How to remove the mk3 TDI injection pump and swap mk4 ALH IP into your car

difficulty: removal and replacing the IP: 3/5, swapping mk3 for mk4 pump: 4/5 back to 1000q: mk3 jetta and passat "how to" index

Introduction

This article shows how to remove and swap a mk3 TDI injection pump (IP) for an ALH engine fuel inejction pump.

The original idea by dieselgeek.

NOTE - if the injection pump is leaking fuel, it does not need to be rebuilt due to only a fuel leak! Fuel pumps can leak due to old seals. Switching from a high percent biodiesel to ultra low sulfur petrol diesel or from low sulfur diesel to ultra low sulfur diesel (USLD) can also cause leaks. All retail diesel sold in the US is now USLD. Even if the pump doesn't say so, the oil refinery has switched over. Switching to a high percentage of biodiesel may swell the seals and stop a small seep.

A rebuild would also restore lost IP efficiency but isn't economical just for a leaking seal. The top cover seal can be replaced in 5 minutes with a special triangle and torx sockets, see 1000q: pump top cover replacement for the procedure. The middle seal requires a VCDS and the triangle security and torx sockets. The head seal can also be replaced while the pump is on the car although it requires you to disconnect the metal fuel pressure lines, here is the procedure from dieselgeek. The rest of the seals can be replaced with the pump off the car. Even a small leak can cause hard starting or lost efficiency and over time will melt the coolant hoses under the pump.

The only reason why I rated a mk4 pump swap 4/5 is because the project requires you to source parts yourself and is one step beyond timing belt removal which requires the timing belt tools. It requires machining of parts because there are no pre-assembled kits for the swap. The reason why you cannot directly bolt on a mk4 IP into an mk3 is because the bracket is slightly different and the electrical plug is a different shape. The sprocket also has to be machined down to fit under the timing belt cover. The rear timing belt cover also has to be modified for the new IP. Expect your car to be down for 2 days unless you buy a spare bracket and sprocket and have them machined ahead of time.

The benefits of using an ALH IP are greater parts availability, higher pressure compared to a 1Z mk3 passat pump (but similar pressure to an AHU mk3 jetta pump), and the availability of replacing your stock mk3 10mm pump with an 11mm pump from mk4 automatic transmission cars (that used an IP, pumpe duse TDI (2004-2006) did not use the Bosch VE IP). This will raise pump pressure even more. In theory, higher fuel pressure (everything else being equal) lets you inject the same amount of fuel in a shorter duration and with better atomization. This can give greater fuel economy, less smoke, and more fuel injected (more power). I would not suggest this swap for economy since the increased fuel efficiency will never come close to the expense of a new injection pump. In addition, I found no increase in fuel economy after the swap. And although the pumps are all swappable in theory, in reality, a few people have reported operating problems. This could be due to some strange electronic problem or incompatibility. In most cases, 10mm and 11mm ALH pumps have been swapped and work fine.

If the injection pump body is smooth, you have the 1Z pump or someone swapped it onto your AHU engine. The AHU and ALH pumps have ribbed bodies, see pictures throughout the article if you're not sure, the last picture in this article shows the ribbed body pump. If you have an AHU engine, you may not see a worthwhile increase in pump pressure over using a rebuilt AHU IP. The advantage is that it may be more economical and give you less down time than buying a spare IP that is known to be good, rebuilding it to new specs, and shipping it back and forth.

Both procedures require at least partial removal of the timing belt. Unless you just put a new timing belt in, it's a good idea to put a new timing belt kit in while you are there. See 1000q: timing belt_removal and 1000q: timing belt_part 2 - installation for more details. Normal replacement interval for the mk3 TDI timing belt is 60,000 miles. Mk4 cars can use a 100,000 mile timing belt kit, it has nothing to do with the injection pump, it's a property of the pulley bearings, etc., and won't work on the mk3 cars. Although a 10mm ALH pump will not significantly change the stress on the timing belt, a larger 11mm pump will slightly raise the stress on the timing belt. Lower your timing belt change interval if you are using an 11mm pump on an AHU/1Z engine. Since timing belt failure will cause engine damage, there is no recommendation on a suitable interval so use your best judgment. This website is not responsible for your work, read the TOS agreement for the full legal disclaimer.

Here are the various known VW part numbers for the pumps. An "X" after the part number indicates that the pump is a rebuild. Make sure the ALH pump has the grey hub attached since, unlike the AHU/1Z pump, you can't index the hub to the shaft!

mk3 1z stock IP 10mm (90hp, 5 speed trans) : VW # 028 130 115 g, 028 130 110 N

mk3 AHU stock 10mm IP (90hp, 5 speed trans):

mk4 ALH stock 10mm IP (90hp, 5 speed) : VW# 038 130 107 d , #038 130 111 b (discontinued #s) , 038 130 107 k (replacement #)

mk4 ALH stock 11mm IP (90hp, auto trans) : VW# 038 130 107 j

Caution: I will not buy any part made by emiata aka. prothe, vwdieseltools, volksdiesel, dieselvw because they are probably low quality counterfeit parts. Many people have had bad experiences with this seller and his parts. I also had a bad experience so never again.

Parts (click links to compare prices or have an idea of new part price)

for removal or replacement 10, 13, 14, 15, 17mm socket/wrenches, 17mm flare nut wrench for fuel lines rubber/vinyl gloves

timing belt tools, see timing belt article for more details

1Z/AHU_injection_pump

for swap

ALH injection pump - can buy used, in new condition as a "take off" from a crate motor, or rebuilt

ALH sprocket VW# 038 130 111 b ALH sprocket bolts (size:M8x16) VW # n 903 285 04

ALH pump electrical plug VW# 1J0 973 735

VW terminal release tool (optional but highly suggested)

10mm_TDI injection_pump

11mm_TDI_injection_pump (from auto but can put on manual)

Optional

ALH, 1Z, AHU (all use same seals) bosch seal rebuild kit - bosch 2-467-010-003-000

Full pump rebuild to new specs - try Diesel Fuel Injection Service, 1700 Southeast Grand Avenue Portland, Oregon, 97214. Phone: (503) 235-1947

injection pump mounting bracket VW# 028 130 147 b (if you want a spare core, used is fine. I suggest the auto recycler: L&T Enterprizes, 6220 Airport Rd. Allentown, PA 18109 ,610-264-9191 or 800-228-3895)

metal fuel lines (pressure lines, in case yours are seized/stripped/damaged during removal) vw# 028 130 301 n, 028 130 302 n, 028 130 303 n, 028 130 304 n, used should also be fine.

Procedure

TDI injection pump removal

Set the engine to TDC, secure the camshaft locking bar, and remove the timing belt as necessary. See <u>1000q: mk3 timing belt removal</u> for more details.

After removing the timing belt from the IP sprocket, remove the IP sprocket (1x 13mm bolt). You can use the IP lock timing belt tool for counterholding the sprocket. The sprocket is a tapered fit onto the pump shaft w/woodruff key.



Remove the sheetmetal timing belt rear cover (2x 10mm bolts marked w/red arrow)



Remove the 2 electrical plugs for the IP.

Put towels around the metal fuel lines (17mm) and remove. I suggest putting a drop of PB blaster around the fuel line unions because they will be stuck. It also helps prevent twisting the fuel lines. Do not reuse the metal fuel pressure lines if they get bent or twisted! The injector bodies will probably be caked into the head so you shouldn't have to counterhold them. If they have been loosened recently, I suggest counterholding the flat of the injector body with a 15mm wrench. The injection pump side of the fuel line will also probably be stuck. First put a drop of PB Blaster around the union thread and let soak. Counterhold the 14mm union on the injection pump when you loosen the 17mm fuel line.

If you don't have a torque wrench that will fit on the nuts, use a permanent marker to make an index mark on the nuts before loosening them. Make each mark in the same direction (like pointing up or down) so that you have a better idea of how much to tighten the nuts during installation.

Remove the fuel filter-to-IP fuel hoses, use paper towels to collect spilled fuel.

Remove the injection pump by removing the mounting bolts (4 total). 1x 13mm bolt threaded into the rear timing belt cover, 2x 13mm nuts threaded into the spring-like bracket's bolts, 1x 13mm bolt on the rear bracket underneath the fuel lines backed by a 16mm nut. These are the same bolts that you loosen to adjust timing with the mk3 style





The IP can now be removed. If you just want to remove the pump, end procedure. The below steps are if you want to swap your mk3 pump for a mk4 ALH pump.

If you're installing a new 1Z/AHU pump, the torque spec for the injection pump sprocket nut is 41 ft-lb.

ALH engine Bosch TDI injection pump swap

Caution - never remove the center nut on the ALH IP shaft! Unlike the mk3 pump, the sprocket mount does not have a woodruff key to mark it's position on the IP shaft. Releasing the nut and removing the sprocket will change their relationship and you cannot index the sprocket to the shaft once it's removed!

Remove the IP. Remove the IP bracket (3x 6mm allen bolts, not circled but they are visible in the above picture).

Take the ALH sprocket and machine it so that the outer face (the tapered side) is almost flat with the gear teeth. This is done for timing belt cover clearance. Your old IP sprocket is flat, you need similar clearance on the ALH sprocket. Don't worry about the center nut clearance because there's a relief in the timing belt cover and it will fit. It's best to remove less rather than more metal because a heavier sprocket will help dampen the jerky pull of the IP on the timing belt through a flywheel effect. Below are before and after pictures of the sprocket. The red bracket indicates about how much you should remove.





Machine the IP bracket to fit the approx 60mm neck on the ALH IP. Make sure it's as tight a fit as possible. Due to tolerances during machining, I suggest machining the IP bracket hole a little bit too small and then test fitting it from there.

Enlarge the sheetmetal timing belt rear cover so the IP sprocket hub (the part the sprocket bolts to) can fit through the cover. This measurement does not have to be as exact as



Here is an after picture. The grey sprocket mounting hub is smaller than the neck of the IP. Do not powdercoat or paint the mounting surfaces since this will reduce clearance and you may not be able to fit shims later. Only make the sheetmetal rear timing belt cover hole large enough to fit the hub.



To hold the timing belt rear cover, I added some thin washers over the 3 IP mounting bolts to firmly clamp the sheetmetal. I suggest light strength threadlocker on the 3 IP mounting bolts. This will prevent them from vibrating out.

Only after installing everything did I notice that the belt was a little too far to one side. Others have also reported this. Everything was machined correctly and the belt's position is not off because of the position of the tensioner or other sprockets. I do not suggest changing the tensioner position or other sprockets' position. After test starting the engine, belt position did improve over the picture below - it was right on the edge of the sprocket (yes I know a fuel clamp is missing, this was a test pic). After driving for a while, I didn't notice any unusual wear and the belt continues to ride right on the edge.

To fix this, I suggest placing a 2-3mm shim between each IP mounting bolt and the mounting bracket. This will move the pump towards the transmission and move the sprocket a few mm over. Adding a shim would also slightly decrease the amount of material you have to remove from the sprocket for timing belt cover clearance. Make sure



Use a terminal release tool to remove the pins from the IP electrical plugs on the wiring harness. An example of this is in the youtube video below, skip to 1:40 in the video below.

Swap the pins into your ALH plug so your wiring harness will work with the ALH IP. Below is a table of pin number and wire color. For example, T10/1 is the #1 pin on the 10 pin ALH connector. T8/3 is the #4 pin on the original 8 pin connector. T3 is the original 3 pin connector which you have to connect to your 10 pin ALH connector. Also note that there are 2 black/yellow wires on your original wiring harness. One is on the 8 pin connector, one is on the 3 pin connector. However, the pins on the 8 pin connector are slightly darker than the silvery 3 pin connector, at least on mine. Mark the wires accordingly to avoid any confusion. Seal the connections with shrink wrap and electrical tape. You can also use paint-on liquid electrical tape.

Wire color	ALH 10 pin connector	Original 8 or 3 pin connector	Wire color
lilac/black	T10/1	T8/1	lilac/black
grey/green	T10/2	T8/2	grey/green
white/green	T10/3	T8/3	white/green
brown/blue	T10/4	T8/4	brown/blue
red/lilac	T10/5	T8/5	black/yellow
brown/red	T10/6	T8/6	brown/yellow
yellow/red	T10/7	T8/7	yellow/black
black/white	T10/8	T3/1	white/black
brown/black	T10/9	T3/2	brown/black
yellow/black	T10/10	T3/3	black/yellow

The ALH plug has a purple terminal lock. It should be 1 notch released when you insert the terminals (picture below is for illustration only, if the lock is off too far the terminals won't let the lock go back on). After inserting all the terminals, push the lock and it will hold the pins in place. Your 1z/ahu plug does not have a lock. From this view, you can see the notches next to the terminals where you insert the terminal release tool. You can also use a thin piece of sheetmetal like chopsticks as release tools. After you insert the terminal release tool, push the pin in before pulling it out. This helps release the terminal hooks that are actuated by the release tool.



The spring-like bolts in the front that held your IP to the IP bracket will not be used, just use 3 new bolts/nuts of sufficient grade (10 or above should be sufficient) to mount the new IP to the IP bracket. Reuse the old bolt/nut that was under the metal fuel pressure lines.

Use an ALH IP lock pin tool to set the injection pump to a position which will let the engine start. See <u>1000q: mk3_TDI_timing_belt_part_2_installation</u> and <u>1000q: mk4_ALH</u> timing belt_installation for more details. Make sure that the pin is actually in the correct spot and not to the left or right of the hole, see the below pictures (also available in the ALH timing belt article). Set the oval bolt holes so that they are roughly in the middle of their play. The pin should be aligned with the center of the square mark on the



a mirror! (sprocket removal is not required, it was removed for illustration purposes.

view with mirror



View with engine removed.



Once the timing belt is installed, leave the (3x 13mm) injection pump sprocket bolts loose with the IP lock pin in place so that the sprocket can rotate independently of the pump within the limits of it's elongated holes.

Again, install the timing belt with the camshaft and IP locks in place **BUT** their sprockets should be loose. This lets the tensioner set an even tension over the whole belt. Set the tensioner as shown in the timing belt installation article and torque to 15 ft-lb. You can now tighten the camshaft and IP sprockets. Make sure to counterhold the sprockets. Then remove their locks. You can also remove the camshaft lock while tightening the camshaft to avoid the possibility of accidentally torquing it and cracking the camshaft.

You no longer rotate the whole IP on its bracket to adjust timing like the old mk3 pump. To adjust timing on your new mk4 pump, adjust its sprocket on the oval holes by slightly loosening the 3 bolts and turning the sprocket. Only loosen them enough so that you can move the large nut at the center of the injection pump to move the pump without moving the sprocket. If you loosen them too much, the injection pump will move too much and you have to reset everything. Since this is a level 4 difficulty article, refer to timing belt_article_part_2 for screenshots and more tips. It's in the exclusive content forum so please join our free community and confirm your account by email to view.

Before turning over the engine, I suggest priming the pump with fuel. To do this, apply suction to the return line, preferably at the fuel filter but the return line at the IP will also work. This will ensure that the pump is lubricated with fuel and help minimize cranking to purge the fuel metal pressure lines of air.

A final note is the effect of higher pressure on injection timing. I would think that higher pressure advances timing because of how the needle lift sensor, the sensor on the #3 injector, works. Please refer to 1000q: fuel injector and nozzle FAQ for more details. I normally try to set timing at the upper half of the timing graph.