected manufacturer of such hoses has heard of failures and believes that some hoses of inferior quality may be at risk because the silicone formulation is poor, low grade fillers can absorb coolant and leaks may follow. Their belief is that such a problem could occur with both IAT and OAT coolants. High grade polyester reinforced silicone hoses are just as robust and unlikely to leak as they ever were. It is unlikely that even a silicone hose would seal effectively on the elbow shown below.

Alternative coolants

This shows a thermostat housing from a Rover V8, the elbow is at a different angle than MGBGTV8 uses. Unknown age or coolant treatment; but heavy corrosion in the hose bead/sealing area and some very deep pits inside the casting. It is unreasonable to expect any hose/clip combination to seal for long without leaking. Replace components in this condition.

Water wetter is sold under several brand names and claims to reduce coolant temperature by lowering surface tension in the coolant which in turn doubles the area of hot engine surfaces in contact with coolant. The only published performance data I can find relates to a Chevy small block race car engine running at 7200 rpm in lab conditions where sustained high loads were possible. The only time a significant coolant outlet temperature reduction occurs is when running on raw water and water wetter, 94.4OC vs 108.8OC for 50/50 coolant; or 14.4OC lower, equivalent to 13%. The chart below shows that raw water is 13% more effective as a coolant than 50/50 water/MEG. The reason for the lower coolant outlet temperature is that water has a higher specific heat and lower pumping losses than a 50/50 glycol based coolant. Lower pumping losses means that the water pump will shift more water round the engine than it can with 50/50 coolant. This combined with higher specific heat means that at the same water pump inlet temperature and engine power output the water outlet temperature will be 13% lower, which it is. Raw water is the dominant component, a water wetter contains the inhibitors to prevent corrosion otherwise provided by an IAT coolant. The advocates of water wetter all seem to be racers. If you are an all year round GT V8 user be prepared to drain and refill with IAT coolant once frost threatens.

Penrite Classic Car Coolant. Penrite offer their Classic Car Coolant which is described as a hybrid organic non glycol based corrosion inhibitor designed to be added to raw water for Veteran, Edwardian, Vintage and Classic car cooling systems. They do not state what the organic constituents are. They clearly state the product is not an anti-freeze, and are pitching it at engines that do not need anti-boil properties in the coolant. That infers thermo syphon coolant circulation and an un-pressurised cooling system, which largely characterises pre-war engine design. It will give the same benefit as a water wetter in reducing coolant outlet temperature. It also contains a Vapour Phase Inhibitor (VPI) which acts to prevent corrosion when the coolant is drained. VPI paper is used to wrap bright steel parts to prevent corrosion in storage.

FBHVC advocate AAA Classic Coolant which is based on Propylene Glycol, it is manufactured in California and imported into the UK. It is sold in ready to use form, so does not need to be diluted with water. It is also recommended that the engine is run for 90 minutes on Classic Coolant Cleaner before filling with AAA Classic Coolant. The cleaner is a 7% Potassium Hydroxide solution which removes, oil, grease, dirt and grime. Not sure I would want to run an all aluminium engine for so long on a caustic solution, so I would pass on that one.

Colour Coolant and antifreeze colour is another variable, the earliest brand was blue, now it is possible to find green, orange, pink and red as well as brands that change colour should a combustion leak to coolant occur. Colour is no guide to formulation, best to read the information on the can or a data sheet to determine formulation.

Specific gravity. It is possible to measure specific gravity with a hydrometer to determine concentration of A/F. Usually SG is quoted at a normal temperature of 20OC, correction tables are used if the coolant temperature is not 20OC. Not sure it is worth the trouble because one then has to calculate how much concentrated A/F to add to get back to 50/50. Easier to fix the leaks and then top up with 50/50.

A refractometer is a service tool that measures the refractive index of coolant to determine A/F concentration, but one needs to know the range of the coolant in question, getting complicated. If good maintenance practice is followed then concentration should not be in question, just don't use raw water whatever the temptation.

Filling practice. Always fill the cooling system through the radiator and then check and adjust the expansion tank level after the engine has been run to thermostat opening temperature. Don't open the pressure cap on the expansion tank until the engine has cooled down, hot coolant under pressure can hurt you. The MG V8 expansion tank has a 2 stage cap, to undo, turn anti clockwise which will vent any residual pressure in the tank, it will rotate and meet resistance, so push down and turn anti-clockwise further until the flange releases. Radiator and expansion tank coolant level should always be checked when the engine is cold. The reason for this is that a 50/50 coolant has 3 times the expansion rate of water. This aids pressure development in the system and is why the expansion tank should not be overfilled. As coolant temperature increases so the volume of coolant in the system expands and the pressure increases, if there is too much coolant the pressure cap opens and surplus coolant overflows. The pipe to the expansion tank from the top of the radiator must be covered by coolant to allow the recuperation process to work to keep the radiator full as an engine cools down. If the coolant level in the radiator falls far enough the siphon is easily broken and the potential for low coolant level and overheating is real. Under normal road running conditions it is pretty unlikely that pressure in a V8 cooling system ever exceeds 6psi. This is because ambient temperature rarely exceeds 20OC, high engine load is rarely sustained for very long periods so the circumstances for stabilised conditions just don't exist for long enough to reach the very high temperatures and pressures shown in the earlier charts. Plus, once 30mph is achieved ram air passing through the radiator provides plenty of cooling air to reduce coolant temperature and therefore system pressure. The most likely high coolant temperature and pressure conditions in the UK are under light load in slow moving traffic or when idling at rest. In my experience one has to be in the Alps running hard to get above normal for a sustained period, that then is the time to keep an eye on the gauge and back off the throttle, factory V8s will pull a high gear that keeps engine rpm down whilst maintaining good forward speed for best cooling effect.

The V8 cooling system is pretty effective and robust so if you are experiencing high coolant temperature or high coolant consumption look at the easy items first. Fix leaks, might need new parts if hose connection corrosion is severe. Check thermostat is working, top hose should start to get hot within a few minutes at idle. Check that the Otter switch is OK, if the cooling fans don't run on demand it does not take long to get into the red. Check that the pressure cap is sealing properly, not expensive to buy and carry as a spare. A bigger job; worth flushing the engine and radiator internally and then giving the radiator a good external clean, surprising how much dirt collects in the core. Spend time venting the engine to get rid of trapped air, heater control must be set to hot, engine valve will then be wide open.

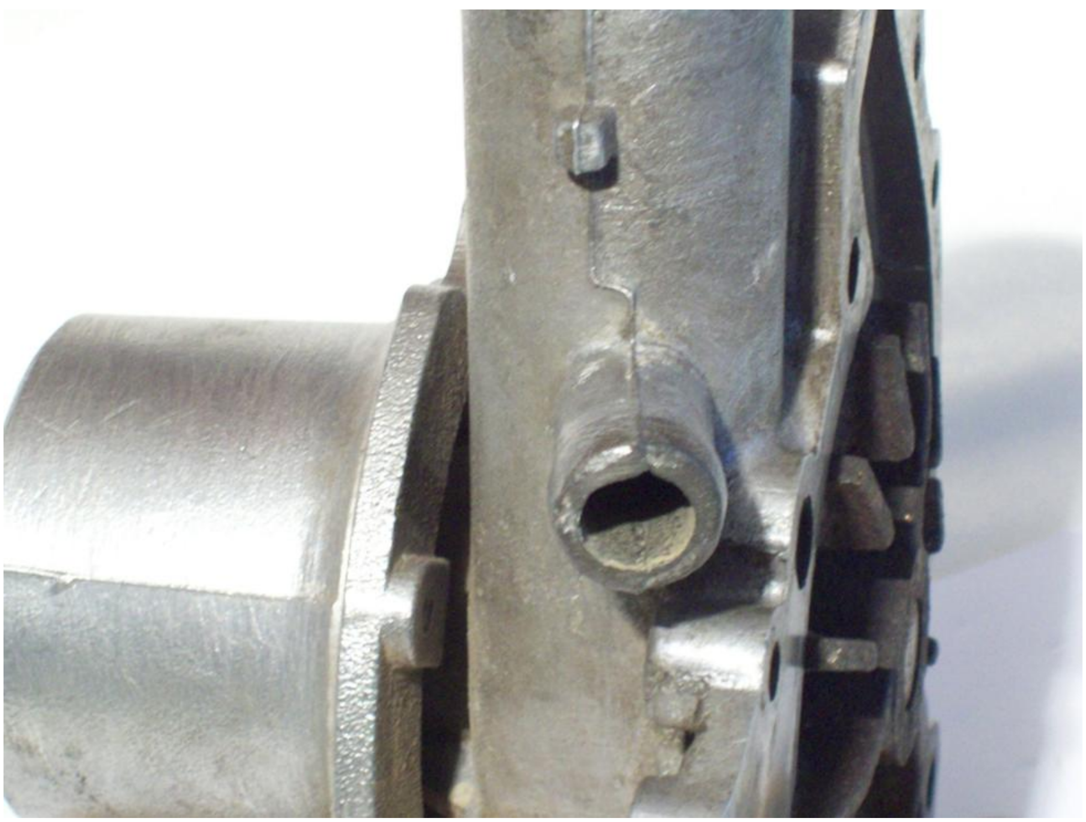
Life. Given the relatively low cost, no more than a can of good 20/50 lubricating oil, then change Traditional IAT every 2 years. Fix leaks promptly and always top up with 50/50 as a routine part of maintenance. If you are uncertain about current coolant condition then definitely drain and refill with a 50/50 antifreeze and water mixture.

MG driver's handbook. The service information contained in MGBGTV8 Drivers Handbook AKD 8423 refers to A/F complying with BS 3150. This was published in 1959, and was the first BSI (British Standards Institution) attempt to link low temperature coolant performance with chemicals to provide corrosion protection. BS 3150 stipulated formulation but did not provide limiting values for corrosion of engine materials that came later. The other technical information about cooling system maintenance in the handbook is still valid today.

Design. The MG V8 derived from the Buick engine of the fifties reflects the design and manufacturing technology of the period. More modern engines have the benefit of better understanding of joint and flange design, load distribution, gasket and hose materials and casting technology with the result that any fluid leakage is unusual. As the need for long life and greater intervals between service points became important marketing and sales tools so detail design and manufacturing processes responded with the result that our V8s can appear quite incontinent alongside modern counterparts.

Sources of coolant leakage. V8 coolant hose leakage at any connection can be troublesome, but there are reasons for this. Worm drive hose clips exert a load which diminishes as the hose material takes a set over time, also cast elbows and connections can have a step across the beaded sealing area because of casting parting line mismatch. Potential leakage paths are not hard to find. Typically the cast water pump inlet connection and the heater return connection on the water pump have a parting line in the hose sealing area which is up to .020" high, see photos; #1 & 2. Similarly the thermostat housing bypass connection on the back of the front cover also has a step and does not have the benefit of a sealing bead to expand the hose. So extra care is needed to position the hose and fit the clip.

The heater outlet connection on the rear of the inlet manifold also has a step on the sealing bead over which the hose is stretched. If such steps are present they should be dressed with a fine file until the surface is smooth. Contrast that with the quality of hose connections on



Above: Water Pump inlet connection showing parting line mismatch which is a potential leak path as worm drive hose clip clamping force relaxes with time. Smooth off the ridges to ensure a good seal.

The recent article about Jubilee clips is relevant because it makes the distinction between worm drive and screw/nut designs. Small diameter worm drive hose clips are relatively stiff in relation their diameter and tend to become oval, so load distribution is uneven. Screw and nut hose clips are to be preferred on small diameter hoses, typically the hose that connects the radiator top tank to the overflow tank, this design of clip remains pretty round.

Below: The photograph below shows the water pump removed from an engine because of slight bearing wear and incipient coolant leakage. The impellor is in cast iron and is more of a paddle than the aluminium centrifugal impellor used on a genuine replacement pump. Bad coolant maintenance practice can lead to seal leakage and then bearing failure. The dominant factors that determine water pump life are the seal design, choice of face materials, coolant insolubles like hard water deposits and drive belt tension.

the current generation of engines in modern cars and the attention to detail is immediately apparent. Patent spring steel hose clips are used that require special tooling for assembly. They exert a much more uniform load over time. When used with hoses that don't relax as quickly on high quality sealing surfaces, joints just don't leak so there is no provision for tightening a hose clamp.

What goes wrong if coolant service and maintenance recommendations are not followed?

The debris from corrosion accumulates, it then agglomerates to form large hard particles which with scale deposits from hard raw water will damage the water pump seal and cause leakage. The galvanized mild steel cylinder block core plugs can suffer badly from galvanic attack. This is because zinc is a good surface treatment in air but when in close contact with the aluminium block and depleted coolant becomes sacrificial and will corrode quickly. The external appearance, which can be quite good, is no guide to what has happened on the wet side, see photo #3. The left hand plug shows typically good external appearance, the right hand example has corroded right through, remove engine to repair.

Core plug appearance. LH plug in good condition. RH plug seen from wet side and corroded right through.

Copper tube radiators can suffer failure if coolant is neglected, tin/lead solder leaches out which leads to leakage. Equally aluminium tube radiators can be damaged by corrosion. The mild steel thermostat bypass tube which runs the length of the intake manifold transporting coolant to the suction side of the water pump during warm-up can corrode quite heavily particularly where it screws into the front of the intake manifold. A classic case of galvanic corrosion where steel and aluminium are in contact and in the

Front cover showing excellent condition after 160,000 miles on correct coolant treatment and maintenance

presence of untreated coolant which can be acidic, a battery cell is set up which results in corrosion.

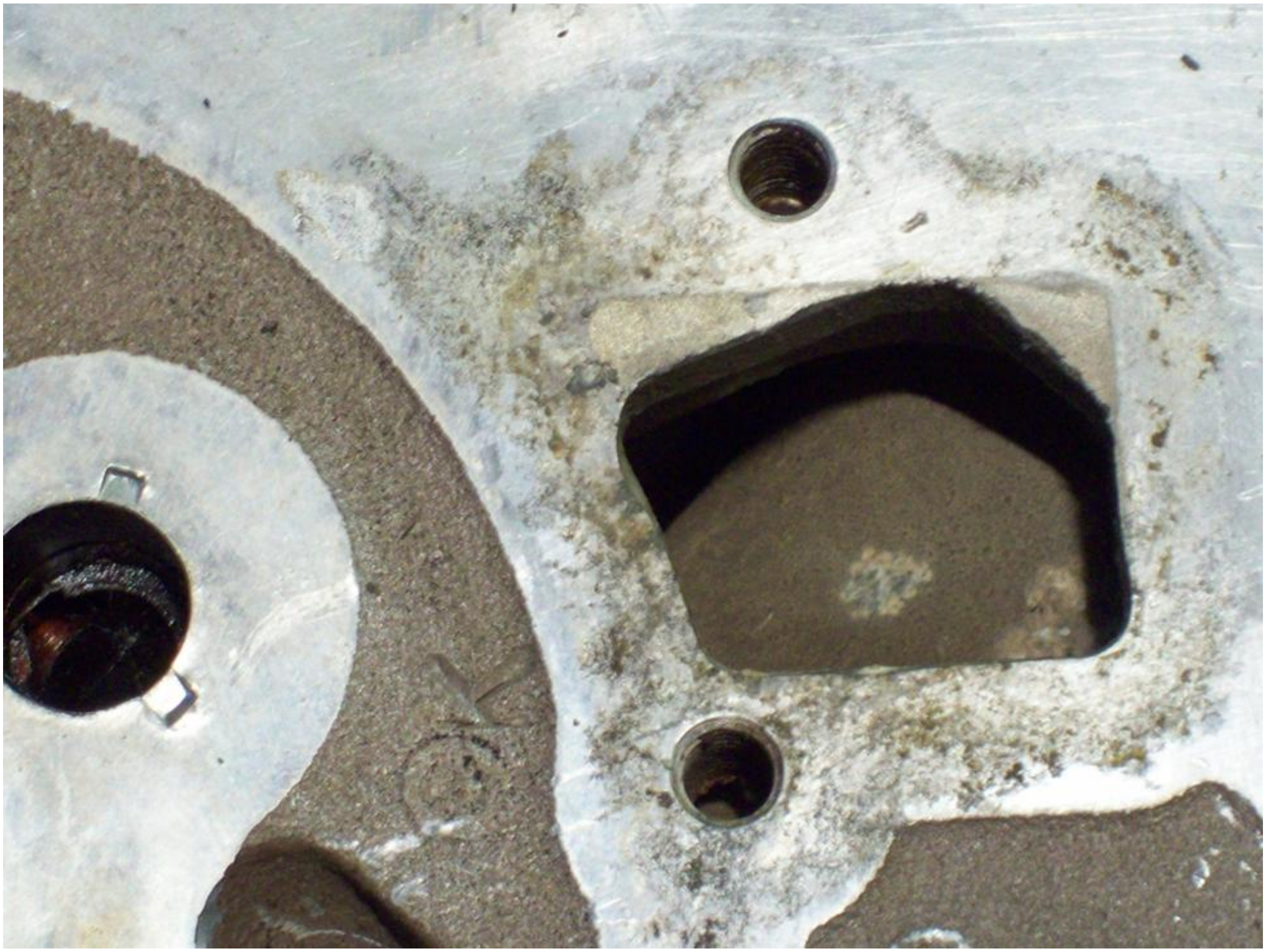
When the rules are followed the all-aluminium design of the V8 stands up well in service, see photo # 4 of the front cover which forms the other half of the volute when the water pump is fitted, no sign of cavitation corrosion, just discolouration. This is from an engine which has done 160K miles.

A well respected engine rebuilder says that cavitation corrosion can be a problem to the extent that a hole is punched right through the front cover, in his experience caused by using raw water and running an unpressurised system. High coolant pressure at the eye of the water pump prevents cavitation corrosion and keeps solid coolant flowing round the system, most important on a hot day when stationary or in low speed traffic.

The coolant transfer ports to the block from the front cover and coolant transfer to the cylinder heads from the rear of the block usually look good, see photos, discolouration but no signs of pitting. I spoke to several rebuilders who without prompting said that the V8 has the most robust cooling system of any engine that they work on. To quote " It is simple, the head gasket seals combustion pressure and coolant is transferred from the rear of the block to the cylinder head, similarly the coolant transfer ports behind the front cover and between the cylinder head and the intake manifold are sealed with robust gaskets, leakage rarely occurs and there is no corrosion at bolted joints or inside the water jacket if recommended coolant practice is followed." So there you have it, a very strong system, so it pays to do the maintenance and service required to keep it that way.

Summary of recommendations

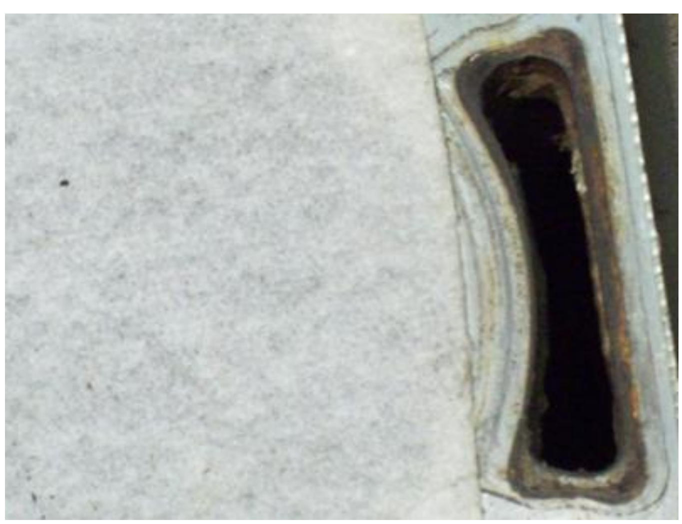
- If changing the coolant use a 50/50 mixture of Traditional A/F and water, select a brand that is suitable for classic cars, it will meet BS 6580 and will use either mono ethylene glycol or mono propylene glycol, properties will be shown on the can or in a data sheet.
- At subsequent checks with engine cold always top up through the radiator filler cap with the same mixture used for initial fill, check and adjust level in expansion tank. NEVER TOP UP WITH RAW WATER.
- Make sure that the expansion tank pressure cap is sound, there will be some clues if the cap is defective, like high coolant consumption and high.



coolant temperature, cheap enough to carry a spare

- Change the coolant every 2 years or at the interval recommended on the can or in the data sheet.
- Replace defective hoses if they are cracked or perished. Troubleshoot leakage by examining connections, replace if badly corroded or repair by smoothing out casting irregularities.
- Make sure air flow through the radiator is unimpeded.
- Don't mix different brands of antifreeze, formulations do vary and may not be compatible, so follow manufacturer's advice.

It is 75 years since the first antifreeze was launched in the UK. In the intervening period knowledge, experience and development of what works best has delivered some excellent products that can make us forget what happens in the engine. Given their age our V8s work pretty well and will continue to do so if we lavish a bit of TLC on the bits under the bonnet.



Left: Coolant transfer port in block and water jacket behind No 1 cylinder on left bank in very good condition.

Above: Coolant transfer port from block to cylinder head adjacent to No7 cylinder at the rear of left bank, still in good condition with no corrosion, just surface staining