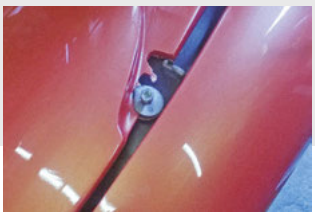
SHIMMING YOUR TUSCAN

There is a lot written about the design of the Speed 6 engine and the fact that as part of a major service the valve shims should be checked. If for you, like me, getting your hands oily is part of the fun of TVR ownership, then this is another thing that may be within your ability. This is how I go about checking, and where necessary adjusting, the cam shaft to valve clearance *(the finger followers are also involved)*. In my view this job is as much about attention to detail as it is about technical know-how.

The tools that I use are nothing out of the ordinary, being spanners, sockets, Allen key 'sockets', feeler gauges *(imperial in my case)*, a digital Vernier calliper *(also capable of working in imperial)* and possibly a torque wrench. I also use a magnetic pickup tool and a screwdriver which holds its bits in with a magnet.

This is based on my approach, and I have done this a few times. I have had my Tuscan just over a year and the car has been very reliable for me, including a trip to Le Mans and a day on a track. I first had a go after reading some posts on the TVRCC forum and PistonHeads and thought, it can't be that difficult, which in my view it is not. But it is one of those jobs that once you have started there is no real going back, so getting the car to someone else to finish it off will require specialist transportation.



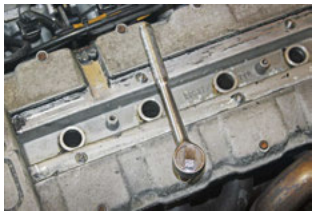
Courtesy of: **Mike Hardy**

To start with you need to get at the engine, which unless you have had a hinging bonnet conversion, will require two people to lift the bonnet off. You will also need somewhere to store it, as the first time you attempt this job *(especially if it has not been done for a while)* it can take some time. However it is easily achievable within a day if you start early enough. Removing the bonnet is standard procedure and requires the service bonnet to be opened, exposing four nuts. There is also a clip each side at the rear, which are undone by putting your finger underneath the edge of the bonnet nearly at the back and pressing the end of the clip. Lifting the bonnet off is best done by two people. Lift the rear so that it is at approximately forty-five degrees then lift up and back. I have found the best place to store the bonnet is on top of the car, after removing the roof and storing it in the boot as normal. I use two cushions to protect everything, one across the top of the windscreen and one across the rear roll hoop, and then rest the bonnet on top of these.

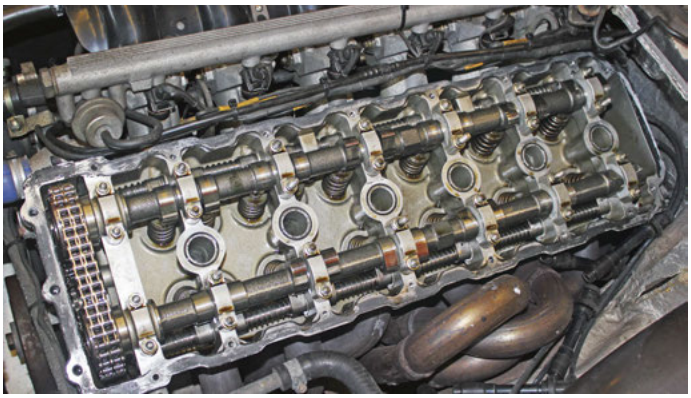
Once the bonnet is removed you will also want to remove the scuttle panel. To do this you first have to remove the windscreen wiper arms. There is an Allen headed bolt through the mounting post for each, which when removed will allow the arm to just pull off with a little wiggle. Remember to remove the washer tube, which just pulls off. Around each wiper post there is a large nut that has to be removed and a rubbery washer underneath. At each end of the scuttle is a self-tapping screw which needs to come out. The rubber finishing strip is attached to my scuttle, and this is bonded with RTV to the screen at the ends, which I slice through with a sharp knife. Once this is all done I can lift the middle of the scuttle, unhooking it from the wiper posts, at which point it can be slid out from underneath the rear bonnet clips without needing to remove them, therefore having to re-align them when putting it all back together.

Now everything is in view is it time to start taking it all apart.

The first thing to come off is the plug cover *(there is probably a more technical term for this)*. On my car this is retained by three Allen headed bolts. I then remove the spark plug leads and put them on the manifolds out of the way *(after making sure that they are cold)*, as there is no need to completely remove them. The spark plugs are then loosened so that the engine can be turned over more easily, but I do not remove them as they work very well at stopping any small things, like shims, falling into the engine.

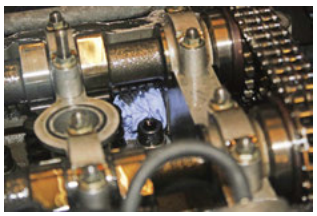


Next to be removed, after carefully cleaning around the outside of it to remove any dirt, is the rocker cover.
This is a case of removing the recessed Allen headed bolts from around the outside, and the six nuts near the spark plug holes which are normally covered by the plug cover.
I go around and just 'crack' them first to get them moving, then undo them all a little before finally undoing and removing them, therefore releasing them all as evenly as possibly. During the bolt removal process I also check that there are no loose cables that will get in the way or trapped later.



As standard, the rocker cover is sealed to the head using black RTV sealant. This also works quite well as a glue, so it is not necessarily just a case of lifting the cover off, and a little careful wiggling may be required. I have to admit to, and if you are of a sensitive nature look away now, using an old chisel to get it started a couple of times.

Once released it lifts off and should be put in a safe place, covered to stop any dirt getting onto the clean side.
The next important thing to do is to block the oil return channels so that nothing can fall down into the bowels of the engine, leading to having to strip it all down. There are two channels, one at the front and one at the back. I use a clean cloth to block these, and yes, it has saved me at least once so it is a must.

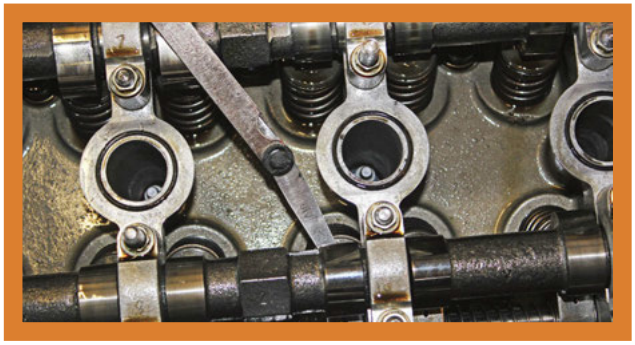


At some point the old sealant will need to be removed and the mating face cleaned on both the cover and the head. What you do not want to do is scratch either surface, therefore it is a must to use something that will not do this. I normally resort to my finger nail or if it is really tough, or I have bitten my nails down too much, half a wooden peg. To remove the last bits I use a soft cloth with some rubbing alcohol on it. When doing this be very careful not to let any sealant fall into the top of the engine *(or make sure that you get it all out if some does)* as it could block oilways etc.

You can also check the inside of the cover to see if the timing chain is hitting or has at some time hit the inside of it. This has happened at some point on my car as can be seen by the marks. There is a tensioner that can be adjusted to stop this, but I am not covering that here.

Now that the cam shafts are in view it is time to start shimming. This is a simple process which can be made all the easier if you have prepared in advance with a sheet of paper made into a grid and a calculator, or in my case a laptop and a spreadsheet *(I have put a copy of the spreadsheet that I use in the Tuscan technical area of the club website).*

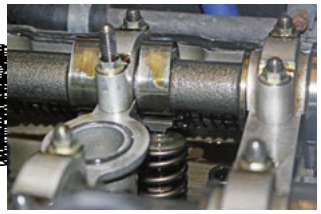
The process of checking and adjusting is very simple. Use the feeler gauge to measure the gap between the finger follower and the existing shim. If the gap is too big replace the existing shim with a thicker one and if it is to small replace the shim with a thinner one.



The tolerances *(obtained from PistonHeads and other online sources)* are:
Inlet Valves 5 - 7 Thou *(Thousands of an inch)* - I aim for 6 Thou
Exhaust Valves 10-12 Thou - I aim for 10 Thou

The reason that I aim for these figures is as simple as I have feeler gauges in these thicknesses.

But before the clearance can be measured you have to get the cam shaft to the correct position for the cylinder. To do this I put a spanner on the front damper nut and always pull it towards the passenger side *(as if I was doing up the nut).* I always use the open end of it as if I forget it is there and try and start the engine it will fall off, hopefully without doing any damage.

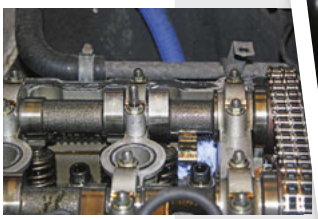


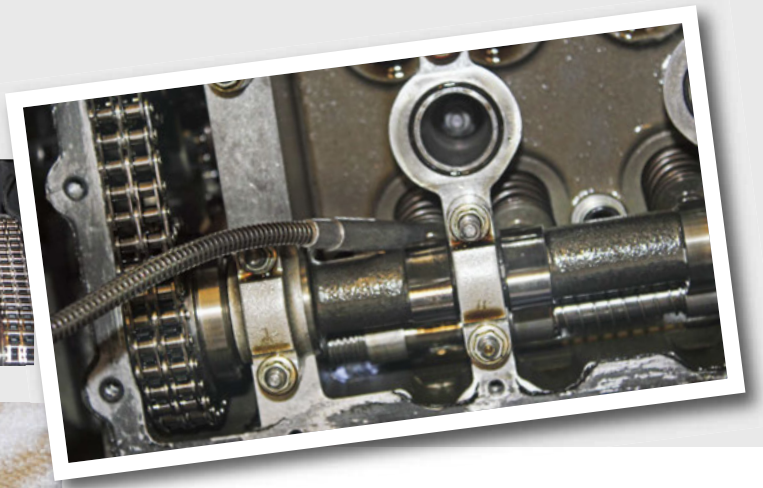
What I am looking to do is to get the cam lobes pointing up *(if the engine was upright)* away from the finger followers so that the lobe is as far away as possible from them. If I inadvertently go past this point I then turn the engine over in the same direction *(two revolutions of the crankshaft nut)* until I get back to the same point.

The way that I go about this is to check the existing gap and record it on my spreadsheet. If it is out of tolerance then I remove the shim *(more on that in a moment)* and measure it using my digital Vernier calliper and record the thickness. My spreadsheet then works out what size shim I require and I put the relevant size in and check again.

The calculation is:
Current Clearance minus Aim for Clearance plus Current Shim = New Shim

If this is the first time that you are doing this job yourself I would, from experience, recommend that you remove and inspect every shim regardless if it is out of tolerance and especially if you are not convinced that the service history is complete. After I had adjusted everything the first time and taken my Tuscan for a test drive I was not happy with the tappyness and did it all again. This time I removed and inspected all the shims and found one that was badly peened over to the point that it was stuck in the top of the valve!

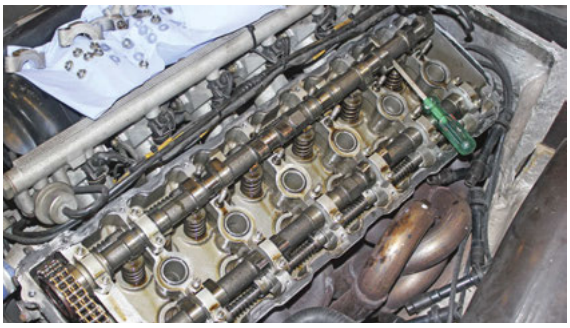




Getting the shims out and putting new ones in depends on which you need to replace. All of them except for the two end ones *(rear inlet and exhaust valves on cylinder six)*, the front valves on cylinder three and five and the rear valves on cylinder two and four can be done by using something to slide the finger follower out of the way and hooking it behind the valve spring. The existing shim can then be removed. To do this I use a suitably cleaned magnetic pickup tool and it should come out easily if the end of the tool is touched to the shim as much as you can get it. Whilst the finger follower face is visible I also check for damage and uneven wear.

The shim is them measured and the calculation carried out. I then put the required size shim back in. To do this I put the new shim on the end of a screwdriver which is slightly magnetic *(I use one with changeable tips which are held in by a small magnet)* and then use a small electrical screwdriver or my fingers to push the shim into place. Once you have put the new one in, double check that it is sitting flat. You can then unhook the finger follower and gently put it back in place. When you have finished, measure the clearance again to be sure you are happy with it.

If it is one of the previously mentioned valves then there is insufficient room to slide the finger follower out of the way, due to either it being the end of the finger follower shaft or there are additional castings in the top of the head. Therefore a different approach needs to be taken. The way that I do these is to carefully remove the cam shaft retaining caps *(a little at a time)*. Providing that you are very careful there is enough slack in the timing chains to allow the cam shaft to be lifted up enough to get to the shims.



If you go down this route then do not turn the engine over to align the cam lobes as this would most likely damage something. Get all the measurements ready, then do all the inlet valve shims at the same time. There is only one exhaust valve that needs to be done like this. Be sure to torque down the cam shaft caps gradually and correctly. *(The information that I have found on this, from more than one online source, is that they should be torqued to 15 foot pounds).*

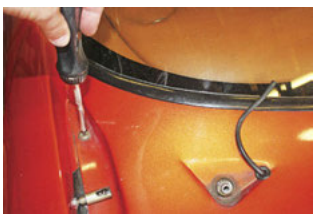
One question that I have not covered so far is where to get the shims from. These can be purchased from the main TVR parts suppliers. The way that I did it was to get a shim set which contained three of all the main size shims, allowing me to do the job in one go. The alternate is to do all the measuring and calculating then order the individual shims that you need, however this means that you are not going to be able to do the job in one day, unless you live close to a supplier who stocks them. After finishing the adjustment work I order the necessary shims to bring my 'stock' back up to a full complement.

When I have finished doing all the shims, I make sure that everything is clear of the engine, especially the spanner that I have used to turn it over. I remove the rags that were used to block the oil-ways and also put some rag in the spark plug holes to stop any oil dribbling in.

After a final visual inspection to make sure everything is sitting properly and everything that should be removed has been, I spin the engine over on the starter motor until I can see plenty of oil running from all the finger followers. I then go through all the valves in turn again and recheck the clearances, just to be sure. If necessary, I repeat the process until I am happy with all the clearances.

Once happy everything is in tolerance, it is time to put it all back together. After checking that nothing has been left in the engine I prepare the rocker cover as previously described. I also replace the o-rings that go around the spark plug holes. Once everything is clean I extrude a thin bead of RTV sealant, no more than about 1mm diameter, around the rocker cover. I put it on the rocker cover as this is a lot easier to clean off and start again if anything goes wrong. When I am happy with the bead of sealant, I carefully lift the rocker cover onto the top of the head, using the central cover studs to line it up. Once in place I quickly put a couple of nuts onto the studs and do them up finger tight. It is then a case of adding the rest of the nuts and inserting all the Allen headed bolts into the various holes, taking care to make sure that the longer small Allen headed bolt goes into the front left hole and also through the pipe support bracket *(if you have one)*. I then go round all of these and gently tighten them up. They do not need to be very tight and I just do them gently hand tight. At this stage I then do up and check the spark plugs before replacing the ignition leads. The final engine bit is the plug cover, which should be sealed around the edges as well. The three retaining Allen headed bolts don't need to be done up tightly either. I then refer to the instructions on the RTV sealant, as some say leave it to go off for a period of time before doing anything, and if it's OK, start the car, then listen to it silently purr *(although who am I kidding, the Speed Six engine is hardly quiet!)*.

Finally to finish, if there is no more fettling to be done, it is a case of replacing the scuttle panel and bonnet. When replacing the scuttle panel make sure that you feed the washer hoses up through it before fitting it. Sometimes the hose will refuse to stay on its own, in which case I put a clothes peg on the end to temporarily hold it. I find it easier to put the driver's side of the scuttle back in place then do the passenger's side, as the layout of the wiper spindles gives more flexibility this way around. After putting the wiper spindle washers and bolts on, which do not need to be very tight, the self-tapping screws in the ends are replaced. I put a dab of RTV sealant onto these to keep them water-tight. I also RTV the windscreen rubber trim back on at the ends.



A short length of masking or electrical tape will hold these in place whilst the RTV sets. I find that if the windscreen was slightly dirty when the work started, there will be a mark left which can be used to get the correct alignment when refitting the wiper arms. When replacing the wiper arms, remember that the one with the bolt cover is the driver's side, and I find it easier to fix the washer pipe back before doing the arm. I also find it easier to 'bend up the arm' when fitting as this takes the pressure of the spline on the post.

All that is left is to replace the main bonnet. I always do a final sweep of the engine bay to make sure nothing is left under there first. As with removal, this is best done with two people. Start by holding it up at about forty-five degrees, lower it over the oil filler etc. at the front then lower the back down. When it is sitting over the bolts I do the two catches up at the rear first as I find this is easier at this point. Finally, replace the four washers and nuts and do them up just over finger tight, close the service bonnet and test drive.

Mike Hardy