#### Removing the engine oil pan

(engine was out of car for illustration)

Remove the vac reservoir bracket/foam insulation (2x 8mm allen head bolts) pictured previously if you haven't removed it yet.

Remove the oil pan (2x 16mm bolts and 18x 5mm allen head bolts, some indicated below). Use the 5 mm long ball end allen (metalnerd <u>MNQ6H5</u>) on the 2 allen bolts by the transmission. The transmission is normally in the way so you have to get them at an angle (reason for using ball end allen) or use some extensions and joints. There are also 3x 16mm bolts and a nut that attaches the oil pan to the transmission. The oil pan should come off easily so if it's still stuck, check for missed bolts. If you're sure it's free, gently tap around the edge of the flange with a block of wood. Once it's off, cover the exposed engine parts and use a razor/green scotch brite to clean the sealing surfaces as much as possible.

**WARNING**: when removing the last 2 middle bolts on the transmission side, make sure you're not removing the rear main seal bolts!





Remove the front oil seal flange (6x 10mm bolts, pic is from an earlier step). Once it's off, put a few drops of PB Blaster or other penetrating lubricant around the edges of the oil seal and let it penetrate for at least a minute. This will make seal removal much easier. Press out the old front crankshaft seal from the backside with a socket of the appropriate diameter wrapped in tape to prevent scratches to the sealing surfaces. <u>Do not install</u> the new front seal.

Note - the crank lock tool was not sitting on the sprocket correctly or in the hole on the front seal carrier, it should be a little to the right when placed correctly. Pic was for illustration only.



# Replacing the balance shaft module and oil pump

Remove the lower plastic chain cover (2x T20 torx screws, white arrows). Note the green arrows for a

# later step.



Loosen the small oil pump sprocket bolts (4x 6mm allen, one of the bolts pictured already has an allen bit on it). Put the crankshaft sprocket back on (with crank yank attached) to counterhold the chain and small oil pump sprocket.



Remove the oil chain tensioner, the green arrows in the previous picture (2x 8mm triple square and 1x 6mm allen head bolt). Mark the direction of the oil chain if you are going to reuse it and remove it along with the small sprocket (since you loosened the bolts earlier). These parts will not be reused on the new assembly.

Now prepare to remove the oil chain's crankshaft sprocket. The service manual shows use of VW puller T40001 with claws /3 and /5. Others have suggested and I suggest using VW puller T10392 as shown below but the puller arms need to be ground down a little to fit correctly. The advantage is that it pulls much closer to the base of the sprocket, has 4 arms instead of 2, and it's much less likely to shatter the

sprocket and make it very difficult to remove. You could use a 3 arm puller but this tool has 4 evenly spaced arms and is easy to use. If the sprocket shatters, remove the nearest crankshaft bearing main cap (#1 cap, 2x 17mm bolts) to get clearance and knock off the sprocket from behind. The crankshaft cap bolts are single use only bolts so if you remove them you must replace them.



Squirt some PB Blaster or other penetrating lubricant at the base of the sprocket and clean the sprocket snout to help avoid scratches. It needs time to penetrate and the sprocket is so tight I'm not sure it can penetrate at all. If not, it should help lube the sprocket as it comes off. Take this time to modify the puller to fit correctly.

The pegs on puller T10392 are round. Slightly grind the inside face of the pegs to clear the sprocket holes as pictured below and by the red line. Don't remove too much! Once that's done, squirt some more lube around the sprocket.



Unscrew the main bolt on the tool. Insert the base plate that came with the tool into the crankshaft bolt hole and put the puller on top of that. As you tighten the bolt, tension will increase until the sprocket comes off. Tighten it a few turns, wait, then tighten it a few more turns. You can gently tap the tool's bolt with a rubber mallet to help shake the sprocket off. Don't try to pull it off too fast, let the tension come down slightly before tightening it more.



If you rented the tool from myturbodiesel, hand tighten the main bolt on the tool back in for return shipping (so it doesn't stick out).

Loosen the 6x 10mm triple square bolts and 2x 8mm triple square (also has 10mm hex head) bolts holding the balance shaft assembly from outside to inside in a diagonal sequence, starting from the outside in. First loosen them all about 1/2 turn before loosening them further and removing each bolt. This helps avoid stressing the assembly or block. If you need a suggested order, refer to the picture below showing the tightening sequence and do it in reverse. Make sure you're not loosening the other bolts. If you look at the sides you can verify which bolts hold the module to the engine.

<u>Prime the oil pump before and during installation</u>: 90% of the time the oil pump will prime itself but if an air bubble is trapped inside, the engine will have NO oil pressure and you'll have to redo everything. Putting oil into the pump and manually moving it around should be enough. You could also pump oil through the oil filter housing's pressure switch.

BALANCE SHAFT DELETE - skip these steps - see the end of this article for the different procedure.

#### Then continue at front cover installation.

Put the new crankshaft gear in an oven and bake it to around 430oF for 20 minutes. Do not exceed 464oF. The best way to measure the gear's temperature is with a "laser pointer" style non contact thermometer on the inner diameter (the hole) on the gear. According to runonbeer and mogolf, it won't go on at about 390oF (200oC) but will easily slip on at about 430oF (220oC). Place it on the middle rack without foil to evenly heat both sides of the gear. I suggest cleaning it before cooking it to avoid an oil odor in the oven. While you're waiting, you can put the balance shaft assembly on the block because the crankshaft gear can go on before or after the balance shaft assembly.

Using a heat resistant glove and a large socket, press the heated new gear onto the crankshaft all the way. Use a large socket or another round tool to firmly hold it flat against the crankshaft until the gear cools and tightens around the crankshaft. It must be perfectly flat or else the new gears will be damaged. If in doubt, use the sprocket puller and reheat, then try again.

The flat side of the crankshaft gear's center hole (the side with the letters/numbers) should be facing you and visible when installed. The other side (tapered side of the center hole) should be facing the curved part on the crankshaft snout. On my install I could see a small ridge just beyond when the sprocket meets the crankshaft as shown below left and right. I believe that one of the ridges was visible just past the gear after installation and wasn't a wear mark from the old oil seal. I could be wrong but your engine will probably have this too either way.





Remove the 2 assembly sleeves/alignment pins from the old module and put them on the new balance shaft module. Gently tap them in all the way. It's normal to have a split lengthwise. During removal, I suggest using pliers wrapped with a shop rag to help avoid marring them.



Lock the balance shaft position with T10255 - it will only fit at one orientation. This holds it at the correct position when the rest of the engine is at TDC.



You can use detailing clay to help stick it in place or have a helper hold it centered.



Install the new assembly on the engine. Make sure the dipstick is out of the way when you reinstall the assembly. It won't hurt to just remove it entirely. In the picture below you can see that mine got stuck to the side of the balance shaft module. If you're unlucky it will get stuck under the module and you'll have to get all new torque to yield bolts if you torqued them to their final torque spec.



The shorter hex head/triple square bolt goes to position "8". The two bolts labeled "5" and "7" are 8mm triple square/10mm hex head bolts. One of the 8mm triple square/ 10mm hex head bolts is longer, it'll be obvious where it goes. The other bolts are all the same.

**Note**: the order of tightening shown here is the same as the service manual and the first .pdf installation writeup by oilhammer/mogolf. The labels are different from the .pdf installation writeup because the picture below is oriented the same as the picture in the service manual (front of engine to the right instead of to the left).

Tighten all bolts to 6 ft-lb. Then tighten in the sequence pictured below. The 8mm triple square bolts "5" and "7" are torqued to 9.6 ft-lb. Other bolts to 14.8 ft-lb. (**CAUTION**: make sure to reset your torque wrench to the lower value when tightening bolts 5 and 7!)

Then tighten each bolt a final 1/4 turn (90o) in the correct sequence. Make sure you're not tightening the other bolts since they're mostly 10mm triple square. If you look at the sides you can verify which bolts hold the module to the engine.



Install the balance shaft gear but keep its 4x 10mm bolts a little bit loose (see below pics). Leave one bolt off to make sure the holes are about centered.

Install the intermediate gear, noting the thrust washer's ears underneath the gear (they should fit into a cut-out), and keep its 14mm triple square bolt loose - it must be able to move a little! This spot for the gear and the small oiling hole is why you cannot convert your old assembly to gear drive.



Put the front main seal flange and the crankshaft sprocket on. Put the bolts on but don't tighten them much or to their final torque. You just want to make sure the front flange is flat so you can set the crankshaft to TDC. Install the crankshaft lock at TDC. Make sure the balance shaft lock is still in place and flat.

The balance shaft gear bolt holes should be in the middle as shown below in the yellow box highlight. They should not be right on the edge of the holes.



Place the intermediate gear on and test fit it. As you you slide it into place, the balance shaft gear bolt holes should stay about in the middle. Again, note the dog eared washer underneath. With the gear in place but not tight, tighten the 4x 10mm balance shaft gear bolts in place to 15 ft-lb (20 Nm) but don't add the final 1/4 turn yet. I suggest not adding the final turn so you can check for play. Once the bolts are tightened to their final torque they cannot be reused. Remove the balance shaft lock.

Note: the intermediate gear coating should be uniform around the gear teeth. This coating will wear away with use and this sets the correct gear lash or play. If the gear has a painted dot on the face and the coating is only at one spot, install the gear so that the coating is touching the other gears. When you tighten the intermediate gear it's normal for the balance shaft and gear to <u>slightly</u> rotate.

Use a piece of wood to push **hard** on the intermediate gear in about the direction of the blue arrow (between the crankshaft and balance shaft gears). While pushing on the intermediate gear, tighten the 14mm triple square intermediate gear bolt to 15 ft-lb (20 Nm) but do not add the final 1/4 turn, the final torque. Again, you should have loosened it (it's lightly installed from the factory) enough so that it can slide when you press on it but have it tight enough so that it won't be lift and be crooked.

The purpose is to test fit the gears and check for gear backlash and gear motion. Once you tighten the bolts to their final torque (the extra 1/4 turn) the bolts should not be reused. The gears should have no backlash (play when turning) and should move smoothly and be tight. The crankshaft lock should be at TDC and the balance shaft lock should slide in and out. Double check that the dog eared washer under the intermediate gear isn't crooked and pushing the gear out. The gears should be relatively flush and it should look like this from underneath:



If it passes these tests, add the final 1/4 turn to the 14mm triple square intermediate bear bolt and then to the 4x 10mm balance gear bolts. When you tighten the intermediate gear, <u>push hard on the intermediate gear as before</u> so that it won't move at all. The front flange is aluminum and can't counterhold using the timing belt crank tool (the black thing with the handle and teeth) so I suggest using the crank yank to counterhold the crankshaft sprocket when tightening the bolts. Again, there should be no backlash in the gears when done. This check is one addition vs the original .pdf writeup. The reason I changed the order slightly to include this check is so that you can check the gears before tightening the bolts to their final torque. The people who wrote the original .pdf procedure are experts and know how it should look and feel. I added this suggestion to help but the installation method you do is up to you.

To install the front seal flange, first remove all old gasketmaker with scotch brite and a razor. Wipe the sealing surfaces clean with brake or carb cleaner to prepare them for new gasketmaker. Proper surface preparation is important in making a good seal! Put a bead of gasket maker about 3mm thick around the

flange, always around the inside edge of the bolts, and evenly press/tighten the bolts to 11 ft-lb to seal the front flange. More is not better since most of it will get squeezed out.

Clean any rust or oil off the crankshaft snout.

Now install the crankshaft oil seal (size: 35x48x10, double check the box label or seal size to make sure you're not using a camshaft seal!) using VW tool# T10053 seal drift. This is a 2 piece drift - the first one covers the ridge on the crankshaft and stretches the seal and lets it slide over the crank lip without damage to the seal. This prevents the lip from folding over - teflon seals are vulnerable to lip damage but seal better. The second is pushed by the old crankshaft bolt. Tighten the bolt gently (don't use an impact wrench, just tighten it with gentle wrench force since the tool is plastic!) until you feel resistance from the tool or bolt. If you have a teflon seal (papery material, no spring, the preferred seal type) do not use oil to lube the sealing surfaces because the service manual says to install the seal dry. You just let it sit for a while before adding oil (the time it takes to put everything back together is plenty). If you have a rubber crankshaft seal (has a spring inside the lip), lube the seal's crankshaft contact surface (inner diameter) with oil before installing.

If you rented the tools, please don't use harsh chemicals to clean the tool since it's plastic. Just wipe it clean and wrap it in bubble wrap like it was delivered. The other heavy metal tools in the box can crush this during shipping.



Install the oil pan using the same techniques as the front flange. Tighten the 5mm allen head bolts in a diagonal pattern to keep it flat and even to 11 ft-lb. Tighten the 2x 16mm bolts to 30 ft-lb.

Install the crankshaft sprocket with a new 19mm 12 point bolt (it's a single use stretch bolt) and tighten the bolt to 88 ft-lb + 1/4 turn. Again, make sure to counterhold the sprocket during installation!

The subframe alignment pins are needed to align the subframe to the body. If anything shifted you have to get the wheels off the ground to shift the subframe back into position. The pins should be in their holes and the same position as before loosening the subframe. You can look for dirt outlines on the frame rails to show the approximate old positions of the aluminum engine mount bracket. First tighten the 2x 13mm bolts holding the transmission mount to the subframe. Then put the rear subframe into position but don't tighten the bolts. Then align the front subframe (refer to the pics in part 1) and tighten it. Then tighten the rear.

The subframe shouldn't have moved but you should get a wheel alignment. If the alignment tools go in and out in the same vertical-horizontal position exactly as before then alignment should be unchanged. The reason you may need an alignment is because the suspension is attached to the subframe. I recommend the alignment tools instead of a socket because the tools won't fall down through the holes (there's a lip that holds it) and is an exact fit. If the subframe is slightly off you can feel the tools catching. When aligning the subframe the car cannot have its weight on the frame rails, tires, or suspension. This is because the weight will move the subframe and it's not possible to align it. You must have the engine weight supported (so you can shift the subframe as needed) and the car's weight on the factory jack points.

During replacement of the subframe bolts, install the new bolts one at a time while the other bolts are almost tight. This ensures that the subframe doesn't fall down and stays roughly in alignment.

The rest of installation is the reverse of removal, refer to to <u>1000q: Passat TDI Timing belt install</u>, <u>1000q:</u> <u>lock carrier service position Passat</u>, <u>1000q: Passat Audi coolant drain flush and bleed</u>, <u>1000q: engine oil</u> <u>change</u>, and <u>1000q: splash shield fastener list</u>.

If your engine mounts were bad, refer to <u>1000q: motor mount replacement</u>. Since you didn't disconnect the transmission mounts from the transmission (you only disconnected them from the subframe) you shouldn't have to align them. If you did, refer to <u>1000q: transmission mount replacement and alignment</u>.

## Torque specs:

5mm allen head oil pan bolts: 11 ft-lb 2x 16mm oil pan bolts: 30 ft-lb (if you had to remove main bearing cap #1) 48 ft-lb + 1/4 turn 6x 10mm front crankshaft seal flange bolts : 11 ft-lb 19mm 12 point crankshaft bolt: 89 ft-lb + 1/4 turn (90o turn) (additional 1/4 turn may occur in several stages, bolt threads/head should be dry and free of oil) (2x per side) 18mm aluminum motor mount bracket bolts: 55 ft-lb (1x per corner, single use only) 18mm long subframe bolt (for both front and rear): 81 ft-lb + 1/4 turn (2x per side) 13mm rear subframe bracket bolts: 15 ft-lb (2x per side) 13mm transmission mount bolts: 17 ft-lb (1x per side) 13mm engine mount nuts: unknown but 17 ft-lb should be enough

### Additional notes for balance shaft delete with ALH oil pump

from <a href="http://www.myturbodiesel.com/forum/f5/hello-2005-passat-tdi-bhw-balance-shaft-oil-pump-delete-19287/">http://www.myturbodiesel.com/forum/f5/hello-2005-passat-tdi-bhw-balance-shaft-oil-pump-delete-19287/</a>

Plug the oil feed hole for the balance shaft. If you do not plug this hole the engine will have low oil pressure. You can tap it (1/8" pipe tap, 5/16) and insert a short bolt w/red locktite.



Install the oil pump - the windage tray may not be snug so MBenzman added a spring and safety wire to hold it in place.

Torque the oil pump mounting bolts to 15-25 Nm (not sure of the exact value). I would feel comfortable at 20 Nm which is 14-15 ft-lb.



The BRM oil pump sprocket will increase the oil pressure but the ALH will work. NOTE: The ALH chain has 25 links. The BRM chain has 23 links. If you use ALH chain you must also use the ALH sprocket (31 teeth). BRM chain goes with BRM sprocket (23 teeth) (thanks harley-shy)





Continue the procedure at front cover installation.