ROCKER SHAFT, ROCKERS, ROCKER BUSHES, ADJUSTING SCREWS AND PUSH RODS

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The oil feed is taken off the side of the low pressure oil relief valve at around 5 lbs sq. in. to the top centre of the block and then through drilled passageways in the block and head, then up through the centre rocker shaft pedestal. The oil passes from the pedestal to the hardened hollow rocker shaft through a communication hole then the oil is delivered axially through the shaft and then radially to each rocker bush.

The rocker shaft carries six offset inlet bushed rockers, three left-handed and three right handed. Early type rockers were held in their respective positions by steel tubes threaded onto the shaft, later engines having springs replacing the former tubes. Retro fitting the springs in place of the tubes does quieten the assembly down. Bush wear causes the rockers to strike the early steel tubes sharply during each rise and fall of the push rod, the situation and resulting noise becomes worse as engine speed rises.

Whenever the shaft assembly is removed from the five pedestals holding it down to the cylinder head care should be taken to capture the special dished washers under the pedestal holding down nuts. The components of the shaft are also loose and as the shaft assembly is raised to a position half way off the studs a keeper stud should be entered in the rear pedestal hole and engaged with the shaft to prevent the parts becoming detached. The hollow shaft is fitted with removable hexagon end plugs that can be removed for internal cleaning and the shaft is held from rotating by a grub screw in the forward pedestal.

Two main types of rockers were fitted. Engines of 4.25 Ltr having “early” type rockers part number RE13974 and RE13975 with a restrictor in the valve end of the arm, both fitted with an EB4198 “early” type bush. The 4.5 Ltr engines have RE17796 and RE17795 “late” type rockers without restrictors with a RE14388 “late “ type bush. In both cases the internal diameter (but not the external diameter) of the bushes is identical. After pressing into the rockers they are intended to be cross-drilled through the bush to communicate with the oil holes leading to the push rod ball cup and the valve end of the arm and reamed to fit the shaft. Each rocker is drilled at the push rod end with a very small oil hole at 90 degrees to the cross drilling and so positioned as to feed oil onto the push rod cup ball. All the oil holes are subject to sludging and blockage and the operation should be checked with the engine running to ensure all the points are receiving adequate lubrication.

The outside dimension of the EB4198 bush is 0.845inch and they were originally made with a Babbitt white metal type wearing face on a wrapped steel backing. Into this wearing facing was an impressed cross shape that was fitted in the upper or top position when the bush was pressed into the rocker. The cross shape depression provides a method of oil distribution around the bearing surface. Subsequent bushes of this type may be manufactured in bronze. The oil feed being distributed evenly from the ingress point to both the rocker valve end tip and the pushrod ball cup end. At this point it should be remembered that the arm to the valve operating end is fitted with a restrictor to limit oil flow to the valve tip. It is possible to make and fit one’s own later type bronze bushes to the RE13974 and RE13975 rockers arms in place of the EB4198 bush. This modification allows better oil flow to the cam riders and heavily loaded push rod ball ends and restricts the oil flow to the valve end of the rocker. The method is to make and fit two bushes to each rocker leaving a gap of approximately 0.100 inch between the bushes in line with the hole through the rocker arm that communicates with the push rod ball cup. This gap takes the place of the annular groove in the later RE14388 bush and serves the same purpose. The rocker arm valve tip ends also need drilling out to 0.125 inch, to remove the restrictor. It is worthy of note that the original EB4198 bushes made with a Babbitt white metal face are more capable of absorbing dirt into the bearing material than bronze material

replacements. This should be kept in mind when the engine is still fitted with the original by-pass oil filter and calls for a strict oil and filter changing regime to be applied.

A number of earlier type rocker bushes have been used over the years, differing in the method in which the oil groove communicates with the drillings to the adjuster or valve end of the rocker. This sometimes causes confusion.

It only needs to be remembered that there is always some form of restriction to the free flowing of oil towards the valve end of the rocker. If the valve end oil hole communicates directly with the oil groove in the bush, the end of the rocker nearest the valve is fitted with a restrictor. If the oil restriction to the valve end is accomplished by offsetting the valve end oil drilling from the oil groove in the bush, the rocker end has no restriction.

The outside dimension of the RE14388 bush is 0.865 inch and they are of the steel backed bronze facing wrapped type. Approximately one-third distance along these bushes is an internal annular groove. When fitted to the rocker this groove must be at the push rod cup end, so ensuring that the largest oil flow returns back down the push rod directly to feed the bottom cups on the cam riders. This directional oil feed also ensures that the valve tip does not receive excessive oil. It is not unknown for these bushes to be fitted incorrectly in the rocker arms with the groove communicating with the oil hole in the valve tip end. In this position not only can excessive oil use be expected down the inlet valve stem but also the lubrication of the cam riders and cam rider push rod cup will suffer. The oil flow directly down the push rod is important as it quickly reaches the highly loaded inlet cam riders after a cold start.

The “early” type rockers are fitted with a RE13539 inlet tappet adjusting screw. The shape of the end of this screw is like an inverted mushroom where it mates with the RE13538 “early” type push rod.

“Late” type rockers are fitted with RE17792 tappet adjusting screws and RE14036 heavier duty push rods. The shape of the adjusting screw takes the form of a very short stub with a ball end.

WEAR AND NOISE CHARACTERISTICS ON THE OVERHEAD MECHANISM

It will be seen that the “early” type rocker assembly individual components are NOT interchangeable with the “late” type. Physical interchanging is possible except for bushes and rockers individually, but practical interchanging is NOT.

The complete assemblies including pedestals, shaft, rockers, bushes, adjusters and push rods are interchangeable between “early” and “late” type cars. Many 4.5 Ltr engines have been fitted with second hand “early” type assemblies from 4.25Ltr engines. “Late” type push rods and adjusters should be fitted as matched sets to early type assemblies that require renewal. Replacing “late” type rockers and bushes in place of the “early” type will assist the lubrication of the cam riders and help in cases when cam riders are sticking especially under cold running conditions.

Owners should however beware of individual components having been incorrectly changed. Many later engines have been fitted with second hand early valve gear parts. The “early” adjusters when matched with “late” type push rods will cause a foul to occur between the underside of the adjuster head and the push rod cup. This fouling condition is worse when the parts are worn.

“Late type adjusters fitted with “early” push rods exhibit heavy wear at the very small contact point. Both these incorrect fitments emit a clicking noise at certain times whilst the latter example means the tappets have to be adjusted on a continual basis. These are quite common rebuilding errors.

Very early on in the life of the 4.25 Ltr engine the ends of the push rods were hardened, the unhardened rods preceded the “early “type described. However both ends of the “early” and “late” type of rods are

subject to wear especially at their contact point with the cam riders. At this contact point a projecting pip will be seen on the end of a worn rod. Often this pip can be some 0.050-inch long and at that point the hardening has worn through. Some relief can be obtained if only a small pip is present by grinding it off the rod ends and leaving a small flat in place of the pip.

Both types of inlet tappet adjusting screws are subject to wear and flat spots, very often the hardening has worn through in one spot and they need careful examination of the wearing end. Often any flat spots hold the push rods from spinning and cause opposing wear in the push rod cup, noise and constant clicking are the result. As the hardening wears through the owner will notice either that constant tappet adjustment will be required or any adjustment will not quieten the engine.

Occasionally the tappet screw lock nuts will actually foul the inside of the rocker cover during the valve lift cycle. During manufacture these rocker covers were fettled locally to the adjuster screw to prevent a foul. However fitting new rockers or bushes or fitting the cover slightly out of position can cause the foul to occur, the fouling sometimes occurs when “early” type components have been fitted to a later engine or non fettled military type rockers have been fitted. The noise will usually only appear at engine idle speed and can be detected as a metallic scraping.

Wear on the rocker bushes and shaft is very common and takes place on the bottom of the bush and shaft. As the wear takes place oil tends to run out of the bottom of the bushes instead of lubricating the valve stem and ball cup. If the wear is allowed to become excessive the offset of the rocker between the valve tip and push rod will cause tilting of the rocker. During the lift and close cycle the rocker will tilt first one way and then the other, in doing so the push rod will lean away from vertical and the rocker tip will strike the valve tip off centre. This action is very small but leads to accumulated wear on the push rod and valve tip end of the rocker and produces tremendous noise.

Rockers should be checked at their valve end tips for wear “depression” and if present the rocker end should be re-profiled correctly on a grinder. If the tip ends are worn in this way it will be impossible to set the tappet gap with a feeler gauge as the gauge will bridge the depression.

Slightly worn valve gear will respond to tappet setting when this exercise is conducted with the engine running as the action of the cam and valve springs will load the valve gear including the bushes in a running condition. This loading is not possible when the tappets are set in a static situation. Setting the inlet tappets under running conditions will not be successful if the rocker tips are worn as previously mentioned.

CAM RIDERS, WATER, UNFILTERED OIL, EXHAUST GUIDE WEAR

The original 4.25 Ltr engines were fitted with cam riders part number RE5705 for the inlets and RE5706 for exhausts of one standard four-window size.

Very early in production these cam riders were replaced with graded four window ones which were colour coded, with the colour also being applied to the cylinder block in the vicinity of the cam rider bore. The colour coding was, blue, green, yellow, and black.

Working to still finer limits the cam riders were upgraded by one colour to the block colour. This caused a spate of cam rider seizures or cam riders sticking. All this occurred prior to 1950 and was further complicated by the addition of two more colours, blue and white and white. Each cam rider varied in diameter upwards from 1.8625 inch between colours by 0.00025 inch. To make matters worse new type two window cam riders were introduced which were heavier and expanded differently, in place of the earlier four window type.

Colour coding was only intended for convenience and it is important to realise with both these cam riders and the later two window ones, selective fit should only be used when replacing tappets and not colour alone.

These cam riders are operating in a somewhat hostile environment, their cylinder block bores are not surrounded by coolant and they are subject to distortion. Not an ideal situation when the running clearance is so fine. On the 4.5ltr engine the main engine cylinder piston bores are connected and No2 and No 5 cylinders are joined to their neighbours on two sides, with no coolant in between. The 4.25ltr is only slightly better in terms of cooling. In both types of cylinder block the distortion and differential expansion on the cylinder block in these areas appears to have a knock on affect on the bores of their adjacent cam riders. No 5 cylinder inlet cam riders do seem prone to sticking if the cam rider itself has been selected to be of a tighter fit than recommended. When the original 4.25 Ltr high lift camshafts were current it was not uncommon to find the cam lobes wearing off the camshaft on no 5 cylinder, probably even then cause by torsional twist at the end of the shaft possibly combined with tight or sticking cam riders, although the cam lobe shape did little to help. Tight cam riders will also have a most severe affect on tooth wear of the alloy camshaft gear.

As explain previously it is imperative to have a good oil flow return down the push rod to supply in particular the heavily loaded inlet cam rider and its mating bottom push rod joint. The nature of this bottom joint where the inlet cam rider is cupped shape does invites dirt collection which grinds away the bottom of the push rod and increases inlet tappet clearance. This alone is yet another good reason for frequent oil changes. Carbon, grit and dirt pressured by exhaust gas escaping down the exhaust valve guides into the tappet chest is also unlikely to assist either the inlet cam rider and push rod joint or all the cam riders in general. Remember all this mechanism is being lubricated by that same unfiltered oil that is supplied to the rockers.

The exhaust valve guide blow by is one of the main causes of accumulated dirt that finds its way between the cam riders and their bores. Exhaust valve guide wear is quite common on these engines and it is normal to find the top of the guides a tulip shape during major overhauls, the guide material having burnt away.

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