TECHNICAL NOTES SERIES

JOWETT JAVELIN – PA, PB, PC, PD & PE
JOWETT JUPITER – SA & SC

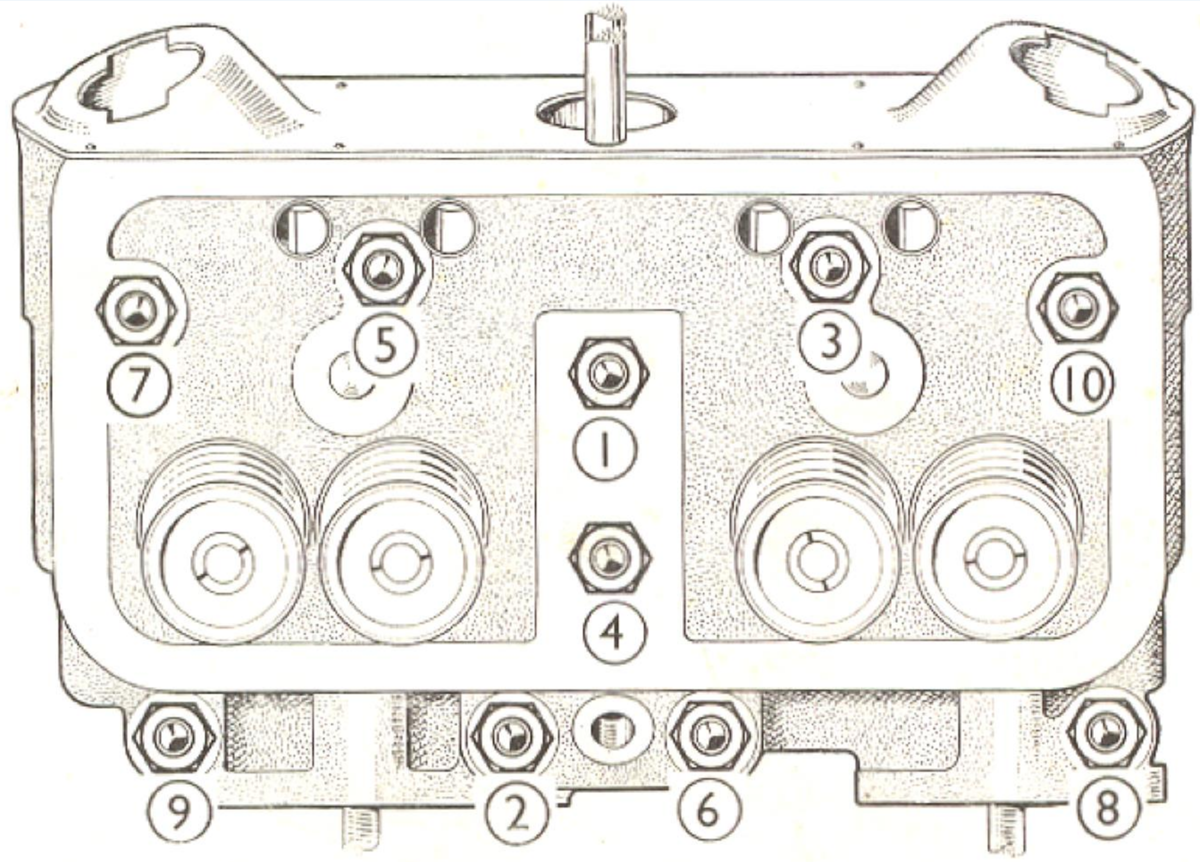


Figure 25.—Cylinder Head Tightening Order.

– PART XIV –
CRANKCASE STUDS
CYLINDER LINER INSTALLATION
CYLINDER HEAD GASKET INSTALLATION
ENGINE COOLANT MAINTENANCE

The Jowett Car Club of Australia Incorporated is not responsible for any inaccuracies or changes that may occur within this document. Every effort has been made to ensure total accuracy. It is not a Jowett Car Club publication and, therefore, the Club has no control over its contents. These Technical Notes have been compiled by using the latest information available.

Compiled by Mike Allfrey – 29th January, 2006.
With assistance from Neil Moore, JCC (NZ).
Revised – January, 2007.

Introduction

These notes cover the installation of studs into the crankcase, the installation of cylinder liners into the crankcase, the installation of current and earlier type cylinder head gaskets into Javelin and Jupiter engines, and the maintenance of the engine's coolant – all very important topics. It should be noted that sealants, adhesives and lubricants mentioned by name are not to be considered as endorsements of those products by the Jowett Car Club Of Australia Incorporated, rather they provide an example of the type of product that can be used during the overhaul of these engines. In these times, there is a vast range of products which are just as suitable as those named in the text.

Crankcase Studs

A stud is a high tensile rod that has been threaded at both ends. A stud must not be confused with a length of 'all-thread rod' which is commonly misnamed (and incorrectly employed). A stud has been designed to suit a particular purpose, in that at one end the thread length has been calculated to suit the strength of the component material that it is being threaded into. The other end has sufficient thread for effective clamping of the component being attached. All studs used in Jowett engines should be threaded fully into the component and then tightened to 40% of the torque specified for that stud's nut. In the case of the cylinder head studs this value would be 15 lb.ft. which is not very tight at all.

A Caution About The Oil Feed Stud – All but one of the cylinder head studs (for each head) tighten against their thread shoulder and do not bottom in the crankcase threaded holes. The one exception where a cylinder head stud is not threaded fully into the crankcase is the stud, described as '1' in the cylinder head tightening sequence, which carries lubricating oil to the rocker shaft assembly. This stud has been designed to bottom in the threaded hole and form a seal at the flared copper oil delivery pipe, against counter bores in the crankcase set. Typically, this stud does not screw very far into the crankcase, which raises a concern.

In the Maintenance Manual there is no mention of caution where this stud is concerned. During the installation of the cylinder head, there should not be a temptation to tighten the cylinder head securing nuts before installing the rocker shaft assembly, by using a packing spacer on the oil feed stud, to achieve even clamping of the gasket – prior to installing the rocker shaft banjo nut with an open ended spanner. This stud has been drilled and relieved along its shank to provide oil passage, it is also not threaded very far into the crankcase, and for these reasons, the specified 37.5 lb.ft torque should not be applied to this stud.

Installing Studs – Javelin and Jupiter crankcases are manufactured from aluminium. This is a relatively soft metal and caution should be observed when installing all studs into the crankcase, and not only the cylinder head studs. Many crankcases have been distorted at gasket surfaces by over-tightening of studs into them. As a stud is over-tightened, two conditions can eventuate; the female thread in the crankcase can be distorted (pulled) to the extent that it is 'stripped' or, the metal immediately around the thread shoulder of an over-tightened stud can deform (swell). This second phenomenon can be such that the clamped component can be held away from the mating surface of the crankcase, thus preventing effective clamping of the gasket. It is wise to remember the 40% of nominated torque rule.

It should be noted that Series III crankcases had cylinder head stud threaded holes counter bored with a clearance diameter to prevent deformation. This engineering change requires the use of longer shank cylinder head studs. These crankcases also had small holes drilled at right angles to the outer stud threads, at studs '8' and '9' in the tightening sequence diagram, to prevent a 'hydraulicing' condition as the stud is threaded into its hole.

Studs threaded into blind holes in aluminium castings should be thoroughly cleaned and then have their threads coated with Penrite Copper-Eze to prevent corrosion, caused by two different metals being in contact with each other, and to permit ease of extraction next time the engine is overhauled.

In those instances where oil is likely to seep along a stud's thread in the crankcase, the stud should be installed using Loctite 518 Mastergasket sealant. This will most definitely prevent oil from seeping through. If this sealant is used, the stud should be screwed in quickly to the 40% torque value, because of fast sealant curing. Another point to bear in mind is that, if sealed studs require removal, application of heat will be required to soften the sealant (unscrew the stud while the aluminium is still hot – or the sealant will set even harder!).

Another option is to clean the cylinder head studs and their threads in the crankcase with Loctite 471 Accelerator Cleaner fluid. Leave the cleaner fluid to stand for twenty minutes and then install the cylinder head studs, with Loctite 269 Studloc applied, and tighten into the crankcase to the recommended torque. Allow the Loctite to cure, preferably overnight. Cylinder head stud removal will require moderate heating of the aluminium prior to removal.

Applying Loctite at the studs ensures that there is no likelihood of a stud rotating while the cylinder head nuts are tightened.

Cylinder Liner Installation

There are four separate components that need to be taken into account, that a cylinder head gasket has to contend with, when the cylinder liners are installed into a Javelin/Jupiter engine. They are:

1. Cylinder liner sealing – pressures up to 180 psi (1,241 kPa), 9:1 + compression ratio.
2. Oil sealing – pressures up to 100 psi (690 kPa).
3. Coolant sealing – pressure of 4 psi (28 kPa), and anti-freeze self search properties.
4. Vacuum – to 22" hg.

To guarantee gas, oil, water and vacuum tight seals at both ends, the cylinder liners should be carefully installed as follows:

1. An essential start to installing the cylinder heads, and their gaskets, is to achieve the correct cylinder liner protrusion, 0.006" – 0.008" (0.15 – 0.20 mm), proud of the crankcase surface. For sealing the cylinder liners in the crankcase, the genuine

soft compound ‘Hallite’ gasket rings c/w thin shims, are no longer used. Three thicknesses of solid copper spacers and shims are available for adjusting the protrusion to the correct specification.

Note: All liners will require a quantity of shims.

2. The threads of both the studs and nuts should have been cleaned-up using a suitable die nut and thread tap. The studs should thread freely by hand into the crankcase and the nuts should spin freely on to the studs, without being too loose in either case. Genuine cylinder head nuts are thicker than standard $^{3}/_{8}$“ BSF nuts and should be lightly oiled prior to use.

   There are ½" deep 3/8" BSF nuts of high quality available, these are 0.522" AF (1/4" Whitworth spanner size) and require good quality flat washers under them. Ideally these nuts should be used with longer cylinder head studs.

3. Cylinder head studs should be installed into the crankcase using Penrite Copper-Eze to facilitate future extraction. Or, for a firmer hold of the studs, the use of Loctite 269 Studloc is recommended.

4. Before installing the shims so that measurements can be taken, clean the surfaces in the crankcase where the liners seat. It is a good idea to suck away any debris with a vacuum cleaner. Make sure that the liners are a smooth sliding fit into the crankcase, using easy hand force. A careful rub in the crankcase bores with fine grade wet and dry paper soaked in kerosene or Penetrene will ease this (wash the crankcase set thoroughly after the cleaning-up process).

5. The liners must be absolutely clean. Slide the liners into the crankcase without any shims. Using feeler gauges, measure the gaps between the liner outer surface and a good quality straight edge clamped to the head gasket surface. Record the values found for each cylinder. During calculations, make sure that each pair of liners have the same protrusion.

   The cylinder liners should be identified by numbering so that they are installed in their selected crankcase bore. They may, initially, require swapping around to achieve equal protrusion per pair. Once this has been established, identify each liner according to its cylinder bore in the crankcase.

6. Select the correct quantities of shims to provide the correct liner protrusion and install them with the liners. Do not apply any sealant at this stage. Install the cylinder heads minus gaskets and tighten the nuts to 10 lb.ft. progressively to clamp the shims. The face of the cylinder head must be clean and flat. Tighten the nuts in the correct sequence. The liner protrusion can now be verified around the entire edge of the crankcase surface. If there is a variance of more than 0.002” between the pair of liners check the cylinder head surface, if this is flat the lowest liner will require extra shims to set both liners to the same height tolerance, of 0.002”.

   If the crankcase surface is found to be severely distorted, the cylinder head studs and the crankcase centre joint dowels will have to be removed. The crankcase half can then be set up in a milling machine so that the minimum amount of metal is taken off to true-up the surface. It should be noted that the internal carburettor balance pipe protrusion will have to be machined off during this process, and, therefore, a machined flanged bushing should be pressed in to the balance pipe to restore its protrusion. The flange should be pressed in with a small smear of Loctite sealant under the flange lip. The flanged bushing should have a minimal wall thickness.

   If the crankcase has been welded, in the head gasket surface area, extreme care should be taken during the milling process.

6. When selecting shims to make up a shim-pack, add the individual thicknesses of the shims (use a micrometer or an accurate vernier gauge) to obtain the correct liner protrusion. This is very important, because if the shims are measured together, a different value will be obtained, because the shims may not be entirely flat after being cut from the copper sheet and it is not a good idea to duplicate 37.5 lb.ft. with a micrometer!

7. With the pair of liners assembled into their crankcase half, with their shim packs, the height of the cylinder head gasket support must be checked. The earlier style support assembly, has a 10 SWG plate (which must be flat) and an aluminium tube. This assembly must be adjusted so that the support is flush with the lips of the two cylinder liners, while resting on the cylinder liner abutments. It is preferable to place a $^{3}/_{8}$” brass flat washer on the tube so that it supports the cylinder head gasket over a greater area than the relatively thin-walled tube. The tube should be machined precisely so that the surface of the brass washer is flush with the liner lips.

   The later style cylinder head gasket support is an aluminium casting which was shimmed at the outer end with copper shims. This casting can be precisely machined so that, with a $^{3}/_{8}$” brass washer installed, the assembly is flush with the cylinder liner lips. The later style support may not be available – if this is the case, a support assembly, the same as the early style support can be made-up quite easily.

   The new club supplied supports are the same as the later Jowett Engineering supplied item. However, there is one difference – the overall length is longer and requires machining to suit the liner and shim set up. The important point to note is that the ledge on the liner should form a part in the machining calculation. The support casting is designed to support the cylinder head gasket, not to forcefully clamp the cylinder liners.

8. Should cylinder liners have been selected from unknown sources, then the radii cut into the skirts should be checked for crankshaft and connecting rod clearance. This advice refers particularly to

cylinder liners not manufactured by Jowett Cars Limited – i.e. non-genuine parts.

9. The shims can be installed dry, providing surfaces at crankcase and liners are in good condition. If there is any doubt, a light smear of Loctite 518 sealant can be used, only on the shim surface that contacts either the liner or the crankcase. It must be noted that Loctite 518 (and other sealants) will build-up after curing, and this condition must be taken into consideration when maintaining liner protrusion. The specified cylinder head nut torque value will not compress the cured sealant film.

   If Loctite 518 sealant is used, the pairs of liners will have to be clamped into the crankcase quickly and evenly. Use sealant only on the shim surfaces that contact the liner and crankcase, the intermediate surfaces will form a good seal. All shim surfaces must be clean.

   To slow the sealant curing time, wash the contact surfaces with methylated spirits – do not use the Loctite 7471 Cleaner Accelerator fluid.

10. Insert the liners and their shim-packs into the crankcase in pairs, making sure that the cylinder head gasket support is also installed at the same time.

    It is a good idea to apply a smear of engine oil to the bores in the crankcase, not on the liners, to ease assembly.

Cylinder Head Gasket Installation

Cylinder Head Gasket Background – Since the late 1960s, the Jowett Car Club of New Zealand have been involved with cylinder head gasket manufacture. This was initiated by Leao Padman who required specially made gaskets because he was using larger diameter pistons – up to 76.3 mm (3.004") – and required a gasket with a larger bore. He experimented with various engines, using different cylinder head nut torques, some as low as 25 lb.ft, and with various materials. The gasket material finally chosen was Reinz, and the gasket design was the same as that used today. The material was of a wire mesh impregnated with compressed asbestos fibre both sides of the mesh, with the copper on the one side. This made a gasket suitable for the higher compression when using flat top pistons (9.25:1). The copper/asbestos/steel gaskets for higher compression ratios, at that time, were still available from the NZ Jowett spares supplier.

By the 1980s, however, the copper/asbestos/steel gaskets were running out, so the New Zealand club had a gasket die made at the same firm as Leao Padman had used in Auckland, but with a standard bore for pistons up to 75 mm (2.93") diameter. They still used the Reinz material and, on low compression engines, one-stepped torquing was probably adequate as the Reinz material wasn't as soft as the original copper/asbestos/copper gaskets and the 0.006" - 0.008" (0.15 – 0.20 mm) cylinder liner protrusion was specified. Neil Moore wrote a technical article in 1993 about setting cylinder liner height with solid copper spacers and shims and mentioned the above about torquing the cylinder head nuts. Somewhere in the repeats of his original text, the term 'Monotorque' surfaced. Payen, in New Zealand do manufacture a type of gasket that is called 'Monotorque', and has absolutely nothing to do with the cylinder head gaskets supplied by Jowett Spares (NZ).

In about 1998, the gasket supplier informed Jowett Spares that the Reinz material was no longer available because of global health concerns about asbestos, Thus an alternative had to be found. This is the grey material currently used, which is a cellulose product impregnated on a perforated steel middle sheet – both sides. This material is softer than the Reinz material, but is 0.010" (0.254 mm) thicker. The initial recommendation from the gasket supplier was for Jowett Spares to experiment, but considered that a hot tightening of the cylinder head nuts would be satisfactory.

The new-material gaskets were tested in a Jupiter used for racing. This engine was equipped with flat top pistons, providing 9.25:1 compression ratio, from a R1 Jupiter engine. Thus it was a fairly severe test over some three or four years. The original 0.006" – 0.008" (0.15 – 0.20 mm) cylinder liner protrusion specification was adhered to, and the gaskets were tried with one tightening over, say, five times at 20 lb.ft to settle the gasket, and a couple each at 28 lb.ft and 33 lb.ft and finally at 37.5 lb.ft.. After this procedure had been used for about one year, water leaked. So the next installation was given the same treatment as previously, but when the engine was hot and re-torqued to 37.5 lb.ft a further increase of tightening was observed as the gasket squeezed home.

The tappets were adjusted with the engine cold, the next day. This installation was used for racing and towing until further mechanical problems surfaced and cylinder head gaskets, when removed, were found to be in good condition. The squashed thickness was the same as the Reinz material. Thus the desired result was achieved.

Installing The Cylinder Head Gaskets – Careful installation of the cylinder head gaskets is of paramount importance. The surfaces of the cylinder heads and crankcase must be absolutely clean.

Note: The cylinder head gaskets must be installed with the flat metal-faced side towards the cylinder head joint face.

1. First, install the coolant water inlet elbows, 50826 and 50829, with their gaskets and tighten. Apply a smear of Loctite 518 to both metal surfaces. Installing the inlet elbows at this stage provides extra support, at the rear of the crankcase assembly, during the cylinder head tightening process.

2. The head gaskets received from New Zealand, are of more modern material than the Jowett Cars Limited's original copper-asbestos-copper (or the higher compression copper-asbestos-steel type) gaskets. They are definitely **not** ‘Mono-torque’ gaskets

   These modern gaskets are softer and thicker in their composition, but, a word of caution – they may not completely conform to severe depressions in the crankcase surface. Therefore coolant leakage could occur at the outer edges of the crankcase.

   The current style cylinder head gasket has provision for placement of an ‘O’ ring at the oil feed stud. The ‘O’ ring seals oil, at engine oil pressure, from forcing its way into the engine’s coolant. The 'O' ring should be slid over the oil feed stud after the gasket has been placed into position.

The surfaces of the cylinder head gaskets that contact the head and crankcase should be carefully wiped with a clean cloth dipped in methylated spirits. A light smear of Loctite 518 Mastergasket should be applied only to edge of gasket and crankcase to assist in preventing coolant seepage at the joint.

Do not apply Loctite 518 Mastergasket to the cylinder liner-to-head seal faces.

Be extremely careful not to obstruct the oil drain holes in the crankcase.

3. The washers at studs numbered 3, 5, 7 and 10 (see front cover of these notes) in the Maintenance Manual, have the smaller outside diameter flat washer. The remaining studs all have the large outside diameter flat washer. Stud identified number ‘1’ has one fibre washer between the cylinder head surface and the rocker oil feed banjo, there is another fibre washer on top of the banjo and then there is a large outside diameter steel washer below the nut. The cylinder head stud flat washers are close tolerance washers. Stud number ‘4’ has a square section rubber ring.

   When installing the rubber ring the recess in the outer cylinder head face and the cylinder head stud must be absolutely clean and free of oil. The water seal rubber washer is then slid over the stud and pushed firmly into the recess. Apply a small bead of Loctite 518 sealant around the cylinder head stud adjacent to the seal rubber. Next, install the plain washer, Part No. 52193-SM, and push it into the seal recess. This washer is followed by the larger outside diameter plain washer, Part No. 52193-LG, and the cylinder head nut. The smaller diameter washer compresses the seal further into its recess than would be the case if a large diameter washer only was employed.

4. Provided the stud threads, nuts and washers are a good fit and the head is tightened on to the crankcase progressively, in three tension stages 20 lb.ft three times, 30 lb.ft two times and 37.5 lb.ft two times, following the stud sequence as shown in the Jowett Maintenance Manual (remembering that nut # 1 is the oil feed stud), the cylinder head gasket installation should be successful. The thread in the cylinder head nuts should be lightly oiled. It is also advisable to use a $^{3}/_{8}$“ square drive socket because of the limited clearances around the nuts. A torque wrench with the specified final torque value at its mid-range point should be used.

5. It is important that the five upper studs numbered, 3, 4, 5, 7 and 10, in the Maintenance Manual, on each cylinder head, are sealed. Cooling water can migrate along these studs and drip into the rocker cover, and thence drain to the engine oil sump. Most commonly, coolant can migrate along the stud identified as number ‘4’.

   The original method was to use very fine solder or strands of lead wool wound round the studs and then the nut and flat washer were tightened squeezing the lead into the threads and the clearance between the studs and the head. Another method is to use a fine bead of Loctite 518 Mastergasket sealant around the stud thread prior to installing the washers and tightening the nuts. This method is probably less likely to distort the tensioning results. Excess sealant must be cleaned up immediately after tightening the nuts. Do not allow any sealant to reach the engine’s oil pump – pieces of sealant can severely restrict oil flow at the oil pump pick-up gauze strainer.

6. Tighten the cylinder head nuts, in the correct sequence, in the stages described at Item 4 to 37.5 lb.ft. (50 Nm). The tensioning must be slow and steady, a jerking action can give an incorrect tension. Use a good quality torque wrench of reputable brand with known tolerance characteristics.

   Note that at stud ‘1’, suitable spacers can be used under the nut and washer, so that a moderate clamp force can be initiated on the gasket. Do not apply the total specified torque at this stud.

7. After tightening the cylinder head nuts, and before the engine oil sump has been installed, use a suitable stiff wire to clean the two oil drain holes in each cylinder head. Wipe away any excess sealant that has been forced through by the wire.

8. Following the assembly of the rest of the components, the engine should be run until it has stabilised at 75 ºC (operating temperature).

   Switch off the engine once this condition has been achieved, the cylinder head nuts must be retorqued after the engine has stabilised for a twenty minute period after switching off.

9. Original style Jowett cylinder head gaskets should be installed using the same procedure as outlined for the current gaskets. It is important to note that, with these gaskets, the cylinder head nuts require re-tensioning when the engine coolant has stabilised at operating temperature, 75 ºC.

Adopting the aforementioned procedure will ensure successful installation of cylinder head gaskets.

Use the Maintenance Manual to assist with further assembly of the engine.

A Tip On Stopping Coolant Seepage

Sometimes, after the most conscientious assembly process and no matter what type of gasket sealant has been used, coolant water seepage can occur. In such an instance, we can take a comment out of the Jaguar V12 service manual. Such an engine, basically aluminium in its construction, has a myriad of joints that have to keep the coolant inside at 12 – 15 psi (83 – 103 kPa) inside its proper places. The service manual for that engine instructs the assembler to add a bottle of Bars Leaks to the coolant. This is not just recommended, but is an actual assembly instruction.

In the past, where slight coolant seepage has occurred after assembling a Jowett engine, the use of half a bottle of Wynn's *Radiator Stop Leak*, a blue liquid in a 325 ml bottle, has been entirely successful. Run the engine for about ten minutes and this chemical will stop the seepage. It will not clog the radiator and it mixes happily with antifreeze

Engine Coolant Maintenance

The owners' handbooks for Javelin and Jupiter cars do not provide pertinent information about maintaining the cooling system. They do, however, mention adding antifreeze mixture – which in most of Australia would have been disregarded due to our warm climate. To preserve vital components of the engine which come into contact with the coolant, a suitable corrosion inhibitor must be used. When the cars were built, no one considered that, in over fifty years time, the cars would be preserved and still in use. Hence no mention of the importance of using soft water and a corrosion inhibitor to protect against cavitation erosion and electrolytic corrosion, due to the use of dissimilar metals to make up the cooling system – i.e. cast iron, steel, aluminium, brass, copper and solder (lead and tin). Water, depending on its chemical make-up, when in contact with these different metals, can be the instigator of electrolytic corrosion, particularly when cast iron and aluminium are in close proximity to each other.

It should be noted that the process of electrolytic corrosion does not only take place while the engine is running – it is active at all times.

There is a very simple solution to this problem. It is a maintenance programme which ensures that the engine cooling system is filled, and maintained, with a good quality corrosion inhibitor such as Tectaloy *Xtra Cool Gold.* One litre of this product will make-up fifteen litres of coolant. It is suitable for three years use in the cooling system. Another approach is to use coolant made-up from 10% Ford R1-3B corrosion inhibitor and 90% soft water or, use a brand of inhibitor that meets AS 2108-1977 and contains 18% ethylene glycol. If antifreeze is required the make-up should be 50% Castrol Antifreeze/Anti-boil Concentrate (Ethylene Glycol 95% mass, to AS 2108-84) and 50% **soft** water.

The cooling system **must** be drained, flushed and filled with a fresh mix of corrosion inhibitor or antifreeze at two or three year intervals. Top-up coolant must be premixed as indicated above. Use corrosion inhibitor when temperature does not drop below 0 ºC. Remember the 'cold night chill factor' when making a decision.

Extreme care has to be taken when making up the mixture – if too weak, the cast iron, steel and aluminium components will corrode – if too strong, brass, copper, solder and rubber hoses will be damaged. The coolant passes through tracts within the crankcase and timing cover which are made from aluminium, consideration must be given to preventing corrosion of these components, which can be severe enough to allow water to pass through into the engine sump and contaminate engine components. If the coolant mix is too strong, the solder in the radiator can be affected to the extent that 'solder bloom' can (in severe cases) cause partial radiator core blockage, leading directly to an engine overheating condition.

Do not top up the radiator each time the vehicle is used, the coolant level will soon settle and the practice of topping-up should be minimal. When the engine is cold the radiator should not be full of coolant to the overflow outlet, the level should be ½" to ¾" below the overflow outlet. As the engine warms up, the level in the radiator will rise.

Inhibitors to AS 2108 provide further protection than preventing a corroded or frozen system – they prevent erosion of the cylinder liners due to cavitation-erosion (liner flexing – induction, compression, combustion and exhaust cycles), this condition can lead to the generation of tiny bubbles which implode against the cylinder liners (usually on the thrust side) and slowly eat away the liner surface. This concern would be most commonly found with the early thin wall section liners. Corrosion inhibitors also prevent the build-up of calcium scale which can cause localised overheating of the liner wall and, ultimately, local pick-up of piston material within the cylinder bore.

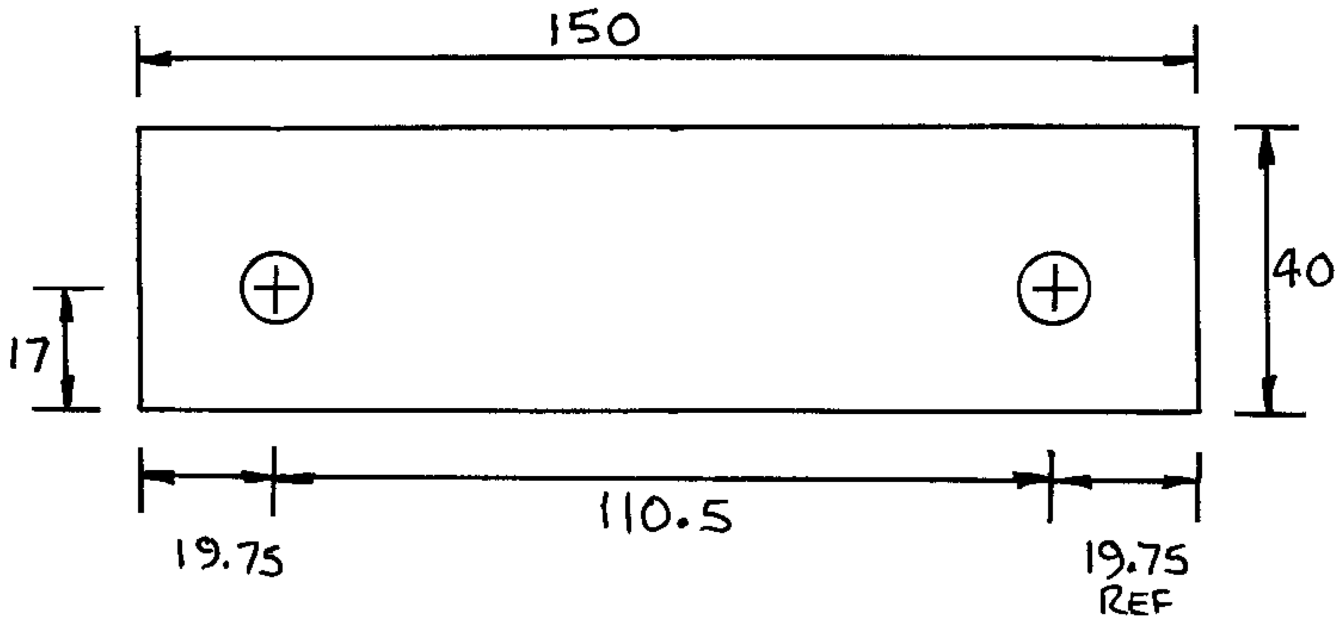
Failure to change the coolant mix regularly can result in overheating concerns due to the coolant settling and forming a jelly-like substance. It can also corrode aluminium components if they are dry. This is particularly so if the engine is not run frequently. Ideally the hoses should be changed at the same time as the coolant. Condition of all hoses should be carefully monitored. A hose in good condition is firm, but evenly supple. A hose in poor condition is either very soft (too strong a corrosion inhibitor mix) or very hard (due to lack of use and age). Good quality, genuine style, hoses are now available from the club's spares stock.

An antifreeze mixture has a 'self searching' property and will find any weakness that may be present at gaskets and hose joints. Any leaks found should be repaired quickly. Leaking antifreeze, when it meets the atmosphere, will corrode aluminium and steel components. Do not store the car for lengthy periods with a drained cooling system. Tectaloy *Xtra Cool Gold* can be left in a stored car's cooling system for many years, it has been found to be in good condition after nine years of storage.

There have been cases where, if engine oil infused with the coolant, liquid detergent was used to disperse the oil in the system. It is not a good idea to use a detergent for this purpose, because it can be very corrosive to aluminium, In those cases where soap detergent has been used in an engine's cooling system, should the system be drained in preparation for engine storage, then it should be thoroughly flushed out using clean water. If there is any trace of detergent within the system after it has been drained, it will cause problems of severe corrosion of metal components and hardening of hoses.

The same warning applies if cooling system cleaning chemicals have been used to flush the system.

APPENDIX 1



Material – mild steel bar, 40 mm x 150 mm x 10 mm

Two (2) holes 10 mm diameter.

All dimensions in millimetres. Drawing not to scale.

Diagram of cylinder head pulling tool – prepared by Ed Wolf

NOTES ON USE OF CYLINDER HEAD REMOVAL TOOL

This special tool was developed to ease a cylinder head away from the crankcase. After removing the rocker gear and all of the cylinder head securing nuts, slide the tool over the two rocker shaft securing studs. Place suitable spacers over the studs and tighten down two nuts. The tool should butt up against two of the cylinder head studs, Items 5 and 3 in the cylinder head tightening sequence. Care must be taken to tighten the two nuts evenly to open up a gap at the cylinder head gasket that is equal at both ends. Once the cylinder head has parted from the crankcase, levers can be inserted so that they purchase on the cylinder liners and pulled to ease the cylinder head off further.

Note: Do not have the levers purchase for leverage at any part of the aluminium cylinder head gasket surface of the crankcase set.