

REBUILD A MARLES STEERING BOX P3691/P3690 (2" BEARINGS) FOR ASTON MARTINS

TAKE THE STEERING BOX APART:

The side plate and dowels has to be removed and the cross shaft pushed out with its sleeve on the top.

Note: what spacers and thrust washers were used under the cross shaft. They may help on assembly.

Remove the base plate, it could have a tube attached for the horn button wire.

The cam or worm and steering shaft can be removed through the front of the box.

The ball bearings may fall out of their cages. The bearings will usually need replacement.

The oil seal was removed from the cross shaft bore.

Clean and degrease all the individual parts and set aside.

Examine the cam or worm and the condition of the cross shaft and its roller.

If the cam is worn the steering shaft will have to be pressed out. Note that it has a master keyway cut in it.

Keep all shims and set aside, they may come in handy.

Main castings were then glass bead blasted.

Now an assessment of what components need to be replaced.

In my particular case the box had been filled with water so it was badly rusted internally which the bead blasting took care of.

REMOVE ALL BUSHES , BEARING CUPS & OIL SEAL:

The top bearing cup might be difficult to remove if the casting overhangs the edge of the bearing cup.

A thin long punch held at a steep angle might do the trick, drive the bearing out.

In my case a piece of metal was welded to the bearing cup which then allowed for its removal.

To replace the cross shaft bushes in the main body the existing ones have to be removed

A 3/8" piece of brass rod was to be used as a punch, it was ground with a curvature on one side so that it fitted the bore on the inside of the casing, there is a small gap between the two bushes.

This gives the punch it a good purchase on the edge of the bush to drive it out.

Each bush was then driven out.

Inspect the casing bore to make sure that there are no burrs.

To remove the bush in the side plate, use a broken hacksaw blade to make an internal cut through the old bush. This will allow it to collapse and be removed.

RE- ASSEMBLY:

A pusher was machined from some scrap to clearance fit the inside of the new bush 1.100" Dia leaving a small shoulder 1.350" Dia so that the pusher comes to a stop against the casting.

The new split bushes had a thin piece of tie wire wrapped around the outside and twisted to hold the split gap of the bush together so that the pusher doesn't spread the bush whilst pressing it in.

Lightly grease the bore to aid installation, press in the bushes till flush from either side of the casting, make sure that both bushes do not project above their adjacent machined faces.

This can be done in a press or a large strong vice.

Check the fit of the cross shaft in the new bushes, if they are over tight they will have to be lightly scuffed with some 600 Wet & Dry. (Use piece of dowel 1.100" Dia with a saw cut down the centre to poke the edge of the paper in and wrap around the dowel, rotate dowel with the wet & dry till the cross shaft is a good push fit.)

Put the cross shaft aside with thrust and shims.

Now to install the cam or worm, assemble the worm (new or old) with bearings and cups, stand upright

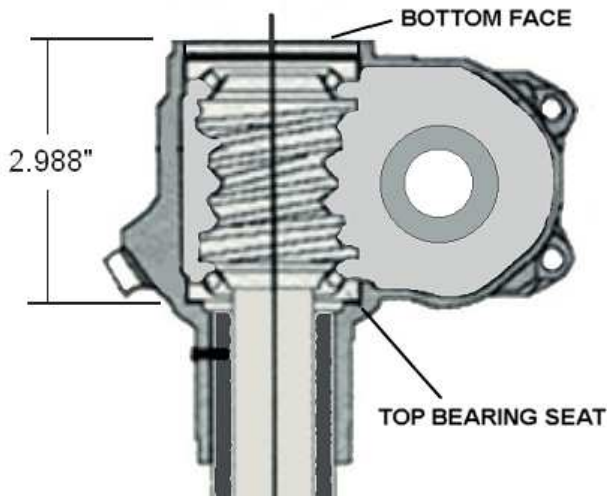
and now, If possible measure the overall height (outer bearing cup to outer bearing cup) should be approx 3.00"±. (see diagram below).

To measure the internal depth of the steering box from top bearing seat to bottom face of casing.

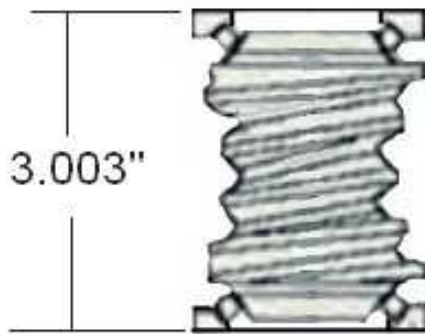
(see diagram below) and do the calculation to help with choosing the required shims.

HINT: Purchase more shims for the cam and the rocker shaft than you think you need, especially thin ones from "**MARLES STEERING BOX**".

STEERING BOX DIMENSIONS



DEPTH TO BEARING SEAT



HEIGHT OF WORM & BEARINGS



SHIMS REQUIRED EXAMPLE :

WORM & BEARING HEIGHT	=	3.003"
DEPTH TO TOP BEARING SEAT	=	<u>-2.988"</u>
SHIM		0.015"
THIS WAS TO TIGHT SO AN EXTRA FOR CORRECT BEARING PRELOAD	+ <u>0.005"</u>	
TOTAL		0.020"



REASSEMBLY:

NEW CAMS THERE ARE LEFT & RIGHT CAMS FOR REPLACEMENT

If the original cam or worm is being used and the steering shaft is attached mount, the assembly on a flat plate or board with a hole to let the shaft through.

This gives a good idea of what is needed to get the cam or worm correctly shimmed with correct preload.

No bearing shims are required under the top bearing cup if the measurements are like above diagram.

Before installing the top bearing cup grind a small groove at right angles to the bearing seat so that a long thin punch can get under the edge of the bearing to aid future removal.

Remove the old grommet and sleeve, press a new grommet and sleeve into the outer tube.

Mount the steering box casing vertically in the vice hold it firmly.

If it is the old cam or worm remember what shims were under the top bearing (closest to steering wheel) if were any, and replaced with new equivalent ones (check thickness with micrometer).

If it is a new cam you will have to check for its central position inside the casing.

As it is most important that the cam or worm be placed centrally within the box to allow for correct number of turns for lock to lock 3 ¾ turns (1 7/8 turns to centre).

Press in the top bearing cup, lightly grease the caged balls and insert the cage correct way up.

It is now obvious why the small grooves were necessary under the edge of the top bearing.

Lightly grease inside the top bearing (closest to steering wheel) of cam or worm and insert it into the casing.

The weight of the steering shaft will help in the adjustment of the shimming for the bottom bearing.

Lightly grease inside the bottom bearing cup lightly grease the balls and insert the cage place over the end of the cam or worm, install the bottom bearing cup over the balls and cage.

WORM ADJUSTMENT:

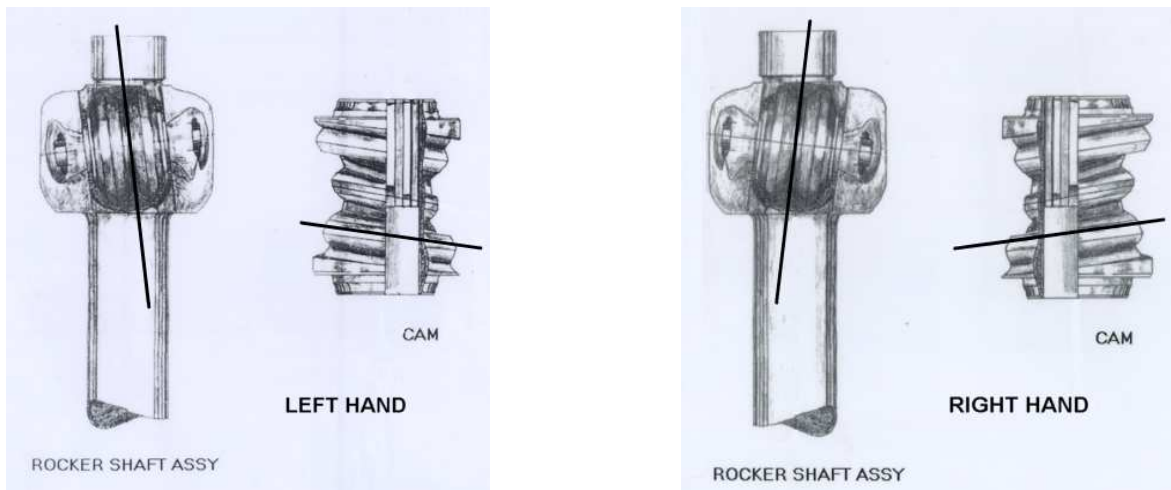
Place a good straight edge across the face of the casting and the bottom bearing, with feeler gauges check what shims are required to give the right adjustment and preload to the assembly.

Either bearing shims will be required to bring the bearing height above the face of the casting, or gasket shims will be required to raise the bottom plate to clear the bottom bearing and give the right preload.

With all the clearance taken up by shimming the measurement has to lessened by 0.001" - 0.002" to create PRELOAD on the cam worm bearings.

Spread a sealant on both sides gasket and bolt the bottom plate on gently tighten the 5/16" bolts and spring washers, fully tighten the bolts to test the adjustment further correction may be necessary to obtain preload by adding and subtracting shims.

CROSS SHAFT ADJUSTMENT: NEW CROSS SHAFTS ARE LEFT & RIGHT FOR REPLACEMENT



CROSS SHAFT ADJUSTMENT:

Now that the correct preload has been applied to the cam and the bottom plate bolted up.

Rotate the cam or worm until the rocker shaft can drop into the casing in the central position of the cam and case opening.

It's time to install the rocker shaft, place the main thrust washer with the cuts and the bevel facing upwards towards the roller. (this is because of the large fillet under the bottom face of the shaft)

Place different combination of shims on the shaft after the main thrust and lower shaft with thrust and with a stack of shims into the casing.

With the cam in the central position see how much side to side free play there is between the roller and the thread track on the cam.

Add or subtract shims until there is no side to side movement. You have now set the rocker shaft up with the right amount of packing shims.

Hint: Try to get in the assortment of shims under the rocker shaft some 0.001" & 0.002" shims, as this will make for easier and finer adjustment of the box in the future as it wears by withdrawing shims.

Remember that there will be some free play between the roller of the cross shaft and the cam on full lock left and right (approx 3 ¼ turns lock to lock or 1 7/8 turns to centre) turns in either direction.

The main concern is that there is no free play in the straight ahead position.

AS AN EXAMPLE : ROLLER IN THE MID POSITION OF WORM FULLY ENGAGED

SHIMS REQUIRED 0.015 x 2 = 0.030"

..... 0.002 x 1 = 0.002"

..... 0.001 x 1 = 0.001"

TOTAL = 0.033"



INSTALLING SIDE COVER:

Install the new bush by carefully pressing into position, make sure that there are no burrs on the edge of the bush where it has been pressed.

withdraw the rocker shaft from the steering box and try the sleeve at the top of the shaft in the new bush.

If it is too tight a fit it will require the sleeve to be machined to fit the bush properly.

Once this is done place the rocker shaft and the thrust washer and required shims back into the casing.

Select the gasket and spread a sealant on both sides of the gasket.

Place on the casing on top of the rocker shaft and lower the side plate on alignment with the casing dowels

and gently tighten the 5/16" bolts and spring washers, drive the dowels home now fully tighten the bolts.

Put some insulating tape around the splines on the rocker shaft and slide on place the new oil seal over the shaft and press home into position.

ADJUSTMENT OF ADJUSTING SCREW & LOCKNUT:

Finally screw adjusting screw into side plate till it touches the end of the rocker shaft.

The purpose of this screw is to make sure that the roller is in contact with the cam or worm.

Do not over tighten this screw to try and get any side play of the roller out of the rocker shaft.

If there is too much side play in the straight ahead position, the shims under the rocker shaft are too thick.

This is why it is wise to have that combination of 0.001" & 0.002" shims so that it can be adjusted easily by adding or withdrawing shims.

Finally tighten locknut on adjusting screw.

Fill steering box with recommended lubricant or a semi fluid grease, tighten the filler plug.