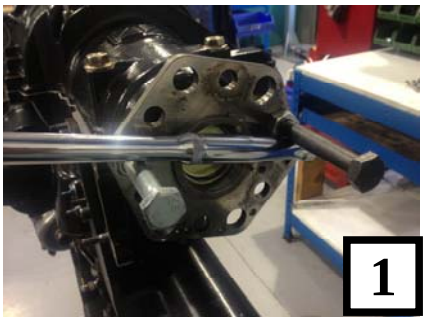
Wilksch Airmotive

Crank Gear Centre Replacement
WAM-120

Issue: A Date: 15-August-2012

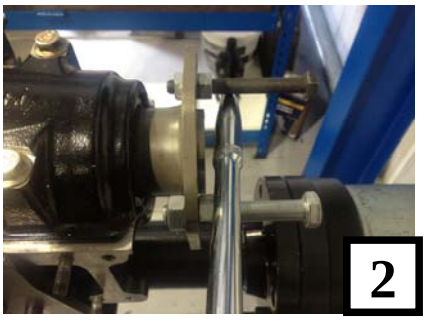
Introduction

The following instructions are only to be carried out after liaison with WAM staff and should not be distributed further. The engine must be removed from the airframe and rested on a secure, solid surface. If possible it should be strapped down to prevent any chance of movement. Throughout the procedure cleanliness is paramount and whenever the engine is not being worked on all exposed parts should be covered. The procedure must be completed fully and in the correct order as directed in these instructions. Failure to do so could cause further problems that would need to be rectified by WAM at the customer's expense. Before and during the procedure be sure to take as many photographs of the engine and its components as possible to help with re-assembly. If any parts seem worn out or damaged contact WAM for further instruction and replacements.

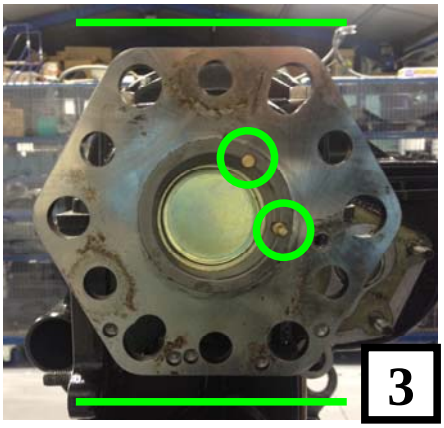


1. Rotate the Engine

The fuel pump must be removed at a specific point of the engine's cycle in order to keep its timing in accordance with the rest of the engine. To rotate the engine, begin with removing the ring gear from the nose of the crankshaft. Using two large bolts, 4 nuts, 4 washers and a long bar, assemble a similar set-up to that shown in pictures **1** and **2**. Once the engine can be rotated freely, rotate it to the position shown, using the prop governor pins and flat sides of the crank nose as reference points as shown in picture **3**. This is 30 degrees before TDC (Top Dead Centre) for cylinder No.1.

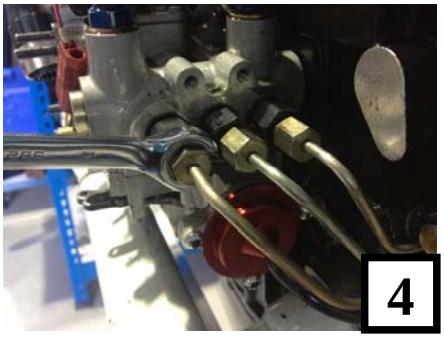


NOTE: For customers that use a prop governor and variable pitch prop, the pin in the lower right of picture **3** will have been removed, leaving an oil transfer port. This may be used to reference the crankshaft in the same way.



2. Undo Injection Lines

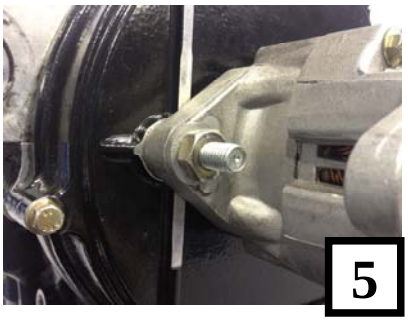
Before removing the fuel pump the fuel lines must be removed. Placing a tray underneath the engine to catch any fuel and using a 14mm spanner, undo the line collars (nuts) from the delivery valves as shown in picture **4**. Slacken (but do not remove) the bolts holding the injector line clamps to the engine.



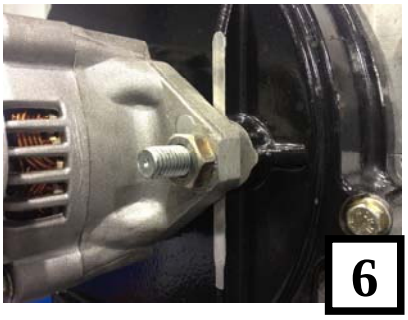
NOTE: Be sure to cover up the exposed ends of the delivery valves and fuel lines to avoid any contaminants entering the fuel system whilst the engine is apart.

3. Remove Alternator

To remove the alternator, undo the two M10 nuts either side of the unit using a 17mm Spanner as shown in pictures **5** and **6**. Take a hold of the alternator on each side and gently pull and twist away from the engine.

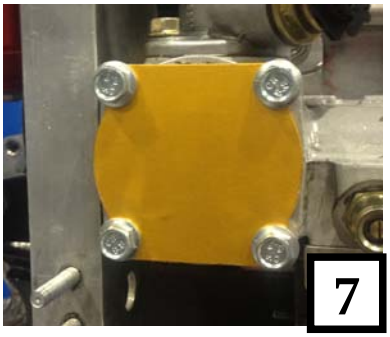


NOTE: The alternator is coupled with the crankshaft using 4 rubber bushes. Ensure to keep these with the alternator. A small rubber band or cable tie can be used to keep them in place safely whilst removed from the engine.



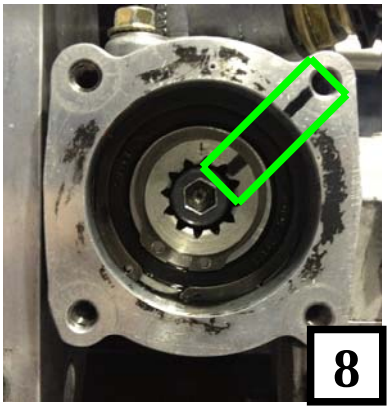
4. Remove Fuel Pump

To remove the fuel pump, remove the camshaft cover plate at the rear of the pump using a 10mm socket. Using 6mm Allen key socket/Allen key, undo the central camshaft bolt as shown in pictures **7** and **8**.



The fuel pump camshaft bolt may be so tight that the engine may rotate whilst the bolt is being removed. If this happens, steady the engine rotation using the bolt and bar set-up shown in stage 1 and ensure the engine is still set to the correct orientation as shown in picture **3**.

Do not remove the fuel pump camshaft bolt at this stage; just unwind it enough to remove the fuel pump. Clearly mark up the face of the fuel pump and the fuel pump body as shown in picture **8** to ensure that it is replaced in the same orientation afterwards.



NOTE: Once the camshaft bolt is removed, it must be disposed of and replaced with a new part directly from WAM.

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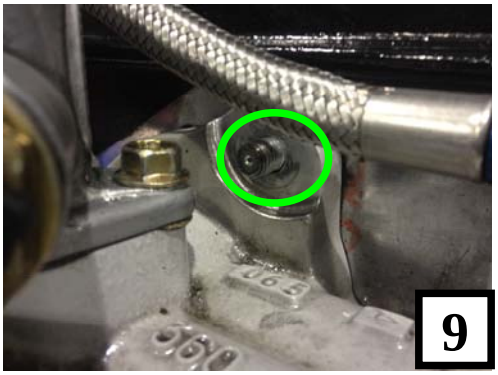
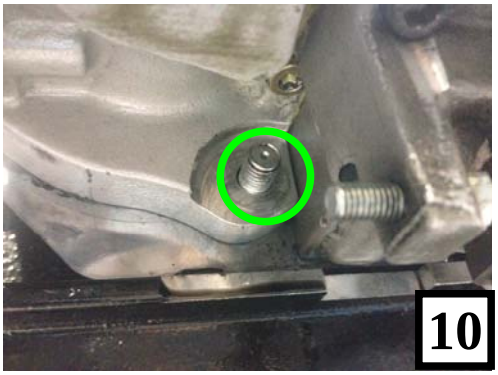
4. Remove Fuel Pump (Continued)



Then, using a 12mm spanner undo the 3 locking nuts located at the top, bottom and left of the pump as shown in pictures **9**, **10** and **11**. Once the nuts are removed take hold of both sides of the fuel pump and gently pull and wriggle the fuel pump away from the engine.

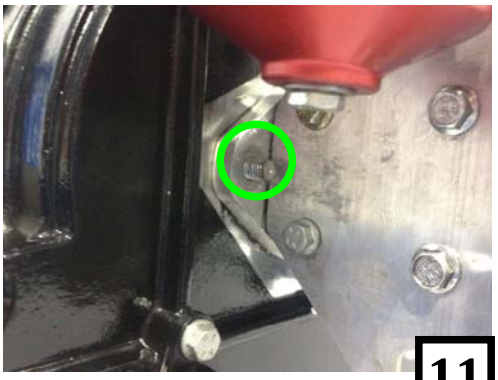


NOTE: Ensure that the pump is taken off so the timing is not disturbed.

Place the fuel pump carefully into a tray to catch any oil that will escape from it and put it into a clean, dry area where it will not be knocked or moved. If the fuel pump camshaft is accidentally rotated then the careful work taken of retaining the correct timing will be lost.

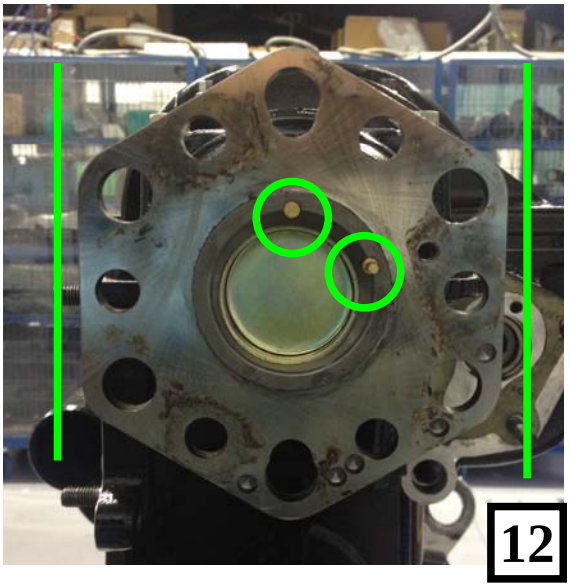
Now that the pump is removed from the engine, gently unwind the fuel pump camshaft bolt out of the pump.

Remove the 7 o-rings and star-washer from inside the fuel pump camshaft using a small screwdriver and dispose of.

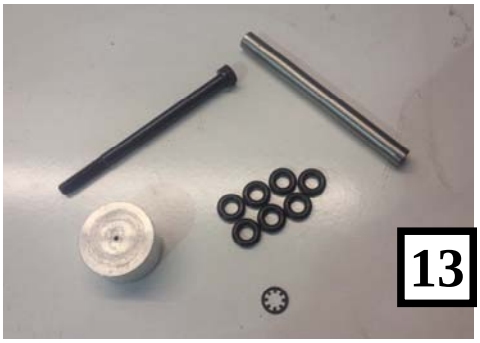


5. Rotate engine to TDC No.1

Using the same technique as used in step 1, again using the prop governor pins as a reference, rotate the crank to TDC No.1 as shown in picture **12**.

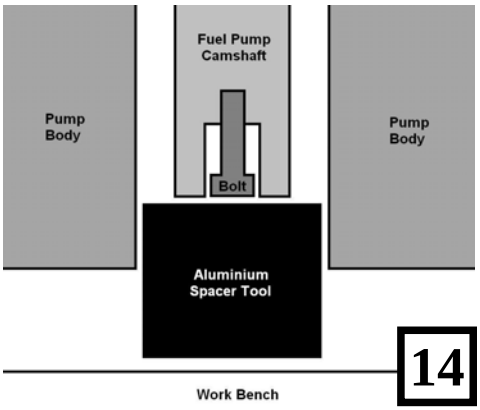


6. Insert New Fuel Pump Camshaft Bolt, Clip & O-Rings



To replace the fuel pump camshaft bolt, clip and o-rings you should have the following. An insertion tool, a star-clip, an aluminium spacer tool and 7 o-rings as shown in picture **13**. Spares will be supplied however if any of this is missing from your kit contact WAM.

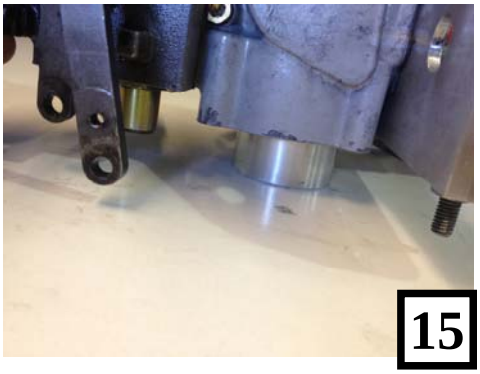
Insert the new bolt into the camshaft and seat the fuel pump on the spacer tool so that it and the bolt are held flat on a workbench as shown in diagram **14** and picture **15**.



NOTE: The camshaft bolt will have some end float (as can be seen in diagram 14) this is normal and expected as it enables easier refitting of the fuel pump to the engine.

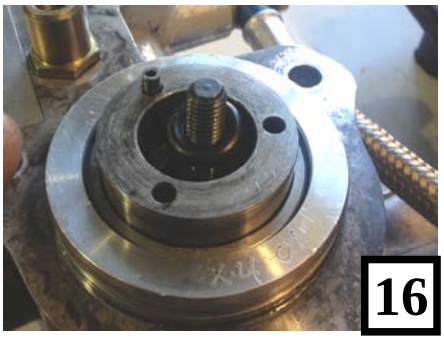
Insert the o-rings one at a time as shown in picture **16**, over the bolt and push home to the bottom of the camshaft with the insertion tool as shown in picture **17**.

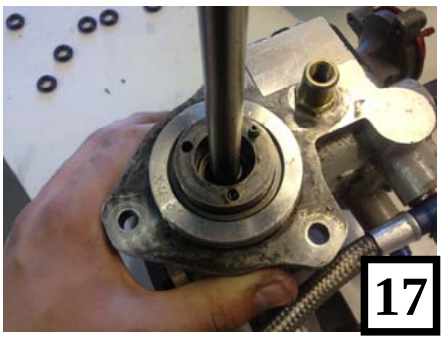
NOTE: These will need a large amount of force by hand to push home, therefore using a socket or similar on top to give a better perch is advised. Smearing oil around the o-ring can also help.

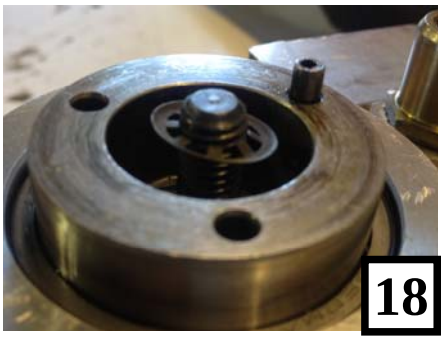


Once all the o-rings have been inserted one at a time, insert the star-clip. Ensure that it is the correct way round as shown in picture **18** (with the domed face facing upwards) and push home in the same way as the o-rings.

NOTE: The star clip will not need as much force as the o-rings. A gentle push should suffice.

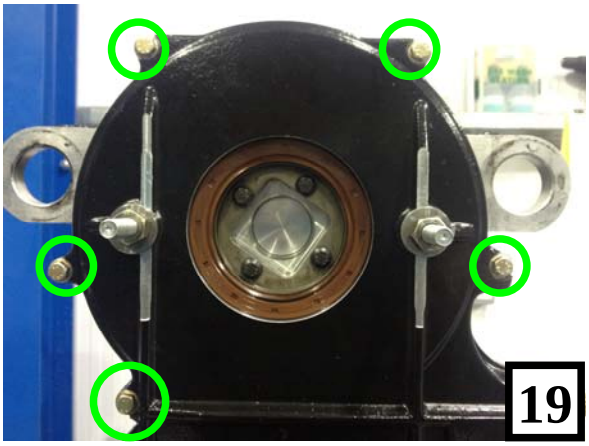


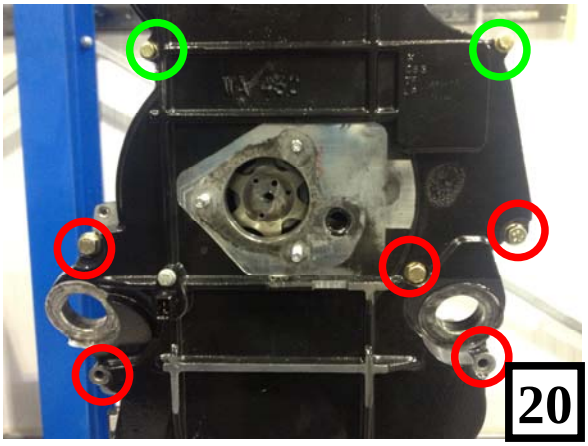




7. Remove Timing Cover

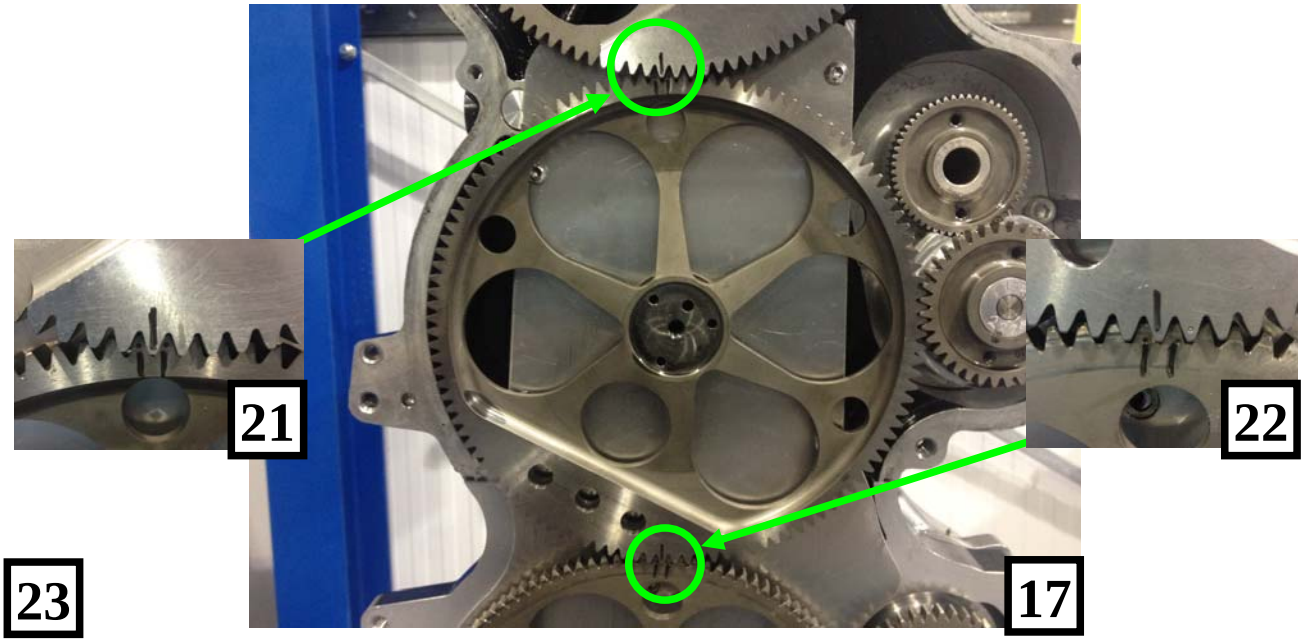
Begin with removing the six M6 (circled green) and the five M8 bolts (circled red) that hold it to the top cover, cylinder head and cylinder block as shown in pictures **19** and **20**. Then, to remove the cover, support the top with your left hand and gently tap the lower right mounting hole with a nylon hammer. Once free, gently remove from the engine ensuring not to damage the o-ring that follows the outer edge of the timing cover. Inspect all parts that are now exposed for any damage or wear.





8. Mark Gears

Using cleaner, remove any excess oil from the face and teeth of the gears. With a paint pen or permanent marker, mark the gears to show their position before removal. Begin by marking one tooth on the bottom of the upper (crank) gear, two on the top of the middle (fuel pump) gear, one on the lower of the middle gear, and two teeth at the top of the bottom (camshaft) gear as shown below in pictures **21**, **22** and **23**. If the factory made circular markings do not line up don't worry. Your markings will be used to replace the gear in the exact same place later on. Be sure not to remove your markings through handling or further cleaning.



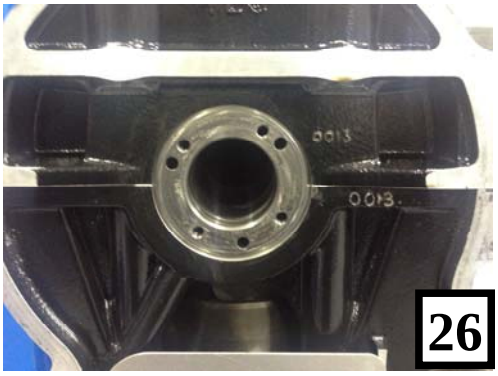
9. Remove Fuel Pump Gear

Once the gears are clearly marked gently pull the middle (fuel pump) gear away from the engine. Once removed, inspect the teeth on all of the gears for any chips or breaks. Contact WAM, preferably providing photographs, if there are any teeth that are of concern.

10. Unbolt Crank Gear & Centre

When removing the crank gear centre and gear from the end of the crankshaft it is important to record the break-off torque's of the 4 bolts. Using an 8mm socket on a torque wrench set to around 10Nm, attempt to undo the bolts. At 10Nm the torque wrench will reach its breakpoint and signal the fact that it has reached its set figure by making a snap or crack noise. When this occurs it is important that the applied force is stopped immediately else an incorrect torque will be applied. After a torque fails to undo the bolt, increase by 1Nm and repeat the process. Do this for all 4 bolts and record the values ready to send to WAM.

Once all the bolts are removed, gently pull the gear assembly away from the engine.

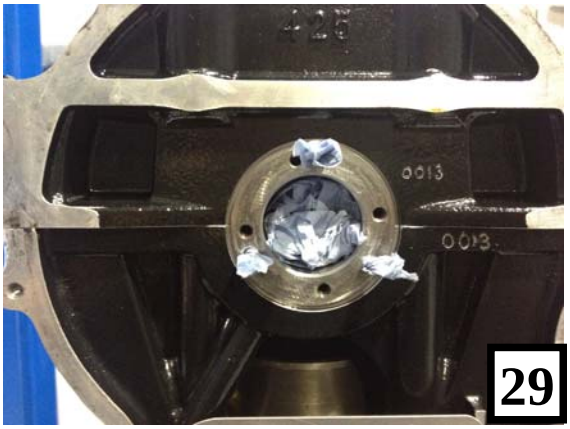


NOTE: Dispose of the old bolts and replace with new new parts directly from WAM.

11. Remove The Old Gear Centre

The centre is only a very light interference fit so requires little force to remove. If you use a press, rest the gear face up with as much support on the flat as possible (as shown in picture **28**). Ensure that the centre can be removed freely and will not foul on the supports. Using a press tool of appropriate size gently apply pressure to the aluminium centre.

NOTE: If this is being carried out on a press there should be very little, if any, reading on the load gauge as the centre is being removed. If there is, stop immediately and ensure the centre is free to drop down.



12. Stone Crank Face and Clean

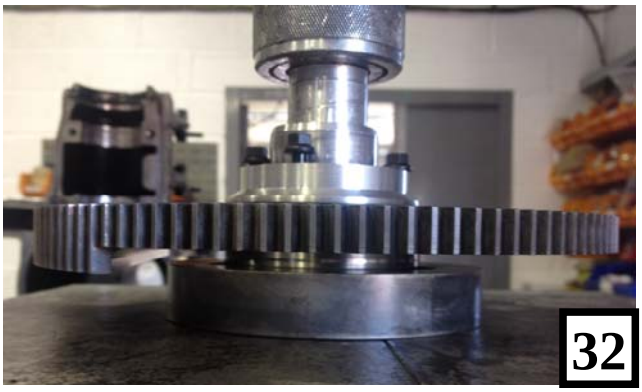
Before installing the new crank gear spacer the mating face of the crankshaft must be cleaned using an oilstone. First, bung the oil ways in the end of the crankshaft to stop any dirt ingress as shown in picture **29**. Rub the stone around the mating face of the crankshaft to ensure that the new gear has a flat, clean surface to seat against on as shown in picture **30**. This will reduce any fretting marks that have been caused by the previous gear centre. Whilst stoning, it is advised to clean the face regularly using cleaner or light lubricating oil applied to a piece of cleaning towel.

NOTE: Do not spray with cleaner directly onto the end of the crankshaft as this may seep into important parts of that engine that require lubrication.

Once completed the face should look similar to the example pictured in picture **31**.

13. Press New Spacer Into Gear

To press the new gear centre into the gear, first ensure that both components are clean and undamaged.

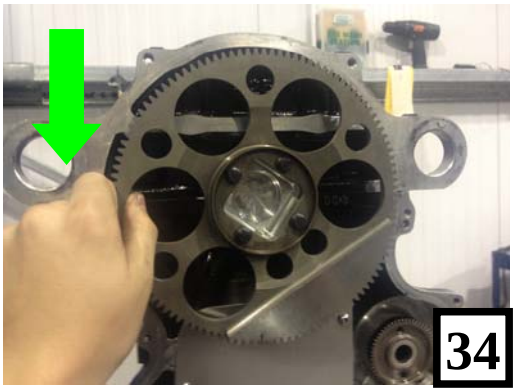


Support the gear by placing it face down and supported on a flat surface as shown in picture **32**. To ensure correct orientation, use the bolts to line up the holes correctly as shown in picture **33**. Ensure that the O-Ring is seated correctly in the groove in the gear (a smear of silicon grease can help keep the o-ring seated) and in good condition. Once in line and seated on top of the gear correctly, apply gentle pressure using a press to insert the gear centre into the centre of the gear.

NOTE: As with the removal this should not require any significant load. This process can be aided by heating the gear in an oven (up to a maximum of 100°C) and/or putting the spacer into a freezer.

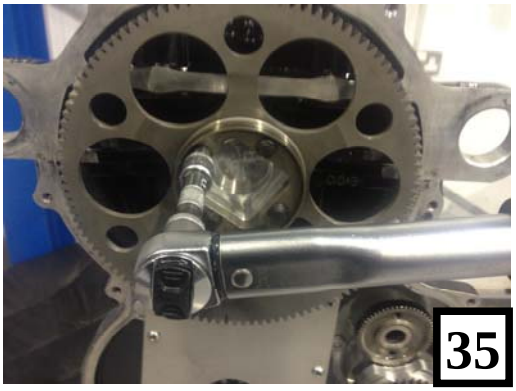
14. Install New Gear Assembly

Place the assembled crank gear centre and crank gear into the end of the crankshaft ensuring that the timing marks you made earlier are at the bottom, this will line the assembly up closely to the correct bolt holes in the end of the crankshaft.



NOTE: Use new bolts supplied by WAM only and oil threads before insertion.

The crank gear centre must be loaded firmly anti-clockwise to remove any backlash as shown in picture **34**. Whilst loading the gear anti-clockwise tighten the bolts evenly to a “nipped up” state, and then final torque to 25Nm. It is critical that there is no deviation in this torque figure. Double-check both the torque wrench and the bolts to ensure that the bolts are fastened correctly.



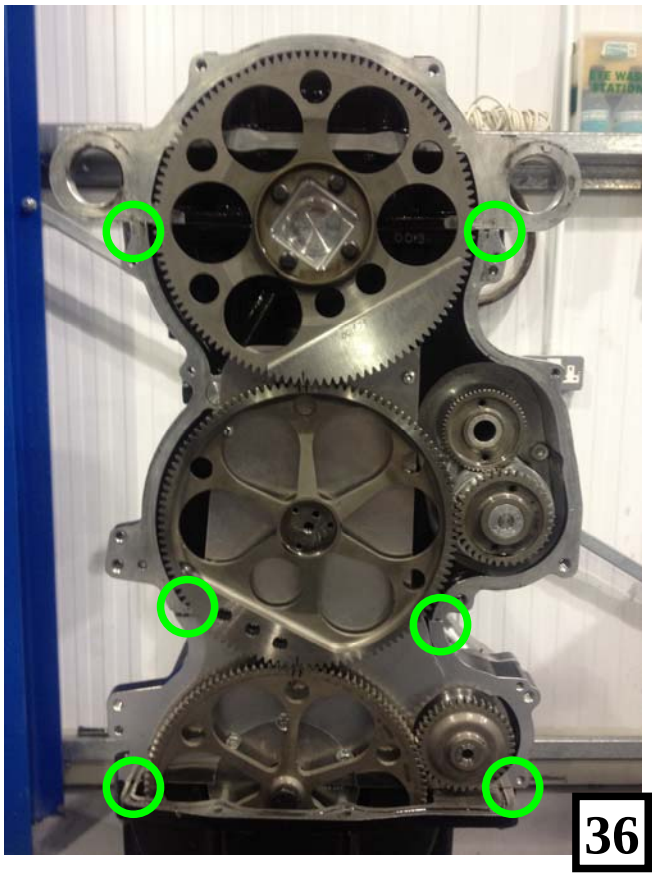
NOTE: The crankshaft may move during the refitting of the gear, therefore it is important to check the crankshafts alignment is still correct once the gear has been replaced. If not, re-align as detailed previously in section 5 before continuing.

15. Replace Fuel Pump Gear

Using the timing marks that you marked earlier, replace the fuel pump gear into its bearing as shown in picture **36**. Ensure that the blower gear on the right is correctly meshed else the fuel pump gear will not seat correctly.

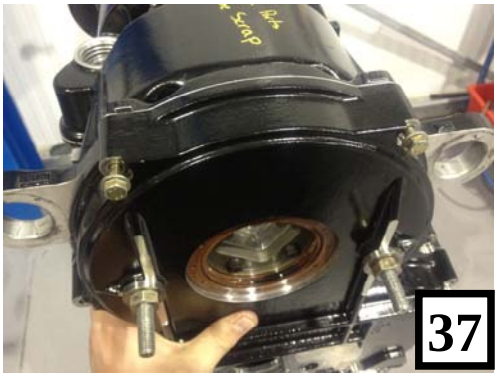
This should be an easy, gentle insertion and not require any force.

If either the crankshaft gear or camshaft gear have moved slightly since removal then, using your hands, gently rotate the gears as required. DO NOT use any tools.

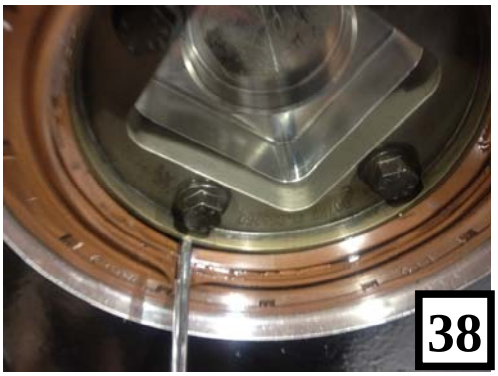

36

16. Replace Timing Cover

Clean both the inside and outside of the timing cover thoroughly and ensure that the o-ring cord around the outer edge is in good condition. Also inspect the rear crank seal to ensure that this is in good condition and in no way damaged, especially on the sealing lip. Clean the mating o-ring face on the top cover, block and head to ensure a good seal and clean any oil reside from the o-ring and crank seal.


37

If the original o-ring around the outer of the timing cover is damaged or perished, use the replacement part supplied. This must be cut to length and held within the o-ring groove using silicon grease. This will allow it to stay seated within its groove whilst the timing cover is held upright during installation.


38

NOTE: Do not replace the o-ring unless necessary as this might cause a new leak. If unsure, contact WAM.

Using the black silicon sealant (Loctite 5910) smear a pea size amount over the joining faces circled on picture **36**.

Continued on next page.

16. Replace Timing Cover (Continued)

Rest the cover over the gears and partially insert the top two bolts as shown in picture **37** to hold the weight. To seat the crank seal around the crankshaft gear a small, blunt flat bladed screwdriver can be used as shown in picture **38**. Gently push the timing cover on using your left hand and at the same time run the screwdriver in a circular motion between the crank gear and the seal as shown in picture **38** until the cover seats flush with the engine. Ensure that the screwdriver has no sharp edges that could potentially slit or scratch the surface of the seal (polish it with some fine grade abrasive paper and clean thoroughly)

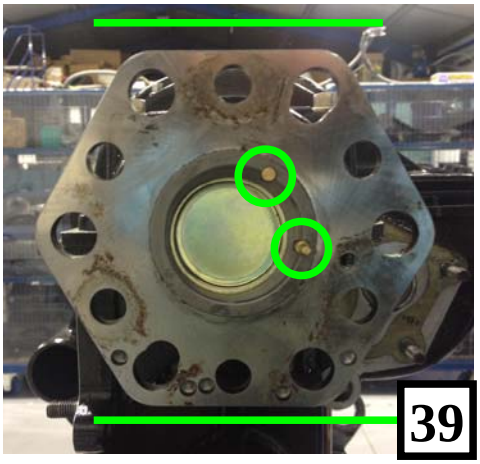
NOTE: It is easy for the o-ring seal to come out of its grove during this process. Check that this has not occurred before continuing. It is a lot less effort to remove and refit the cover several times at this stage than having to fix a leak later!

Once the cover is seated up flat against the engine and the crank seal is correctly seated, replace the six M6 and the five M8 bolts. Gently nip up all bolts to first ensure the cover is correctly seated and torque the M6 bolts to 12Nm and the M8 bolts to 20Nm. Again, double-check both the wrench and the bolts to ensure they are fastened correctly.

17. Replace Fuel Pump

Begin by rotating the crankshaft back to approximately 30 degrees before TDC No.1 as shown in picture **39**. Ensure that both the timing cover and the fuel pump are both clean and free from damage before continuing.

The fuel pump will only sit flush to the timing cover when the timing pin is correctly located into the gear. When everything is correctly orientated the fuel pump will solidly slot into place.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To insert the pump, line it up onto the studs on the timing cover and gently push the pump towards the engine. If the pump does not slot into place first time, keep gently pushing and rotate the engine by a few degrees via crankshaft both clockwise and anticlockwise. This will rotate the gear inside the timing cover and should align the pin in the fuel pump camshaft with the original hole.

WARNING: The rotation should only amount to a few degrees in each direction. Any more and the pin could enter an incorrect hole, setting the timing for the fuel pump incorrectly.

Once the pump is slotted into place the fuel pump camshaft bolt must be gently wound in and torque to 30Nm. Followed by the 3,12mm locking nuts shown in pictures **9**, **10** and **11** to 20Nm.

18. Replace Injection Lines & Alternator

Replace the injection lines to the fuel pump and tighten until solid using a 14mm spanner. Tighten the injector line clamp to 12Nm.

Ensure that the Alternator rubbers are in good condition and seated correctly around the square on the Alternator drive. Line up the rubbers on the drive to the shape in the middle of the crankshaft (as shown in picture **40**) and gently push home.

Re-attach the alternator to the timing cover using the two 17mm locking nuts and torque to 30Nm.

19. Clean, Inspect and Test

Once the engine is back together, thoroughly clean all exterior surfaces and ensure that everything looks the same as the photographs taken at the start of the procedure. Run extensive ground tests and check for leaks, especially around the timing cover, fuel pump and injector lines.

If there are any issues once the procedure has been completed, contact WAM immediately.