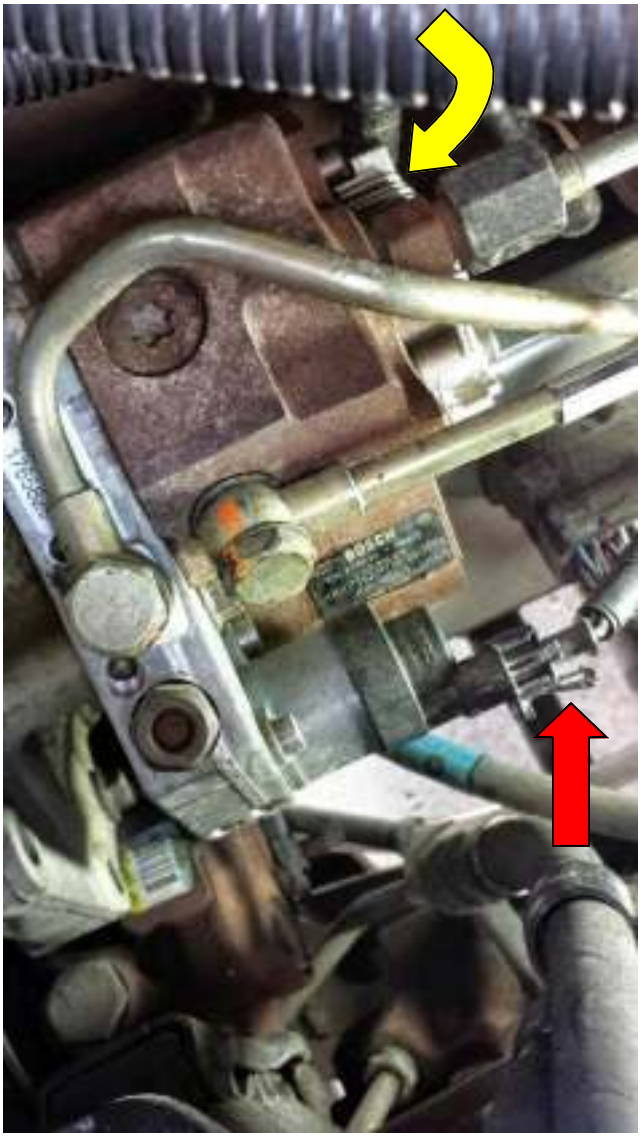
Replacing seal & o-ring between supply pump and main pump body

2006 CUMMINS 5.9L ENGINE, DODGE RAM PICKUP, BOSCH CP-3 High pressure common rail pump

This is what a new CP3 pump looks like off of the engine.

The item we will be removing is the supply pump. It is the aluminum assembly that has ribs on its back (see the red arrow). There are 4 torx screws holding this supply pump to the main body of the CP-3 pump. The fuel leak occurs between the supply pump and the main body of the injection pump (see orange arrow for location). Fuel runs down and dri onto the wiring harness below the pump.

The torque specification for these screws is 9Nm. Some folks say th the leak comes from "heat cycles", describing the heating and coolin cycles of the whole injection pump. Since aluminum and steel expan and contract at different rates, the gap between these two pieces can vary. This leakage is usually more prevalent in cool, or colder weather. There has been no shortage of cold this winter, so the pump on my truck started to seep between the supply pump and the main pump body once again. Time to do something to try to fix it.



Looking down at the pump assembly on the engine, you can barely see the supply pump below the output fitting and line from the pump. B it is there! See the yellow arrow.

In the interest of saving time and labor, I planned to remove ONLY th supply pump from the main pump body while the lines remained connected. Prior to beginning the service repairs, I had purchased the Bosch gasket kit for this CP-3 pump, part number DGK603, so that I would have every gasket or seal I might need to perform the repairs.

To allow room for my hands to reach under the lines and get in to the tight spaces, I did unplug the connector from the Fuel Control Actuato and move the wire harness out of the way. See the red arrow in the picture for the location of the connector I unplugged. Simply squeez the release tab, and pull straight towards the back of the truck removing the connector from the FCA. Tuck the connector back out of the way in between one of the other wire harnesses behind the injectio pump for safe keeping.

Before removing the screws on the back of the CP-3 which are holding the supply pump to the main pump body, the CP-3 should be thoroughly cleaned, degreased, and free from dirt or any other contamination. Place your oil drain pan or suitable catc pan under the truck, directly below the CP-3 pump to catch the cleaning solvent when cleaning and the fuel when removing the supply pump. Spray the entire pump, the supply pump housing and wire harness below with brake clean spray. Pay special attention to the supply pump where it mounts to the main body with the cleaning spray. This will serve to clean and degrease the pump surfaces. Use compressed air to finish drying the supply pump and main body of the CP-3. Visible in the inspection mirror in the p ture above, 3 of the 4 screws holding the supply on the main body are seen. These are T-27 torx head screws, and are torqued at 9 Nm.

There is a sequence for removing and replacing these screws in the Bosch service instructions. Be sure to loosen each scre in the proper order before removing any of the screws. The removal sequence is the same torque sequence order used for installati .

Screw number one is the top screw closest to the outlet fitting of th pump. If you assign the number one screw the "12 o'clock" position, the the number two screw is at the "6 o'clock" position. The number 3 scre is at the "9 o'clock" position, or closest to the driver's side of the truck. Th final screw is the one nearest to the engine block, or at the "3 o'clock" position.

This is the number 1 screw to loosen.

This is the number 2 screw to loosen.

The number 3 screw is in the yellow circle in the picture.

(The number 4 screw is not visible, but is directly across from the number three screw in the 3 o'clock position.)

After removing the screws in sequence, slightly twist the supply pump assembly while pulling it straight back out of the ma pump body. If you look at the picture, there is a seal which pilots in the main pump body with the outside diameter of the seal's steel casing. The lip seal fits over the pump drive shaft that turns the supply pump gear. When the supply pump releases and is ulled rearward from the main body of the CP-3, some fuel will leak out. This can be caught by the drain pan previously placed directly below the pump.

Carefully remove the supply pump assembly, and place it on clean, lint-free shop towel. For the next procedures, you will want to use "clean room" conditions. The supply pump will not last if allowed to ingest dirt, grime, or any foreign contaminatic If there is dirt or dust blowing around under the hood, cover the exposed back of the main body of the CP-3 with a clean, lint-free cloth to prevent any contamination from entering the passages of the main pump body while working on the supply pum

CAUTION!: DO NOT turn or disturb the gears in the supply pump, and handle this assembly *carefully*. Doing so will make it easier to install the supply pump back on the main body, indexing the pump drive shaft with the gears exactly the way they were be re removal.

Again, DO NOT allow any dirt or contamination to enter the supply pump! This unit should remain assembled, and free from fc eign items entering the unit.

Using a nylon pick, or any "non-marring" o-ring pick, carefully remove the green o-ring seal from the groove in the pump, and set aside. Inspect the o-ring groove for contamination. If there is any dirt or residue in the groove, protect the openings of tl supply pump and clean it lightly using a clean, soft bristled brush such as a toothbrush or nylon bristled cleaning brush. Do not se a brass, stainless steel, or bronze bristled brush and risk damage to the sealing surfaces of the supply pump. Protect the openings of the supply pump and finish cleaning the groove with some brake clean spray on a soft, clean cloth. While covering the port you can lightly spray compressed air to dry the o-ring groove. Stay away from the fuel ports and seal area with the air nozzle, as residu- al fuel in the supply pump will be sprayed out of the pump, or contamination could be forced into the pump gears

Check the height of the seal protrusion above the mounting surface of the pump. I used my digital caliper to measure the height of seal in the supply pump. It measured about 0.105" above the face of the housing. I didn't know if the pump housing had a shoulder below the seal that would serve as a seat, so I wanted to document the depth of the seal in the housing before I removed it. Also shown in the photo are the new o-ring and the new seal.

Without damaging or marring the supply pump mountin surface, carefully grab the lip of the seal with a good pair of pliers or vice grips, and while holding the supply pump down on the bench, give the seal a good tug to pull it out of the housing. I discovered that the seal bore does have a shoulder for the seal to rest upon. Check the o-ring groove for any contamination, as well as the seal bore. You can wipe each clean with rag saturated with brake clean spray. Not wanting to disturb the gears or chance contaminating anything inside the pump, I d ot use compressed air on the seal bore area. Wiping it with the clean cloth dampened with brake clean spray seemed to clean it properly.

Center the new seal over the bore in supply pump housing with the open end of the seal facing (up) away from the supply pump. Using a seal driver that will support the seal yet not damage the rubber inner part of the seal, align the seal with the bore and gently tap it into the bore until it lightl bottoms in the housing. No sealant is required no should be used on the outside of the seal. Check the protrusion of the seal to see if it matches or is close to the original dimension of the old seal. After the new seal is installed properly, fit th green o-ring with the two ears into the groove in the supply pump. It fits snugly in the groove, so it should not fall out or get misaligned easily. Cover this pump with a clean, lint-free rag, and set it aside.

Using a new clean, lint-free rag, spray it wet with Brake clean spray, and wipe the back of the CP-3 pump where the supply pump mounts. Wipe <u>carefully</u> around the fuel passages to insure that no rust or dirt particles can enter the pump from the dragging contamination from the pump mounting surface into the ports and passages. The picture below shows the seal driver I used to install the sea

Lubricate the rubber lips of the supply pump seal with a little engine oil or pump assembly lube Also put a little lube on the drive shaft at the tape where the seal expands over the shaft. Install th supply pump to the main pump body by first checking the alignment of the slot in the supply pump, and indexing it to the tang of the drive shaft. Carefully slide the seal on the driveshaft s that the outside of the seal pilots into the main pump body. Slightly twist the supply pump to align the mounting screw holes. Insert the # screw into the pump and thread in finger tight Repeat for the remaining screws.

With the screws holding the supply pump onto the main pump body only finger tight, check to see that the screw holes in sup ply pump align with the screws so that the supply pump body does not bind against the screws. In other words, the screws will be close to being centered in the holes in the supply pump.

Tighten the #1 screw to 7 Nm torque. I used my Snap-On digital Techwrench, which displays the amount of torque being applied. It also emits an audible beep and buzzes in the handle when it reaches the entered setting. Due to the size of th torque wrench and interference from the fuel lines, I had to use a long 1/4" drive extenstion, a 1/4" drive universal joint, and th T-27 socket.

In the proper sequence, tighten screws 2,3, & 4 to the 7 Nr setting

Finally, go back and re-torque all of the screws in the proper sequence to 9 Nm torque.

Pictured here are the tools which I used to perform the task. I used a Snap-On FC72, 1/4" ratchet that actually has a 3/8" drive in it with a T-27 socket to loosen and remove the supply pump screws. This works great for working in tight space

Plug the wire connector back into the FCA (fuel control actuator). Spray the back of the CP3 pump again with brake clean spray, as well as the wiring harness below the pump in order to dry off any remaining fuel. Blow it dry with compressed air. This will aid in determining if there are any fuel leaks after you start the engin

The fuel system has gotten air into since the supply pump was removed, so you must prime the system before actually starting the engine. Bump the starter very quickly with the key so as to avoid turning the engine over. Wait on the supply pump to force fuel from the tank through the filter and on through the CP3 pump. The pump in the tank will quit after about 30 seconds, so repeat this process 3 times. After th priming, go ahead and start the engine. Check for leaks between the supply pump and the main body. Test drive the vehicle long enough for the vehicle to be fully warmed up. Recheck the pump for leaks after test driving the vehicle, and again after the engine cools completely overnight.

This picture of the back lower part of the common rail pump was taken the day following the pump repairs. The vehicle had been driven for about 20 miles immediately following these repairs, warming the engine to operating temperature. There were n eaks visible when the vehicle returned with the engine warm. The smell of hot, leaking diesel fuel was gone from under the hood. The slightly darkened areas around the edge of the supply pump is the pump assembly lube weeping out of the groove around the green o-ring. I used this lube to lubricate the seal and the o-ring when the supply pump was mounted to the main pump body. The residual lube in the groove on the exterior of the green o-ring was crawling out of the groove from engine heat.

The same "darkness" is seen around the torx plug at the bottom of the main housing as well as a small amount is seeping ou rom under the name plate on the pump. Both are remnants of this assembly lubricant, and is not diesel fuel. The brake cleaner spray apparently did not fully dissolve all of that lube, and thus the leftover lube tends to crawl out of those spaces from the h at of the engine. No fuel odor was detected when sniffing all around in the engine compartment before starting the engine and after w rming it up to operating temperature

The final test will be when the morning temperatures drop down to around freezing again. I'll have to check it to see if I smell any diesel fuel odor in the heat coming out from the grill area when the engine is just shut down. Prior to the repair, if you were to walk in front of the truck after shutting the engine off, you would get a whiff of diesel fuel smell telling you there was s mething leaking. Now, maybe that will be a thing of the past!

Update! Now 2 weeks later, morning temperatures dropped to below freezing again, and in rechecking for leaks on or around the CP-3 supply pump, none have been found. Hopefully, this has cured the problem for a while.