POMPE A EAU RST

Water Pump Seal

Since the introduction of the V60 Rotax engine there have been many instances of water pump seal replacement that fail. The procedures outlined in the factory shop manual for both disassembly and assembly are crap! It looks quite simple. Once everything is torn down you drive the water pump shaft out of the cover with a soft hammer against the threaded end. Now use a pin punch to drive the water and oil seals out of the primary cover. This action moves the oil seal first, very easily, till it comes up against the water seal (called the sliding ring in the parts book). It then requires significantly more force to get the water seal moving. On my first attempt at this job, by the time I got the seals out, the oil seal had been so distorted that it made a deep gouge in the housing bore wrecking the primary cover. I now use an expanding bearing remover with slide hammer to remove the water seal from the outside first and then remove the oil seal. The manual then directs you to drive in the oil seal followed by the water seal with the Aprilia special tools. Sounds good. Now you are told to drive the water pump shaft through the water seal, oil seal, and housing bore with a hammer and block of wood. This directive is so ill-conceived that it is laughable. For those who do not know, the water seal is actually a ceramic seal common to virtually all water pumps. It is made up of two dissimilar ceramic rings, very finely finished, one fixed, one rotating which are held in contact by a spring. A rubber boot surrounds the spring to make the package water tight. These ceramic rings are fragile. While driving the shaft through the seal the force of each blow must travel through a rubber seal to the 1st ring, to the 2nd ring, through the rubber boot, through the spring after it bottoms,and through the rubber boot again before the shaft moves through its interference fit in the seal. The chances of doing this without cracking the rings are not good. Then the shaft must find its way, unguided, through the oil seal. While tearing one down once I found that the spring in the oil seal was half way out of its groove. Witness marks indicate that it was jarred out of place when the shaft was driven through upon initial assembly at the factory. Lastly the shaft must now find its way into the bearing bore in the housing with only a few thousandths clearance while you're pounding away on your block of wood.

There is a better way. It does require some special tools made on the lathe but they are simple and I will describe them and the procedure. First install the oil seal in the housing. A light smear of oil on seal OD and housing bore helps ease it in without damage. Set the housing aside for later. Now we need to press the shaft, threaded end first, through the back side of the water seal. This requires making special tools. A thick steel plate with a 23/64th inch hole drilled through it makes our anvil. This must be drilled on the drill press, milling machine or lathe so it is perpendicular. Now make a guide pin from steel turned on the lathe to a slip fit in the drilled hole. Thread one end of the pin internally 8mx1.25 while on the lathe. Do your threads first! Then turn the OD. Make the pin about 1 1/2 inch long. Before proceeding, check the edges of the hole that goes through the pump shaft. If there are sharp edges or burrs they will cut the lip of the oil seal when the shaft is installed. I use a small grinding point followed by fine wet/dry sand paper to smooth the edges. Screw the pin onto the pump shaft. Make sure it's straight. Insert the guide pin and pump shaft, guide pin first, through the back side of the seal. Invert everything and insert the guide pin into the hole in the anvil. Carefully press the shaft into the seal. Make sure the face at the base of the threads on the pump shaft is flush with the flange of the seal. Now apply some mostly assembly lube to the pump shaft bearing bore, some light grease or oil on the oil seal and shaft, and insert the pump shaft through the oil seal and housing bore. Now the lathe comes in again to make a drift to bear against the flange at the OD of the water seal and press it in till it bottoms against the flange. I made mine from aluminum and drilled it to receive the guide pin so everything is kept nice and square while pressing in. Remove the guide pin and install the impeller. Do not use thread locking compounds. Install the washer, drive pin and plastic gear on the back side and you're ready to put it all back together confident that you haven't damaged anything because of a bunch of hammering.

The tools from left to right: Anvil, Guide Pin, Drift for Water Seal, Mandrel for Drift. The drift could be made in one piece. Notice that the drift and mandrel are drilled to receive the guide pin

so it can be left in place on the shaft while pressing in the seal. This helps to insure perfect alignment during the pressing operation.

Guide pin installed on the water pump shaft.

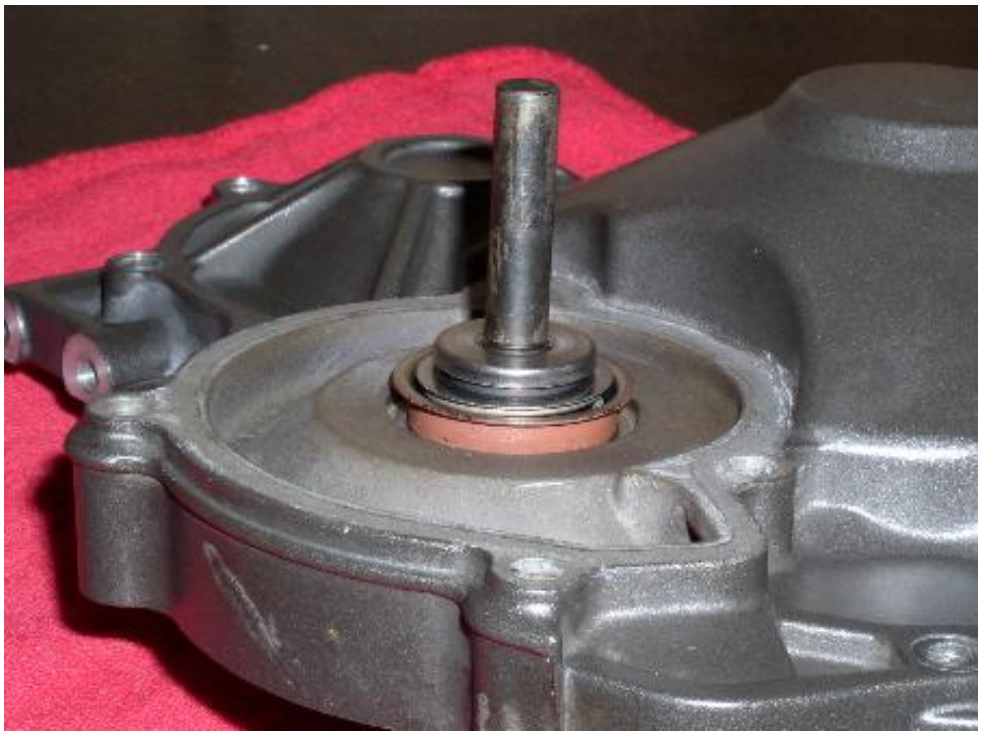
Insert the assembly through the back side of the seal.

in this shot you can see how the drift is machined to contact the outer rim of the seal.

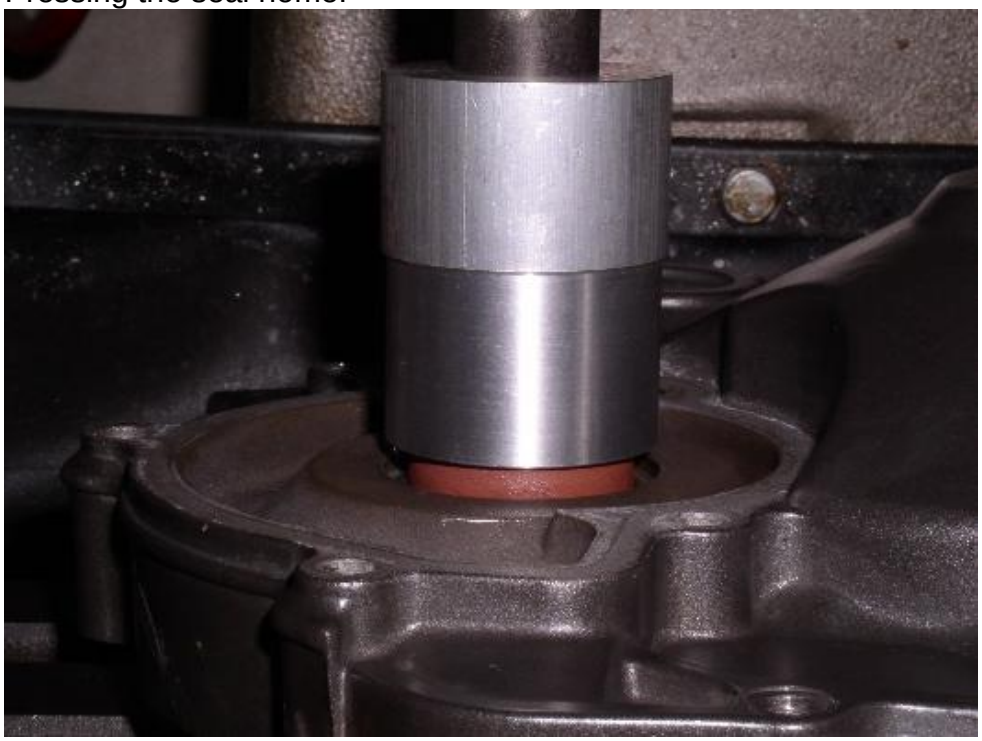
Before proceeding, check the edges of the hole that goes through the pump shaft. If there are sharp edges or burrs they will cut the lip of the oil seal when the shaft is installed. I use a small grinding point followed by fine wet/dry sand paper to smooth the edges. Insert the guide pin, shaft and seal into the anvil.

Carefully press the shaft in till the face of the shaft contacts the anvil.

After you have installed the oil seal lubricate the shaft bearing bore and the oil seal lip and insert the shaft through the seal and housing.



Pressing the seal home.



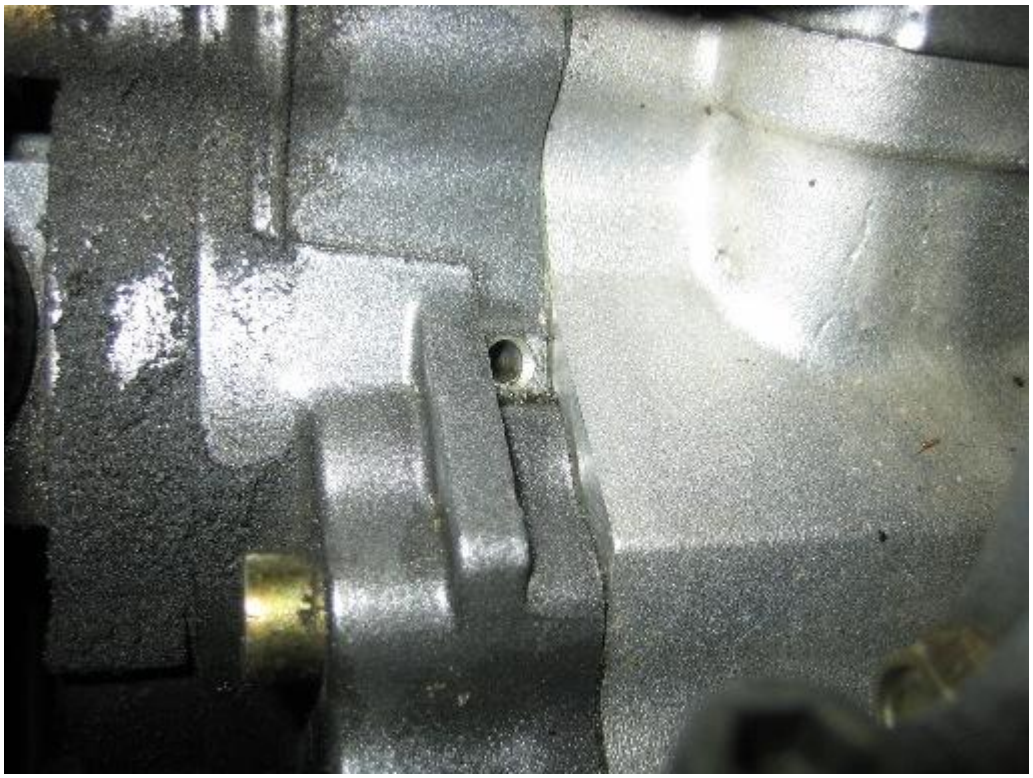
All pressed in.

Remove the guide pin and you are ready to install the impeller and drive components and put it all back together confident that the job is done correctly.

There was an oil seal upgrade sometime during or after the 2001 model year. The original seal was black. The upgraded seal is dark brown. This is the only change I am aware of. I just think it is a bad procedure, not to be confused with poor workmanship which I do not think is the problem. There are two possible problems; leaking either oil or water from the weep hole. The oil leak problem was partially corrected with the upgraded oil seal. Lubrication is not an issue with either seal provided the oil seal and pump shaft are lubed during assembly. Water pump lube additive is not necessary. Water pump seals(the water seal) last almost for ever. If they are damaged during assembly they usually leak immediately. The oil seal can work well for a long time even if compromised and the leak is very small. There is no oil pressure near the seal. The pump shaft, oil seal and drive gear are lubricated by oil splash. Inspect the weep hole when ever you have the body work off and don't worry about it.

Recently while installing seals in the cover in the pictures above, for my very understanding friend Bill, I neglected to check the pump shaft for sharp edges at the drive pin hole and it bit me. Started leaking oil in a very short time. When I pulled the seals out there were four little cuts in the oil seal from the sharp edges of the hole in the brand new pump shaft. Be sure and remove any sharp edges.

Is this the weep hole being talked about? It seems I have a slight oil leak from this hole. Actually, I'm not sure how "slight" it is yet. I cleaned the area and I'm going to keep an eye on it and my oil level. I hope it doesn't become necessary to replace this seal, but if I do, I know where to find the info I need to do it.



The weep hole leads into a cavity between two seals on the water pump shaft; one for oil and the other for coolant. If either seal leaks it drains out the weep hole.

Oil is leaking past the water pump shaft seal. Make sure it is oil and not coolant, the waxy residue coolant makes quickly goes black with road dirt and looks like oil. You can't replace the oil seal without renewing the shaft water seal also - not an easy job (I've just done mine). kzmilli has all the stuff about renewing the seals on this thread I think.
If it's just a little oil and not coolant I wouldn't worry - just keep an eye on it. A coolant leak is more of a worry since it could contaminate the engine oil.
PS a big thanks the kzmilli and others on the forum. The info helped me avoid any major f***ups and my new water pump shaft seals seem fine so far. One thing of note - I couldn't undo the impeller with the shaft in the clutch housing, I had to pull off the drive gear, remove the drive pin and then push the shaft out together with the inner part of the water seal from the engine side. Only then could I get sufficient torque on the impeller to undo it. It did come undone by hand but only just.

You don't need to remove the clutch, just the clutch cover (it's a big cover and incorporates the water pump assembly). You don't need any special tools to remove the clutch cover. You need to drain the coolant and the oil before you start. It's worth downloading a shop manual for the clutch cover removal and replacement as the procedure for this is OK. The difficult stuff starts once the the covers off and on the bench, ie getting the old water pump shaft seals out and the new ones in (that's where the shop manual is pants). I managed to do this without any purpose made tools and so far so good.

I got the water pump seal yesterday and couldn't wait to try my own method of installing it. The only good thing about waiting 6 weeks is I had plenty of time to read this excellent thread and devise a plan. Here's what I did: First, my shaft had some pretty severe grooves, so I took it to work and hard chromed & finish ground it. The hardness is now around 70Rc and is industry acceptable for a lip seal (basically what the oil seal is and what failed on mine, oil was spitting out of the weep hole). I installed the oil seal by hand, it popped in pretty nice. I installed the water pump seal (sliding ring I think the manual calls it) by using a 27mm socket, it hit the outer edge of the seal without touching the spring loaded part and also fit into the recess of the housing to allow it to be installed all the way down. I had a center put into the shaft so it could be ground after hard chroming, and this was also used to install it into the seal. I first chucked the shaft (on the threads) without the impeller and pushed it in far enough to engage the oil seal, making sure it was perpendicular and not cocked. Then, I chucked a center into a small drill press, installed the impeller per instructions, and pushed it thru the seal with the center chucked in the press centered in the hole of the shaft (the drill press wasn't plugged in, it was used for leverage). I coated everything with Royal Purple oil first, and was very careful not to get a running start, I made sure the spring loaded seal was in full contact with the seal, and slowly pushed until the impeller bottomed onto the housing, it did make a few popping noises as it slid along, but not too severe, then followed the instructions for reassembly. I ran it last night on the rear stand at 50mph for 15 minutes, no leaks. I took it for a test ride this morning, hit some decent speeds, and no leaks. I can only assume it's fixed. Hope this helps anyone trying this repair yourselves.

Water Pump Seal

Since the introduction of the V60 Rotax engine there have been many instances of water pump seal replacement that fail. The procedures outlined in the factory shop manual for both disassembly and assembly are not very dependable! It looks quite simple. Once everything is torn down you drive the water pump shaft out of the cover with a soft hammer against the threaded end. Now use a pin punch to drive the water and oil seals out of the primary cover. This action moves the oil seal first, very easily, till it comes up against the water seal (called the sliding ring in the parts book). It then requires significantly more force to get the water seal moving. On my first attempt at this job, by the time I got the seals out, the oil seal had been so distorted that it made a deep gouge in the housing bore wrecking the primary cover. I now use an expanding bearing remover with slide hammer to remove the water seal from the outside first and then remove the oil seal.

The manual then directs you to drive in the oil seal followed by the water seal with the Aprilia special tools. Sounds good. Now you are told to drive the water pump shaft through the water seal, oil seal, and housing bore with a hammer and block of wood. This directive is so illconceived that it is laughable. For those who do not know, the water seal is actually a ceramic seal common to virtually all water pumps. It is made up of two dissimilar ceramic rings, very finely finished, one fixed, one rotating which are held in contact by a spring. A rubber boot surrounds the spring to make the package water tight. These ceramic rings are fragile. While driving the shaft through the seal the force of each blow must travel through a rubber seal to the 1st ring, to the 2nd ring, through the rubber boot, through the spring after it bottoms,and through the rubber boot again before the shaft moves through its interference fit in the seal. The chances of doing this without cracking the rings are not good. Then the shaft must find its way, unguided, through the oil seal. While tearing one down once I found that the spring in the oil seal was half way out of its groove. Witness marks indicate that it was jarred out of place when the shaft was driven through upon initial assembly at the factory. Lastly the shaft must now find its way into the bearing bore in the housing with only a few thousandths clearance while you're pounding away on your block of wood.

There is a better way. It does require some special tools made on the lathe but they are simple and I will describe them and the procedure. First install the oil seal in the housing. A light smear of oil on seal OD and housing bore helps ease it in without damage. Set the housing aside for

later. Now we need to press the shaft, threaded end first, through the back side of the water seal. This requires making special tools. A thick steel plate with a 23/64th inch hole drilled through it makes our anvil. This must be drilled on the drill press, milling machine or lathe so it is perpendicular. Now make a guide pin from steel turned on the lathe to a slip fit in the drilled hole. Thread one end of the pin internally 8mx1.25 while on the lathe. Do your threads first! Then turn the OD. Make the pin about 1 1/2 inch long. Before proceeding, check the edges of the hole that goes through the pump shaft. If there are sharp edges or burrs they will cut the lip of the oil seal when the shaft is installed. I use a small grinding point followed by fine wet/dry sand paper to smooth the edges. Screw the pin onto the pump shaft. Make sure it's straight. Insert the guide pin and pump shaft, guide pin first, through the back side of the seal. Invert everything and insert the guide pin into the hole in the anvil. Carefully press the shaft into the seal. Make sure the face at the base of the threads on the pump shaft is flush with the flange of the seal. Now apply some moly assembly lube to the pump shaft bearing bore, some light grease or oil on the oil seal and shaft, and insert the pump shaft through the oil seal and housing bore. Now the lathe comes in again to make a drift to bear against the flange at the OD of the water seal and press it in till it bottoms against the flange. I made mine from aluminum and drilled it to receive the guide pin so everything is kept nice and square while pressing in. Remove the guide pin and install the impeller. Do not use thread locking compounds. Install the washer, drive pin and plastic gear on the back side and you're ready to put it all back together confident that you haven't damaged anything because of a bunch of hammering.

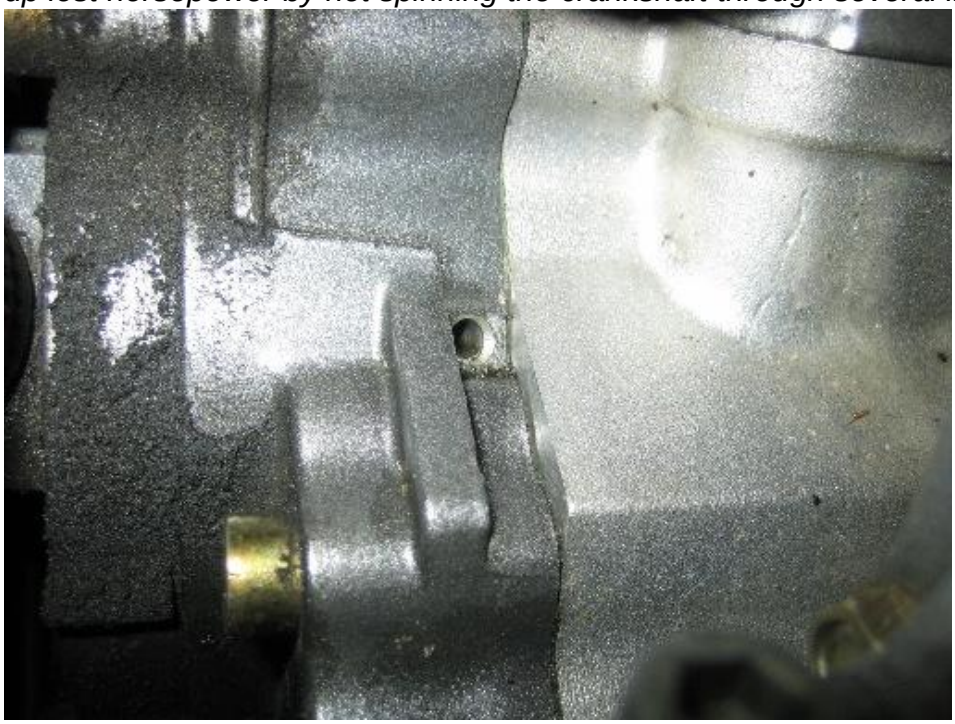
The tools from left to right: Anvil, Guide Pin, Drift for Water Seal, Mandrel for Drift. The drift could be made in one piece. Notice that the drift and mandrel are drilled to receive the guide pin so it can be left in place on the shaft while pressing in the seal. This helps to insure perfect alignment during the pressing operation.
The bike has a dry sump pump and most of the oil has probably drained into the sump and that's why you don't see any when you check.... Also, unless you follow the process correctly, two outcomes will follow:
1) you will NEVER see oil in the sight tube, and
2) you WILL end up overfilling with oil

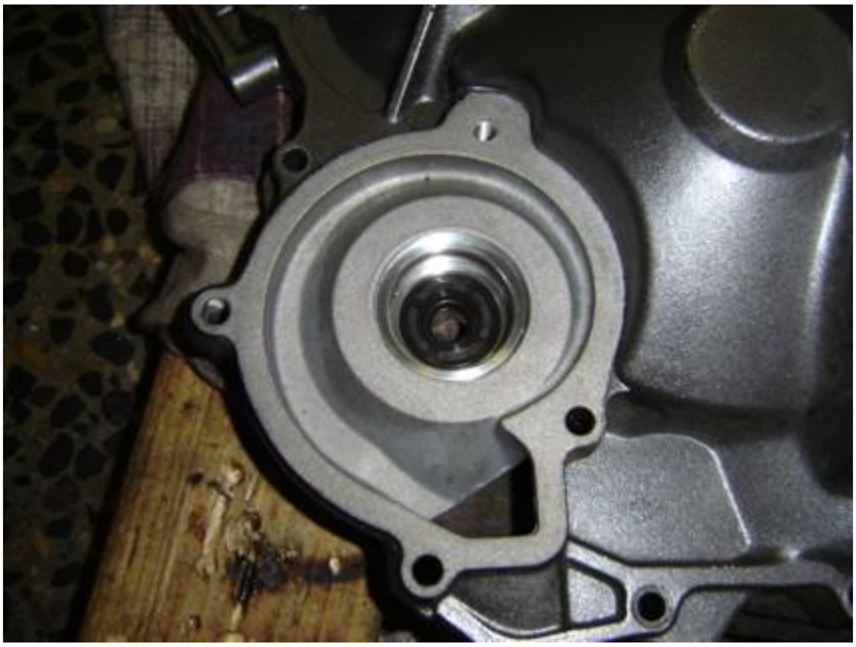
Although there are seveal methods to check oil - I always use the following:

With the engine warmed up and running - rev the bike and hold it at 3500rpm and look at the site tube.... The engine has to be warm to check all of this.... Never fill it to more than 3/4 of the tube...

More:
A simple explanation of how a dry-sump oiling system works in the RSV1000 Mille, SL1000 Falco, RST1000 Futura, and Pegaso 650. This oiling system can also be found on all types of race cars (F1, Indy, circle-track, even NASCAR). This dry-sump oiling system frees up lost horsepower and prevents oil starvation problems associated with long wheelies and high G-forces. Aprilia is the only one to use this dry-sump oiling system in all of their 4-stroke motorcycles. I strongly feel that other manufacturers should also use this system.
The basic dry-sump oiling system consists of two oil pumps, an oil filter, and an oil tank.
We'll start at the oil tank, since most of you know where that is located. The oil tank always contains a minimum level of oil. The oil is drawn down the bottom hose to the first oil pump called the pressure oil pump. The pressure oil pump pushes the oil through the oil filter, and then to all major lubrication points (bearings, crankshafts, cams, transmission gears, etc.) thru oiling passages just like in all other engines. This pressure pump is analogous to the single oil pump in a wet-sump engine.
Oil splashes off the moving parts and drains to the bottom of the crankcase. Here, is the main difference between dry-sump and wet-sump. In a typical wet-sump engine, the crankcase (oil pan) is very deep and full of oil. The crankshaft partly spins through this oil causing a HP loss. The single oil pump in a wet-sump engine has its pickup in the oil pan. Under certain conditions (high G-forces, long wheelies, stoppies, etc.), this oil pickup can be sucking in air and not oil.

This will starve all the moving parts for oil. NOT GOOD!!!
In a dry-sump Aprilia engine, the oil does not sit in the pan, hence the bottom of the crankcase is "dry" and very compact. A second oil pump, called the recovery or suction oil pump, returns this oil back to the oil tank through a hose. This hose connects to the top of the oil tank. With a dry-sump system the "oil pan" is effectively moved to the side of the engine (now called the oil tank). Remember, because the oil tank always has oil to feed the pressure pump, the pressure pump will not run out of oil. No oil starvation problems!!!
This system allows the engineers to make a more powerful and compact engine, and provide adequate lubrication under all conditions (high G-forces, long wheelies, stoppies, etc.). It frees up lost horsepower by not spinning the crankshaft through several inches of oil.





Yes. There is two shaft seals. One for the oil, inside and one for the water, outside.

But is pressed in for shaft seal for the water. The housing must be warmed up for the development. Then the new seal is pressed in.

Here's another write up of the seal replacement from the old RST 1000 list. The leak is normally caused by overfilling the oil level or just running it at max. I had this replaced 3 times under warranty & it still wiped. Finally said the hell with it & it eventually stopped weeping.

"Thought I would try to post this here. It's very detailed but may not make a lot of sense without pictures (I took notes but no pics). This procedure worked without stress."

Strud

~~~~~~
~~~~~~

PARTS & MATERIALS REQUIRED
· 650310 oil seal
· 650370 sliding ring (mechanical water seal)
· 650330 gasket (side cover)
· 950141 gasket ring (optional - see SIDE CASE INSTALLATION notes)
· Locktite 572, Permatex 101BR or equivalent
· Locktite Thread-Lok (blue) or equivalent

SPECIAL TOOLS REQUIRED
· Drill Press with 3/8" or larger chuck
· 1-Ton Arbor Press (1/2-Ton might do it or any other shop press)
[Northern Tool 146702, Harbor Freight 3552-5VGA or Grizzly Industrial G4018]

SIDE CASE REMOVAL
1. Put bike on centre stand.
2. Remove middle and lower side panels on both sides and also the seat.
3. Remove radiator duct panel on right side.
4. Remove bolt on right-side fillet-panel next to gas tank (near steering head).
5. Drain coolant by removing right-side radiator drain plug and radiator cap. Retain for refilling if desired.
6. Replace drain plug after applying Locktite 572 (I used Permatex 101BR) and torque to 7-ftlb (A note of caution here. Many torque wrenches are wildly inaccurate at small values so use care).
7. Remove and drain overflow tank. No need to disconnect the hose as you can just lay it up on top of the gas tank with a rag for protection.
8. Remove overflow tank mounting bracket.
9. Remove coolant hose where it enters the bottom of the radiator.
10. Remove the bottom screw of the four which hold the water pump cover. This will drain the pump.
11. Remove the other three screws securing the pump housing. The rubber gasket that seals this pump cover is reusable.
12. Twist the pump housing and the hoses attached to it up out of the way. Use cord or something similar to tie it up to the right handgrip.
13. Put bike on side stand.
14. On the left side, drain crankcase oil by removing the drain plug just to the rear of the oil filter cover. This will yield about 20-oz of oil (retain for refilling if desired).
15. Replace the drain plug and torque to 9-ftlb.
16. Remove the clutch cover bolts, noting the position of the fairing mount bracket for reassembly.
17. Unplug the sensor wire and remove the clutch cover. Use cord (or similar) to tie the clutch cover up out of the way (that's why the seat is off).
18. Pull rubber clutch cover gasket free from alignment pins on case. This gasket is reusable.
19. Hold the clutch shaft in place with a hex wrench then remove the nut.
20. Remove washer, retainer and rubber clutch gasket. Note their sequence and polarity for reassembly.
21. Remove the two bolts holding the starter motor to the side case (these are just in front of the water pump).
22. Remove all the perimeter bolts securing the side cover. Two of these bolts also hold hose restraint brackets. Note bracket and hose positions for reassembly.
23. This part is a little messy. Remove side cover by pulling on cast

flanges at the bottom of the cover. After removal, protect the edge of this soft aluminium cover as the thin gasket requires a pristine surface if it is to seal effectively.
24. Remove green gasket and discard. Now is a good time to remove just enough of the oil laying in the gear compartments so that it does not interfere with the application of the new gasket. Also, check the bolt holes at the bottom of the engine case to make sure that oil did not run into them when the side cover was removed.

WATER PUMP DISASSEMBLY
1. Hold the gear while unscrewing the water pump impeller (I was afraid the impeller would break so I clamped a couple of small hex wrenches in a vise, spaced so they would fit into the holes in the impeller. Then I turned the gear until the impeller broke free.)
2. Pull the plastic gear from the pump shaft.
3. Remove the retaining pin that holds the shaft in place.
4. Use a soft-headed hammer from the gear side to drive the shaft out the impeller side.
5. Remove the sleeve from the shaft by shouldering the sleeve in a vice and hammering on the threaded end of the shaft.
6. Remove both seals from the case by driving a drift punch into the two small holes next to the water pump shaft hole on the inside of the case. Use a .125" to .150" drift punch and a small hard faced hammer. Tap a little at a time in each hole so the seals don't get wedged. Putting a mark on the drift will allow you to measure your progress. You will feel the oil seal let go, then bump into the mechanical water seal. Keep hammering and they will both come out together.

WATER PUMP ASSEMBLY
1. Use a drill press to drill a 5/16" hole in a piece of scrap metal stock (1/8" thick minimum). This will be used to limit how far the water pump shaft will go as it is pressed into the mechanical water seal.
2. Lightly clamp the pump shaft into the drill press chuck so that the threaded end protrudes.
3. Position the metal stock under the chuck so that the water pump shaft lines up with the 5/16" hole.
4. With the larger end of the seal facing the drill press chuck, push the new mechanical water seal onto the threaded end of the pump shaft by hand just far enough so that it stays attached.
5. Use the drill press to seat the shaft in the seal. Finish the job using an arbor press or equivalent. This process uses the perpendicular nature of the drill press to align the shaft correctly in the seal. When complete, the shoulder at the end of the shaft's threaded section should be flush with the small end of the seal.
6. Use a press to install the oil seal. Set the seal in place with the closed end facing out. Select a hex socket whose outside diameter is just slightly smaller than the seal. Align the socket between the press and the seal so the force from the press is applied on the outside edge of the seal. No lubricant is necessary; the seal should slide in with very little effort.
7. Lubricate the water pump shaft with Molykote and, by hand, slide it first through the oil seal and then the shaft bushing until the mechanical seal rests against the casting.
8. The mechanical seal takes quite a bit of force to install. Select a hex socket that allows the smaller part of the mechanical seal to fit up inside it (I chose a 1") while the edge rests on the outside rim of the

seal. In the same manner as the oil seal, press the mechanical seal, shaft and all, into place.
9. Slide the retaining pin through the shaft. The spring in the mechanical seal will compress enough allow this.
10. Slide the plastic gear onto the shaft over the pin (note the alignment tabs).
11. Screw the impeller onto the shaft and hand-tighten.

SIDE CASE INSTALLATION (assemble in reverse order - these are only notes)
· Clean ALL the green gasket material off both mating surfaces.
· Put Molykote on the water pump shaft and both shafts that protrude from the engine.
· As the side cover is slid back into position it will tend to hang up on the starter motor mount.
· As the side cover is slid back into position the impeller may need to be rotated to get the plastic gear to mesh.
· Look through the bolt-holes to see that the green gasket is aligned correctly.
· The forward most, large-diameter side case bolt requires a copper gasket. You may try to use the original, buy the $10 part from Aprilia or go to your local hydraulic supply house and buy an equivalent for 30 cents (SAE size equivalent works).
· Large diameter side case bolts are torqued to 14-ftlb, small ones (including the starter motor bolts and water pump cover bolts) to 8-ftlb.
· The bottom-most water pump cover bolt either requires a new seal or just use Locktite 572, Permatex 101BR or equivalent.
· The threads on the left-most water pump cover bolt require Locktite thread-lock (blue).
· To torque the clutch shaft nut (don't hook the rubber gasket to the tabs yet), hold the nut in place with a wrench and turn the shaft CCW with a torque wrench set to 22-ftlb.
· Clutch cover bolts are torqued to 4-ftlb.
· The cooling system will purge itself of air automatically as it is filled.
· Run the engine to refill the crankcase before topping up the oil.

John B.
02 Ash Black w/Staintunes, PC3 w/custom map, Evo Filter, Mille Air Boot, derestricted air box, Heli-Bars, Rick Mayer seat, Wilbers shock, new rectifier, Scottoiler, heated grips, T'meister, c/f frt. fender & hugger.