

A club member's story on the restoration project of his

1972 Jarama S

Part 2

Dissecting a frog

PART 2

While I wait for the block I crack on and lap all valves and set the tappet gaps. This involves installing the camshafts many times and putting a different thickness shims on top of the valve stems until all gaps are about 0.25mm. This took a few days and was incredibly tedious but so vital to a correct running engine.

On the 10th July the finished block is back in my garage and it looks stunning. When nothing else is installed on it the block is not that heavy.

There are 14 days to go so the pressure is on.



Here you can see slight corrosion between each pair of large coolant channels. This is very common on these engines and the reason is because the head is hollow on the mating surface added to the fact that aluminium does react with

water. Check your antifreeze guys, as this will prevent it. I'm going to fill Kermit up with waterless coolant when I'm finished to eliminate this problem altogether.

With the sand cast block skimmed you can see the imperfections in the casting. You can just about make out that the liners are not quite flush.



This crankcase is ready so enough banter, let the assembly begin.

First Job



First job is to upend the crankcase so it sits on the flywheel end. Now install the M6 studs on the front and the timing chain drive gears. These gears must be done before the crankshaft goes in. The reason for doing this vertically is that a spacer is sandwiched between 2 ball bearing races in the timing chain gear and this spacer slips down between the 2 bearings preventing the pin from being inserted. When vertical it stays in place.

The end of the crankshaft drives these gears and then these gears drive the oil pump when it is fitted.

Studs and adjusters

Now that's done it's time to get the block on the engine stand. I've made a plate from aluminium that bolts to the flywheel end. This will attach to the M8 studs that are installed in this end.



Next job is to install the rest of the studs. There are M6 sump studs, 2 M8 head studs, the 28 head bolts and the main bearing cap studs of which there are 14 large inner studs and 14 small outer studs.



The large main bearing studs look all the same but they are not. They are 120mm in length except 2 which are 123mm. You can almost miss this difference (which I did initially) but it is important that the two longer studs are installed for cap #7. This cap is taller and thicker than the others as this is because it houses the shims that control the crank float.

I was asked why the main bearing studs were removed and the answer is they got in the way of the head skimming machine at HT Howard Engineering so they removed them.



Timing chain adjusters are installed. These devices adjust the tension of the timing chains. All oil o-ring seals are being replaced. The old oil seals were solid and broke apart. I probably should be thankful for the poor oil seals as the coating of oil in the engine bay and underneath the car has preserved the bodywork quite well.

Nice new shiny big end shells are all installed and diameters checked with the appropriate journal on the crank.



Main shells come in three differing sizes. The largest is for bearing #7 the next largest is for bearing #1 and the rest go in the others. The oil feed comes from the top of the crankcase through a groove to the bearing cap and out of two holes in the lower shell. So it goes that the solid shell is installed in the crankcase and the grooved shell is in the cap. I've done this and torqued them down (sans crank). Inside diameter on all are 63.007 and this is compared with the corresponding journal on the crank. Journals 1 to 7 are 63.002, 63.001,62.997,62.998,62.997,62.997 and 62.997. All within tolerance. Caps are then removed awaiting the installation of the crankshaft.

There has been some discussion on the Vintage Lamborghini Garage about whether the grooved shell goes in the crankcase or the cap. Some believe the solid shell should be in the cap as this shell will get all the downward pressure from the pistons. Many also believe the grooved shell should be in the cap as having a small amount of pooled oil is vital for cold starting. Anyway the manual says groove in cap so the groove goes in the cap.

Main bearing caps are stamped with the numbers 1 to 7. 1 is at the timing gear end and 7 next to the flywheel. There is also another mark on each cap to one side and I think this is an orientation mark to make sure the cap is installed the right way round. This orientation mark may have been put on by another mechanic as this is not a Lamborghini mark (officially anyway).

Having stated that, my friend Marc in the U.S. also has a Jarama and his engine has the very same orientation marks on the case and caps so it would be interesting to see more engines of this type.





Crankshaft

In goes the crankshaft. This thing is a work of art and was machined out of a solid bar of Nickel-Chrome-Molybdenum steel and took nearly a week to make. When the engine is first started there will be no oil pressure for several seconds as the oil pump sucks up oil from the sump, fills up the oil filter and pumps oil through all the little channels in the engine. Because of this every component is getting a liberal covering of nice thick green 20W50 engine oil.



Torque the caps 1,2,4,5 and 6. Tighten cap 3 but don't bother torqueing it down until later as the oil pickup goes under those nuts once all the pistons are in place. The float shims (without the tabs) are fed in the slots between the crankshaft and the crankcase at bearing 7 (flywheel end) making sure the slotted surfaces are facing away from each other.

The crankfloat is then measured (should be between 0.15 and 0.17mm) and then install the cap. The shims on the cap have a tab which hold them in place. These tabbed shims must have the slotted surface on the outside which means it is the surface next to the crankshaft.

What is the crankfloat? It is the movement end to end that the crankshaft can make within the crankcase. If there is too much movement then the big and little end bearings can suffer excessive wear.

Pistons

Piston ring gap has been checked at the top of the new bore and the bottom and it is between 11 and 14 thou. I'm happy with this so they can now be put on the pistons.



The connecting rods and ends are all marked with their weight and numbered (here we see number 5) so cap and rod can always be kept together. This is vital as the engine must be balanced or it will shake itself to destruction. It is also very important to make sure the piston is inserted into the block with the large inlet recess toward the top of the block. The pistons are inserted from the top so it is good to be gentle here as I don't want the con-rods scratching the newly fitted and honed liners. I also make sure all shells are generously covered in engine oil.

Once all pistons are in torque the castle nuts and insert split pins. We don't want these coming off mid cruise.



The weight is etched on my con rods (500 grams). For some reason Lamborghini felt it necessary to also stamp this weight on the crankcase. Why?



I'm certain these markings are by Lamborghini as once again Marc's Jarama has similar markings. His con-rod weight is 486 and 486 is also stamped on the front of the crankcase.

Now, please read this bit carefully. Some of the markings I have described are not Lamborghini marks and therefore some of the procedures I have described (or will describe) may not apply to another engine of this type. Please do not use this article alone to embark on a rebuild yourself. If you are fortunate enough to have one of these engines and mad enough to undertake a rebuild then please be aware that this article describes the reassembly of Lamborghini engine number 40949. Ask questions, and if in doubt, ask again until all doubt is gone.

I now turn the crankshaft to roughly Top Dead Centre (TDC) i.e. piston number 1 at the top of travel. Drop the timing chains in so you have roughly equal lengths hanging down for all 4 ends and then put in the oil suction pipe.

Now you can torque down bearing cap number 3.



We can now put on the sump. It is at this point I will be taking the engine off the stand and onto a bench. This is so I can attach the flywheel which is going to be an important measuring device.



Here you can see the new ring gap versus the old. New gap is 11 thou, old is 47!