

A main bearing tunnel being measured with an inside micrometer. Measurements should be taken in three places.

is that of 'main bearing crush' - a term that may well be unfamiliar to many people. This procedure involves checking that the new main bearing shells are fitted into the block correctly. The main bearing shells fit into an aperture called the main bearing tunnel, comprising the block and the main cap. The main bearing tunnels should be perfectly round. Fortunately, the XK Jaguar block is as solid as it looks and there are usually few problems here. Each main bearing cap combination must be checked with an inside micrometer to make sure that the aperture is in fact round and 'on size.' (within specification). The minimum diameter of the main bearing tunnels is 2.9165in/74.079mm and the maximum size is 2.9170in/74.091mm.

If the main bearing tunnels are not within tolerance, the chance of bearing failure ('spun' bearings) - the bearings rotating in their housings - is dramatically increased; in fact, to the point that failure is virtually guaranteed if the engine is subjected to any serious stress. When a main bearing spins the oil supply to the relevant big end bearing is cut off, and that bearing will fail immediately. The straightforward checking of the seven main bearing tunnel sizes will prove the integrity of the block beyond doubt.

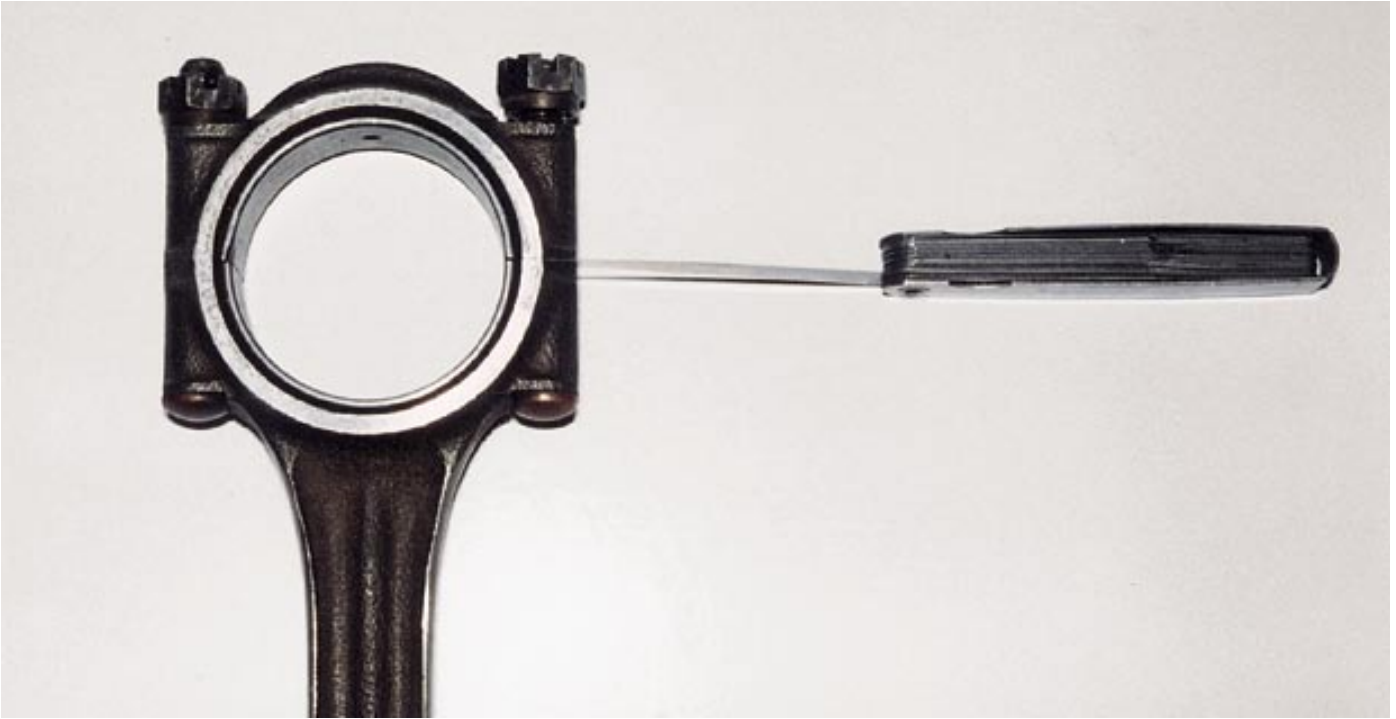
Tunnels damaged by 'spun' bearings can usually be detected by looking at the bearing tunnel surfaces and checking for circumferential score marks. If an engine has had a main bearing 'spin up,' the tunnel will not be 'on size' and may well be at 'top size' or beyond tolerance. The only solution in this situation is to align hone or align bore (line bore) the bearing tunnels to restore them to standard size. Be



Main bearing tunnel being measured in the second position ...

very suspicious of a block that has any circumferential score marks on any of the tunnel bore surfaces. Minimum factory recommended size main bearing tunnel bore diameters are the safest bet!

The next stage in checking bearing crush is to fit each new pair of bearing shells to the engine block. This checking procedure is designed to make sure that the new bearing shells are being squeezed and held



When one bolt is undone the cap must have a gap between it and the connecting rod on the side of the connecting rod cap which has had the bolt undone. The gap is between 0.004 and 0.006 inches.

and thereby gain a false reading (it takes some practice to become adept at doing this). The diameter of each bearing is recorded for future reference when the bearing running clearances are checked. Expect the big end bearing bore diameter (shells fitted) to be from 2.088-2.0885in/53.03-53.047mm.

Although insufficient bearing crush is not a common problem, it does happen from time to time and can ruin an engine (possible spun bearing). It does not take much time to check each connecting rod, it's good engine assembly practise and an expensive engine failure may be averted. Good engine reconditioning/engine machine shop engineers always 'check fit' the components of any engine as they assemble it. The last thing an engine rebuilding workshop wants is an engine to come back damaged, all for the sake

of 20 to 30 minutes extra work. They avoid this sort of problem through good preparation and so should you. Take nothing for granted: check everything ...

The goal of all this checking and preparation is to restore the connecting rods as much as is possible to original condition or better. Doing all of this work does not, of course, remove the possibility of metal fatigue and consequential connecting rod failure. After all this work a connecting rod could still fail, the risk of, though, has been reduced to a minimum and is usually quite low.

Caution! - Avoid using connecting rods that you know came from a racing engine that was revved to high rpm. This is a real risk because, although Jaguar connecting rods are of excellent quality, they'll only stand so much stress. Second-hand connecting rods

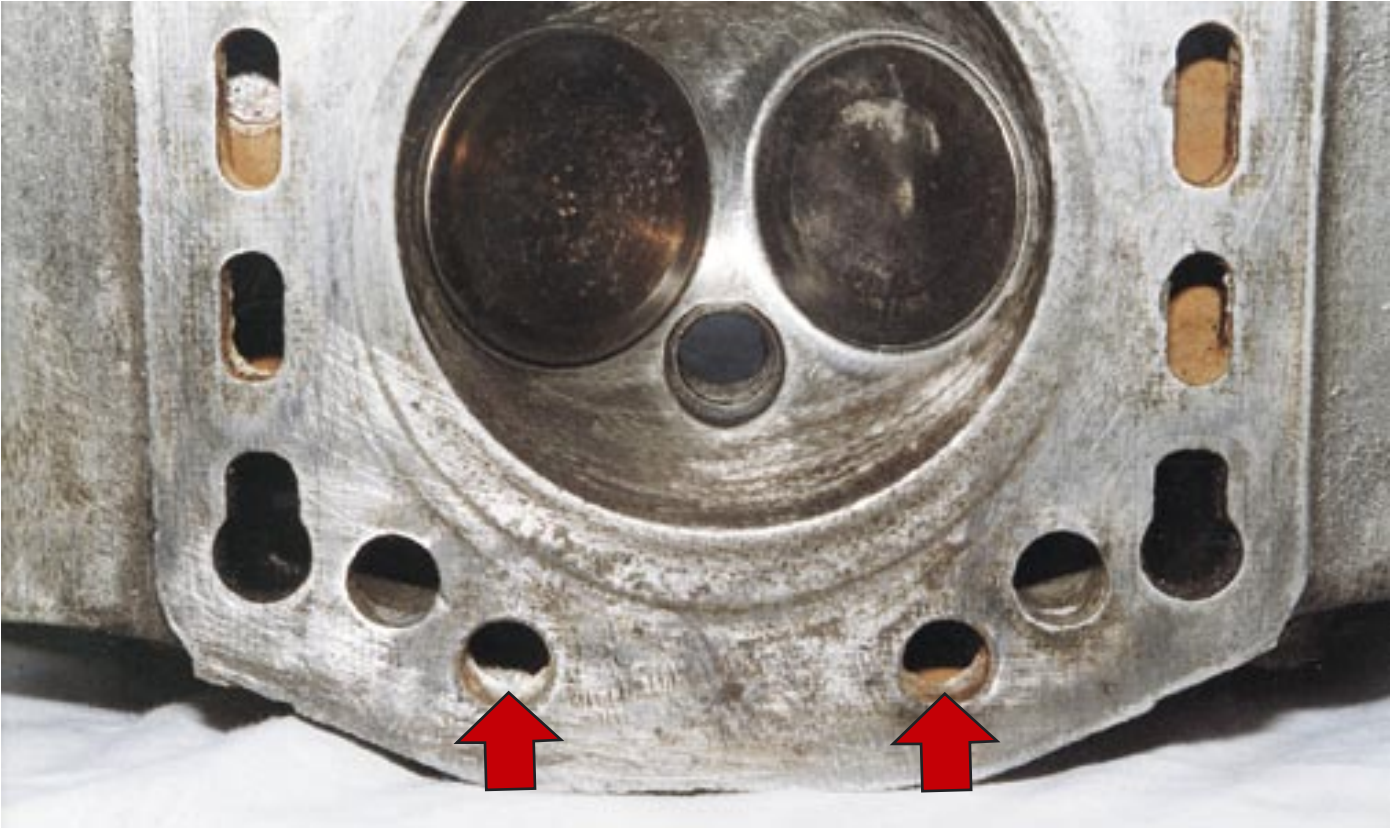
from an engine that has only ever been used at normal road going revs are the safest bet.

CRANKSHAFT

The crankshaft is first thoroughly cleaned and then the journal surfaces are inspected to see what condition they are in. The ideal journal surface has a mirror finish, with no score marks of any description on it. The journals themselves must be perfectly round and 'on size.'

Cleaning oilways

The 'sludge trap' plugs fitted into the throws of the connecting rod must be removed and the contents, accumulated over of thousands of miles, removed. This can sometimes take some work as the plugs can be very firmly located in the crankshaft. Applying heat to the plug by way of



When fitting an XJ6 cylinder head onto a 3.4 or 3.8 block plug these two waterway holes.

carburetors are going to be used, appropriate inlet manifolds are more readily available for a straight port cylinder head. Given the choice, everyone seems to want a straight port cylinder head, and the fact that the B-type cylinder head can be reworked to match the straight port head doesn't usually come into the equation.

The valve head sizes for production cylinder heads (up until the XJ6 Series III engine) were all the same: 1.750in diameter for the inlets and 1.625in for the exhaust valves. The XJ6 Series III cylinder head, however, has 1.875in diameter inlet valves and the usual 1.625in exhaust valves. The inlet valve seat insert is also larger in the Series III cylinder head.

Caution! - Before any XK cylinder head has any time and money

spent on it, the camshafts should be checked for free turning by hand. The purpose of this is to check for a warped cylinder head. In some instances, cylinder heads have been excessively overheated and are well and truly warped. The gasket face might well have been trued up by being refaced, but the camshaft tunnels most certainly won't have been re-align bored. XK cylinder heads have been known to warp more than 0.080in/2mm, and this means that when each camshaft is fitted into the cylinder head (with the valves removed) the camshafts cannot be turned freely by hand. The engines will run like this (unbelievable as it may sound) and the camshafts might not break (at least not straight away) but the situation is far from ideal and must be avoided.

If the cylinder head is basically 'straight', you should be able to turn the camshafts by hand. This very simple test sorts out a good' cylinder head from a bad one.

It is not recommended that the camshaft tunnels in a cylinder head be align-bored to correct for warpage. Other considerations include the fact that the tappet bores will no longer be at absolutely 90 degrees to the camshaft axis. Find another cylinder head in good condition.

EXHAUST PORTS (ALL HEAD TYPES) - MODIFICATION PROCEDURE

The exhaust ports of all of these production XK cylinder heads are the same and all need a minimum of reworking. The ports are really



The original valve guide was removed before work commenced. The port has been roughed out with a rotary file and a new valve guide fitted. The valve seat is still standard.

simply regrind the valve seat to clean it up and make no attempt to narrow the valve seat cut into the cylinder head. The valve seat (as cut by the factory) is not all that good in absolute terms, but is good enough for a standard production engine. For high performance applications, the valve seats need to be reground so that they are 0.060in/1.52mm wide. The inlet valve seat width could be slightly less (ideally 0.050in/1.27mm, but never less). The outer diameter of each valve seat, as ground into the cylinder head, needs to be the same size as the inlet valve diameter which is 1.750in (44.45mm).

The inlet valve seats on just about all XK cylinder heads are just about proud of the aluminium of the cylinder head by around 0.010-0.020in/0.254-0.508mm. The actual valve seat contact area should be re-cut so that the outer diameter is the same as the inlet valve size (1.75in/44.45mm in the case of the B-type cylinder head). The 45 degree valve seat is re-cut, and a radius used to blend the 45 degree valve seat into the valve throat on the port side of the valve seat. **Caution!** - This radius can be cut by hand, but care is needed - one slip and the valve seat will have to be re-cut!

Large inlet port

For motor racing purposes, the B-type cylinder heads inlet ports can be opened out more radically so that they become so-called 'large port' cylinder heads. The inlet valve guides are almost always removed to do this, and the ports are then opened out to a maximum size of 1.5in/38.1mm in diameter. This target diameter involves the removal of between 0.125in/3.175mm and as much as 0.187in/4.76mm of material from the inlet port. It is possible to enlarge the inlet ports of a B-type cylinder head to this extent with the valve guides in place and make a very satisfactory job



It's a good idea to replace these items with new genuine replacement parts.

VALVE COLLETS AND KEEPERS

Most of these engines will have done thousands of miles by now and most will still have the original collets and keepers fitted. **Caution!** - It is strongly recommended that brand new, genuine Jaguar collets and keepers be bought and fitted to any engine that is being rebuilt for high performance. This is a measure to preclude, as much as possible, the failure of one of these items. Failure of these parts is rare but it does happen from time to time. For the modest cost of brand new replacement parts the benefits can be enormous.

VALVE SPRINGS

Caution! - Always use new valve springs in high performance applications so that the valve spring tension is the maximum possible with that particular spring set. Valve springs lose tension with age and use, so

never fit used valve springs to a high performance engine unless they're relatively new and still make their rated poundage (within 5%).

Caution! - Electronic rev limiters are readily available and should be fitted to all XK engines when they are being used in competition. With standard, but new, valve springs fitted there is not a lot of room for error with regard to engine over speeding. The standard poundage, while being more than adequate for a standard engine does not allow all that much of a safety margin at engine speeds beyond 6000rpm. Fitting a rev limiter is the solution to possible valve damage via engine over speeding (caused by missed gear shifts, and so on), where the engine rpm can rocket. Avoid this situation at all costs.

Standard type

The standard dual valve springs are designed to work with standard valve

lift and not significantly more. Taken to the safe limit, this means that standard dual valve springs are only good for a maximum of 0.410in/10.41mm of valve lift. That's 0.035in/0.889mm more than standard. **Caution!** - Even though the standard dual valve springs will take slightly more than this, it's not safe on the basis of valve spring reliability (too near to coil bind). Jaguar valve springs are, of course, of excellent quality, but there are limits to just how much a valve spring can be compressed before spring breakage, through fatigue, can happen.

The fitted height of the outer valve spring in XK cylinder heads is approximately 1.325in/33.65mm. The fitted height of the inner valve spring is approximately 1.250in/31.75mm. The coil bind height of later valve springs (in combination) is approximately 0.875in/22.22mm. This means that the valve springs in combination are coil bound at 0.450in/11.43mm of valve lift. This is why the maximum recommended valve lift using standard valve springs is 0.410in/10.41mm as it leaves a total clearance between the coils of 0.040in/1mm.

The seated tension of later XK valves springs, for example, is approximately 70-80 pounds/31.75-36.28kg. The (valve) fully open pressure is approximately 130-140 pounds/58.96-63.50kg at 0.375in/9.525mm of valve lift (outer valve spring compressed to approximately 0.950in/24.13mm). These later standard dual valve springs are quite sufficient for all high performance engines with camshafts featuring up to 0.410in/10.41mm of valve lift and engines that are rev limited to 6000rpm.

Caution! - Irrespective of what valve springs you buy, they should all be checked for installed height pressure (at 1.325in/33.65mm), and the coil