

## Honda Reflex Water Pump Service

I have had a problem with dark brown oil probably combined with some coolant leaking from the weep hole under the Reflex. This article describes how the water pump can be serviced without any special Honda tools.

### Removal

This requires the removal of the following assemblies.

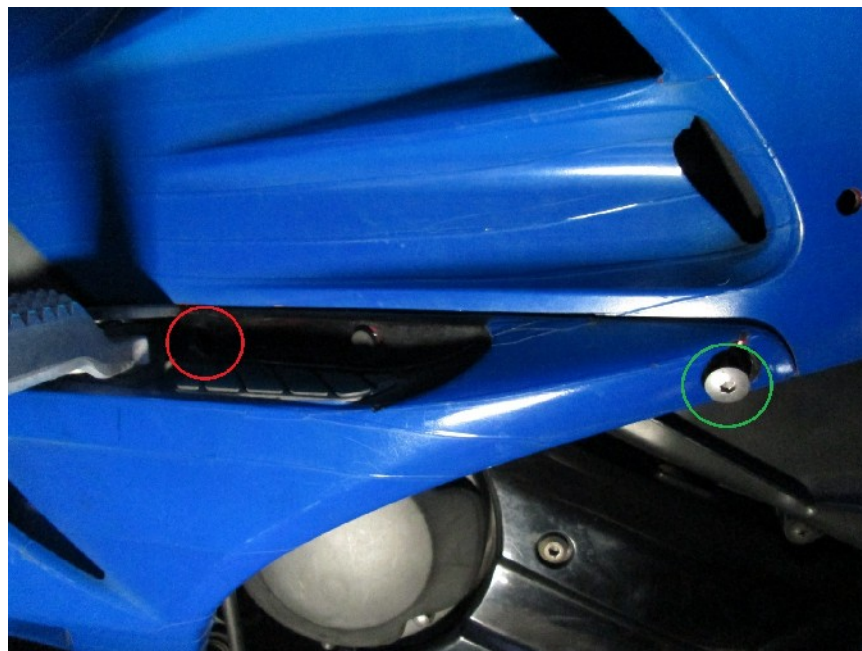
- the left side skirt ( shown in figures 1 through 6 )
  - seven screws, three use a 4 mm Allen head wrench circled in green in figures 2, 3, and 5.
  - two plastic snap fasteners circled in yellow in figure 2
- the belt case air cleaner assembly ( three screws shown in figure 7 )
- the case cover protector ( three 5 mm Allen head screws shown in figure 7 circled in yellow )
- the left crankcase cover ( five screws shown in figure 8 )



*Figure 1*



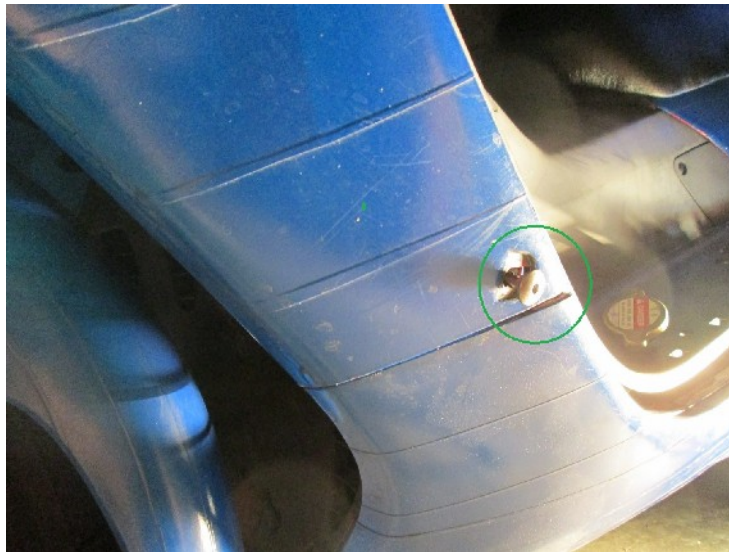
*Figure 2*



*Figure 3*



*Figure 4*



*Figure 5*



*Figure 6*





*Figure 7*



*Figure 8*

Once these assemblies are removed the next steps are as described in the Honda service manual. The cap to the radiator must be removed by taking the battery cover off in the under seat trunk. This is done by removing a screw from the metal bracket shown in figure 9 and sliding the radiator hose with the cap to the left and down for access. Then the cap for the coolant reservoir under the locked gas cover is opened as shown in figure 10. These two steps let air into the cooling system so the coolant will flow out.



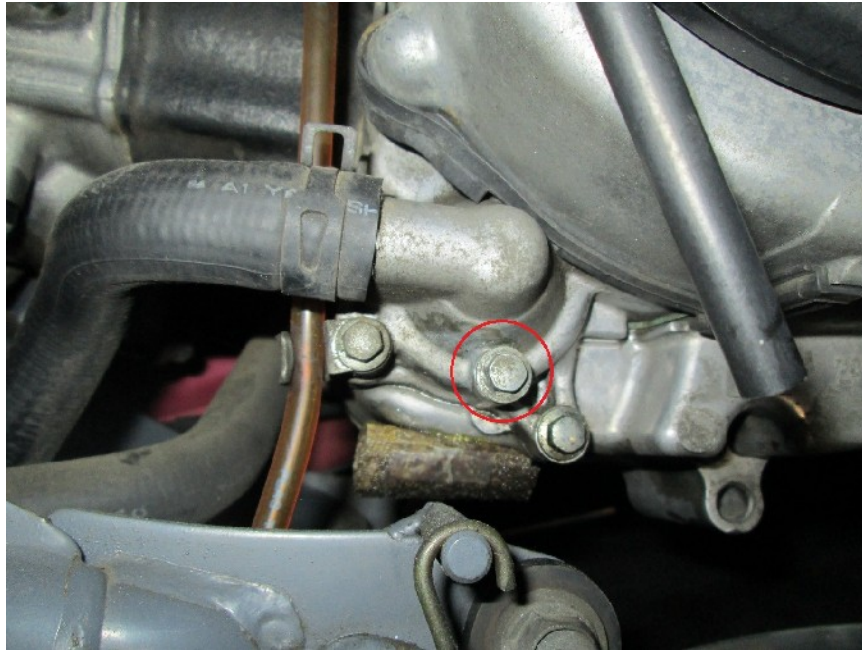
Figure 9



Figure 10



Remove the coolant drain bolt in figure 11 circled in red.



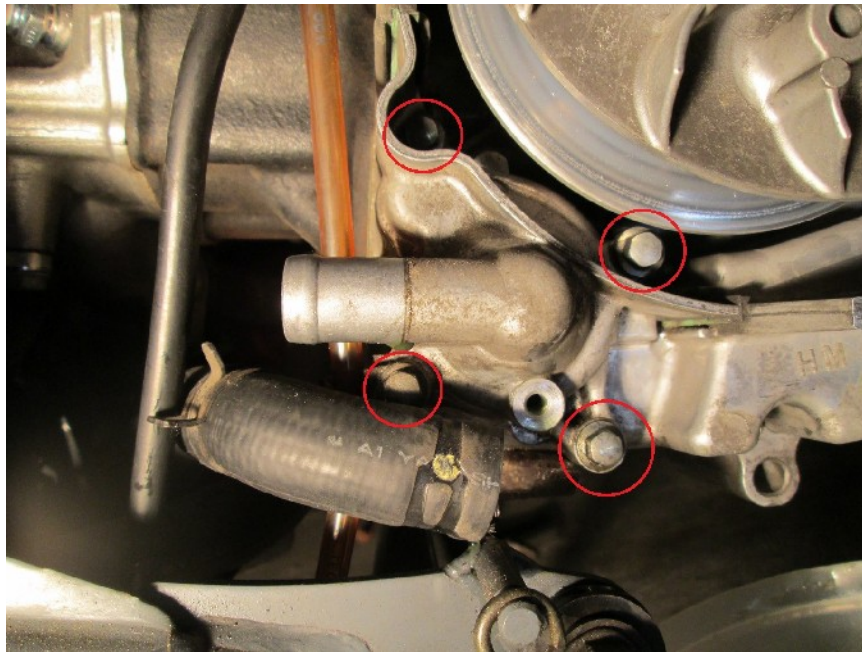
*Figure 11*

Figure 12 shows the plastic bucket used to catch the coolant. Notice how far away from the drain hole it is. I was caught by surprise when the coolant squirted a good 12 to 18 inches away from the drain hole.



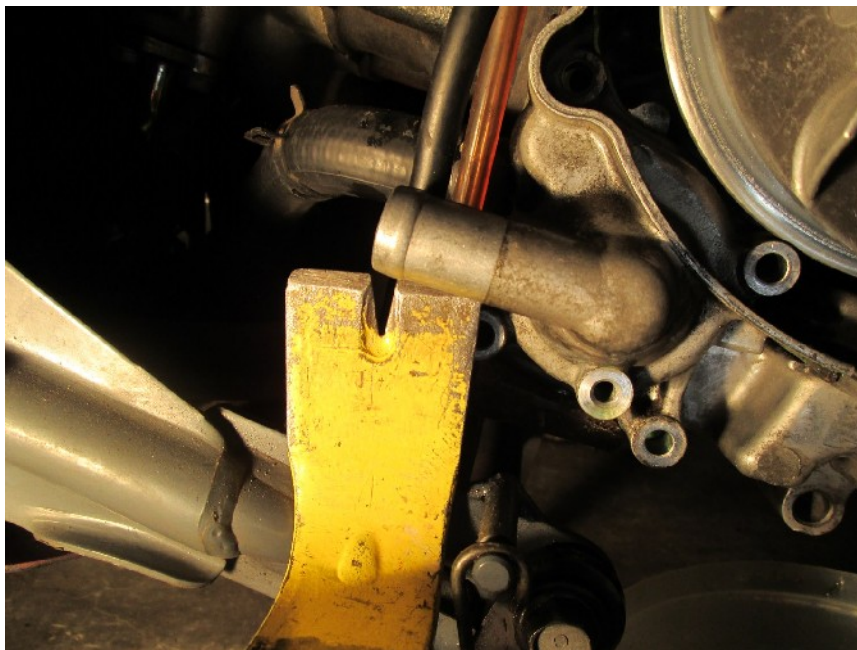
*Figure 12*

Next comes the removal of the water pump cover. The hose to the pump cover is detached as in figure 13. Four bolts are removed two of which are under the left crankcase cover. They are circled in red in figure 13.



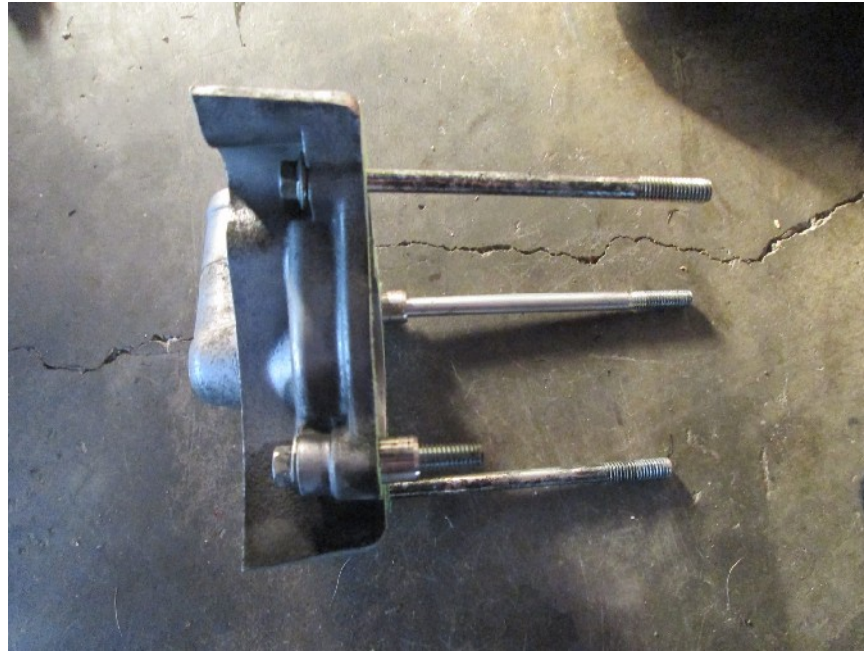
*Figure 13*

If the cover is on tight, a pry bar can be used against the side stand to pop it off as shown below.



*Figure 14*

The water pump cover bolts are of three sizes as shown in figure 15.



*Figure 15*

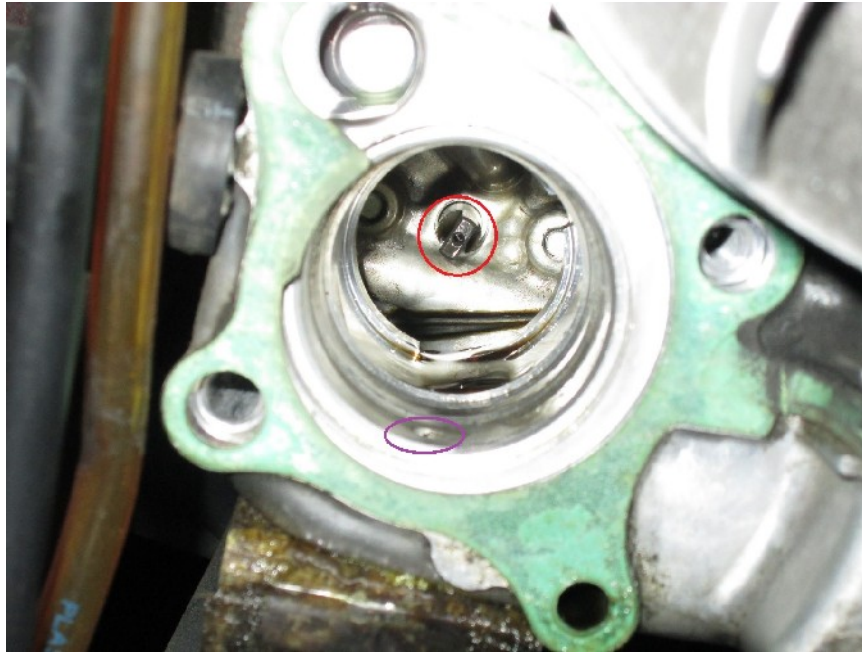
Next comes the actual removal of the water pump itself. Here I choose to depart from the Honda service manual's recommended procedure. The factory procedure suggests using the variator tool to hold the drive face of the variator which prevents the crankshaft and oil pump shaft from rotating. Since the oil pump shaft also drives the water pump shaft, the water pump shaft will not move, allowing a wrench to be used to remove the impeller.

There is a danger to using the factory procedure as described here by member Rod,

*“The book said to hold the pulley. Then turn the impeller nut off so I could put the 7mm nut on the pump shaft. As I was attempting to loosen the impeller nut, the tab on the oil pump ( the one that drives the coolant pump) broke. I was following the procedure in the book when the drive tab broke. “*

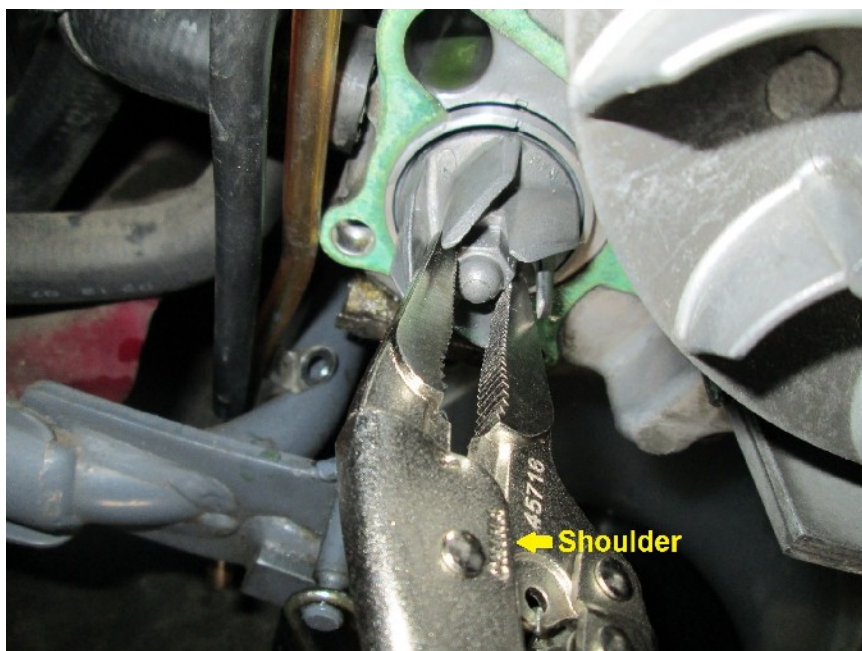
Figure 16 below shows the flat tab of the oil pump shaft circled in red that drives the water pump. This is the tab described by Dan as being able to break. Circled in purple is the water pump weep hole.





*Figure 16*

Rather than risk having to replace the oil pump shaft an alternative procedure was used. A pair of locking pliers was used to grip the cap nut in the center of the impeller. The cap nut and impeller are a one piece aluminum casting. The locking pliers have a shoulder as shown in figure 17.



*Figure 17*

A pry bar was used against the shoulder of the pliers with the base of the pry bar resting against the steel pin that retains the side stand spring shown in figure 18. This allows pulling the water pump straight out.



*Figure 18*

Be prepared to have a bucket under the water pump. A gush of oil will suddenly come out as shown in figure 19 but it will not squirt very far and the quantity will be small.



*Figure 19*



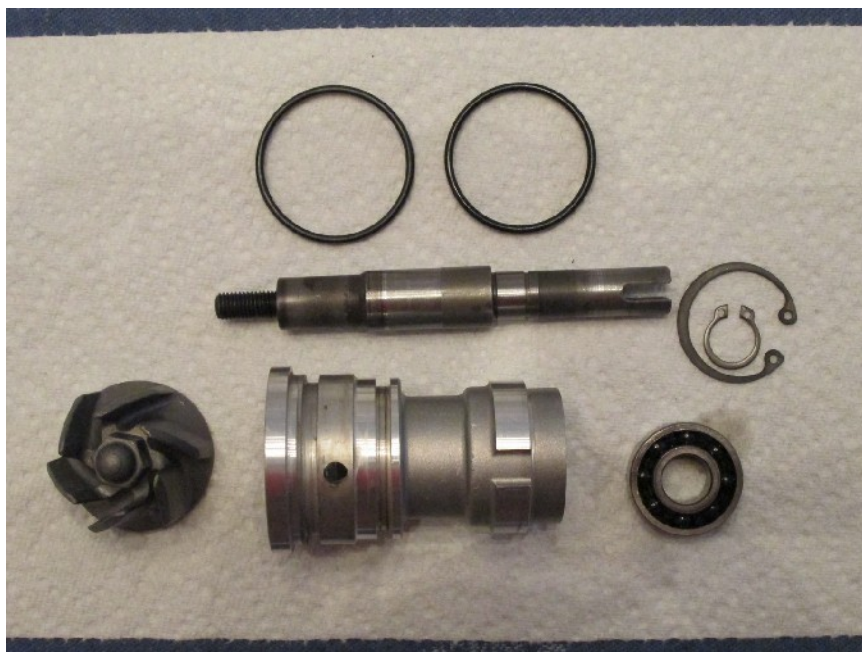
Figure 20 shows the extracted water pump ready for service. The pump holder and impeller are both aluminum.



*Figure 20*

### **How It Works**

Figure 21 shows most of the parts of the water pump.



*Figure 21*

Starting on the left we have the impeller. Unlike on some bikes, the impeller cap nut is actually a part of the cast aluminum impeller and not a separate part. Above are the two “O” ring seals that go outside the water pumps aluminum body. The left seal prevents coolant from passing to the weep hole in the engine and the right seal prevents oil from doing the same. The water pump holder also has a weep hole which aligns with the weep hole in the engine.

Below the “O” rings is the pump shaft. On the right side of the pump shaft is a groove which engages a flat tab on the oil pump shaft described earlier and shown in figure 16.

The pump shaft has a ball bearing which is to the right of the pump holder above. This bearing slides on the pump shaft from the right until it stops against a shoulder. The bearing is locked in place with the smaller of the two snap rings. The pump shaft is then inserted into the pump holder from the right side. The bearing will come to a stop in a cavity in the pump holder. The large snap ring then locks the bearing in the pump holder. These two snap rings prevent any further left or right movement by the pump shaft. The very left end of the pump shaft is the threaded portion to which the impeller is attached.

There are two items not shown in figure 21, the oil seal and the mechanical seal. The mechanical seal consists of two parts. The first part is shown in figure 22 mounted on the backside of the impeller. This portion of the mechanical seal consists of a rubber cup with a ceramic disk inside.



*Figure 22*

The separated parts are shown separated in figure 23. The ceramic ring is about 3.5 mm thick so it is pretty robust. These parts can be easily removed just using fingers from the impeller.





*Figure 23*

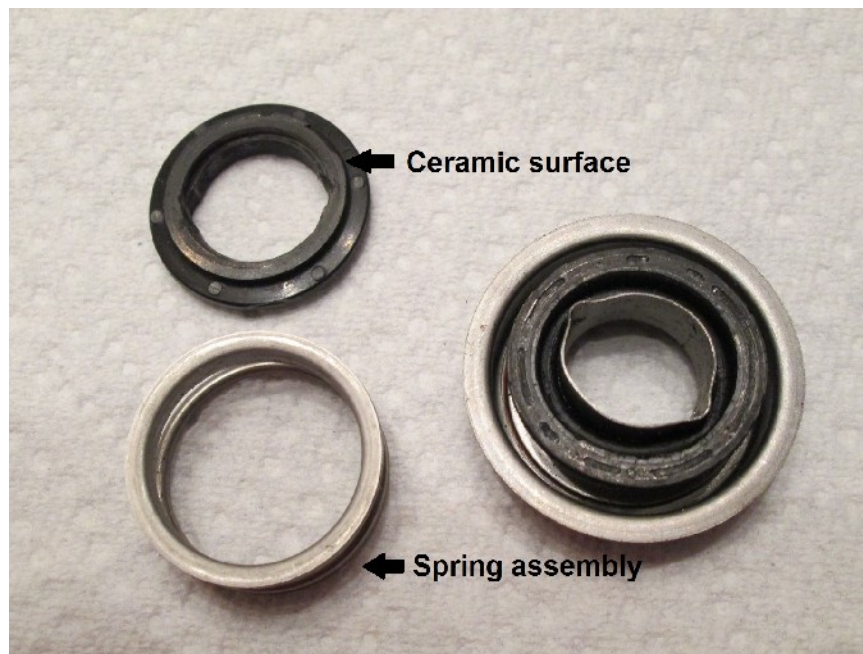
The second half of the mechanical seal is shown in figure 24. This part is pressed into the body of the pump from the left in figure 21. It is pretty complex with these elements,

- a cup shaped metal part with a raised center portion forming a shaft which is pressed into the mouth of the pump holder
- a rubber seal that goes over the shaft of the above part
- a metal retainer that goes over the rubber seal holding it against the shaft
- a spring that fits over the retainer, and
- a ceramic ring that it attached to the rubber seal pushed out by the spring to mate with the ceramic ring on the back of the impeller.



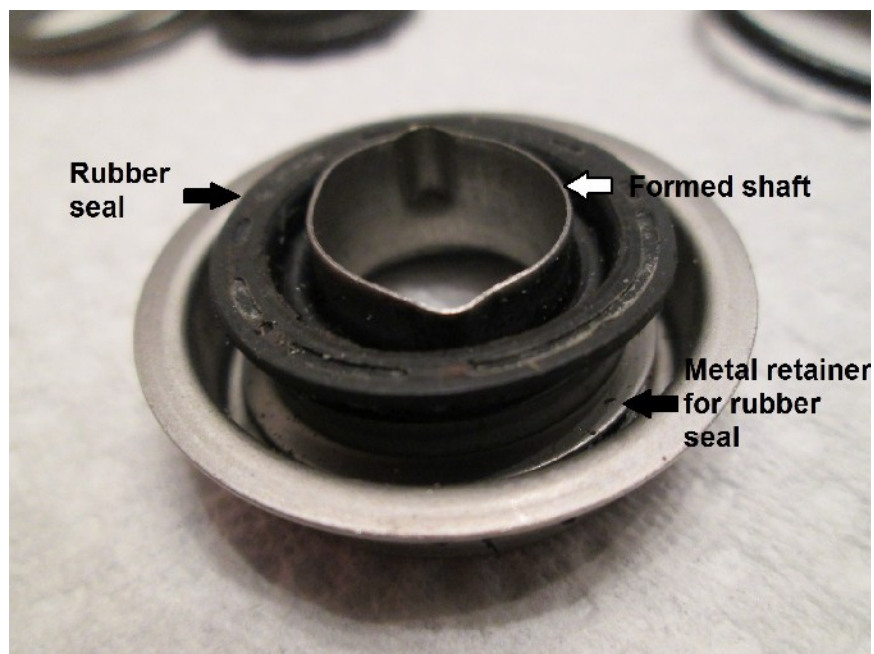
*Figure 24*

A dis-assembled mechanical seal is shown in figure 25 and 26. The shoulder of the spring assembly sits under the lip of the rubber seal. The ceramic ring seems to be glued to the face of the rubber seal but will pull off with pliers.



*Figure 25*

The metal ring that retains the rubber seal is visible in figure 26 below. The spring rests against the shoulder of this ring.



*Figure 26*

When the pump is assembled, the two surfaces meet with the spring pushing the ceramic ring of the mechanical seal pressed into the pump holder against the ceramic ring on the back of the impeller. As the pump shaft turns, these two surfaces rub against each other



tightly enough that coolant does not get by.

Here is what one web site states about mechanical seals.

“Some seal manufacturers design seals for high face loads that minimize leakage but also shortens the seal life. Others use lightly loaded faces for long life but these seals are more prone to greater leakage, figure 2.

The main point to be understood is that ALL MECHANICAL SEALS MUST LEAK to operate properly. MECHANICAL SEALS ARE CONTROLLED LEAKAGE DEVICES, NOT ZERO LEAKAGE DEVICES. This is not what anyone wants to hear but that is the current state-of-the-art in single mechanical seals.”

Figures 27 and 28 are photos of a new oil seal. The oil seal is pressed into the pump holder from the impeller side before the mechanical seal is pressed into the same. The seal itself is a rubber covered metal band. The rubber portion forms a cup between the pump holder wall and the pump shaft. There is a spring that goes around the rubber portion that the pump shaft goes through. The spring is visible in figure 28.



*Figure 27*



*Figure 28*

### **Dis-assembly**

The Honda recommended method of removal of the water pump results in the removal of the impeller before the pump is removed from the bike. The alternate method results in the removal of the water pump as a complete assembly.

To remove the impeller from the complete assembly, a screwdriver can be inserted into the groove of the pump shaft while a ratchet wrench with a 12 mm socket is used on the cap nut of the impeller as shown in figure 29.



*Figure 29*



The portion of the mechanical seal shown in figures 22 and 23 above can be removed with fingers. With the impeller removed, the pump shaft is held in place by a large internal snap ring. To remove the snap ring, a pair of snap ring pliers was purchased from Harbor Freight for \$3.99 ( SKU 3316 ). These are shown below.



*Figure 30*

The pump shaft can be pulled out as shown below once the large snap ring is removed.



A small snap ring holding the ball bearing on the pump shaft can be removed to release the bearing.

The most difficult part of dis-assembly is removing the pressed in portion of the mechanical seal. This requires a special tool that from the photo in the Honda service manual resembles a cross between a slide hammer and a gear puller.

Instead of trying to duplicate the Honda tool, a tool was created for \$2.98 in parts from Home Depot. The parts purchased are shown below,



Figure 31

This is the receipt for all the parts needed.

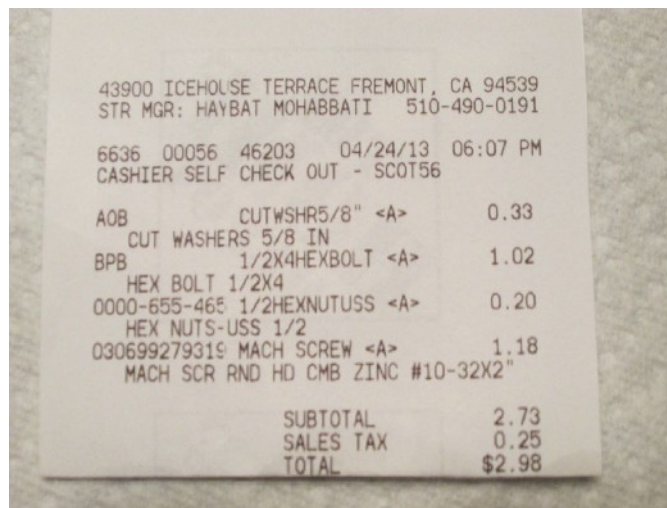


Figure 32

The parts consist of

- a pack of two inch long 10-32 screws for \$1.18

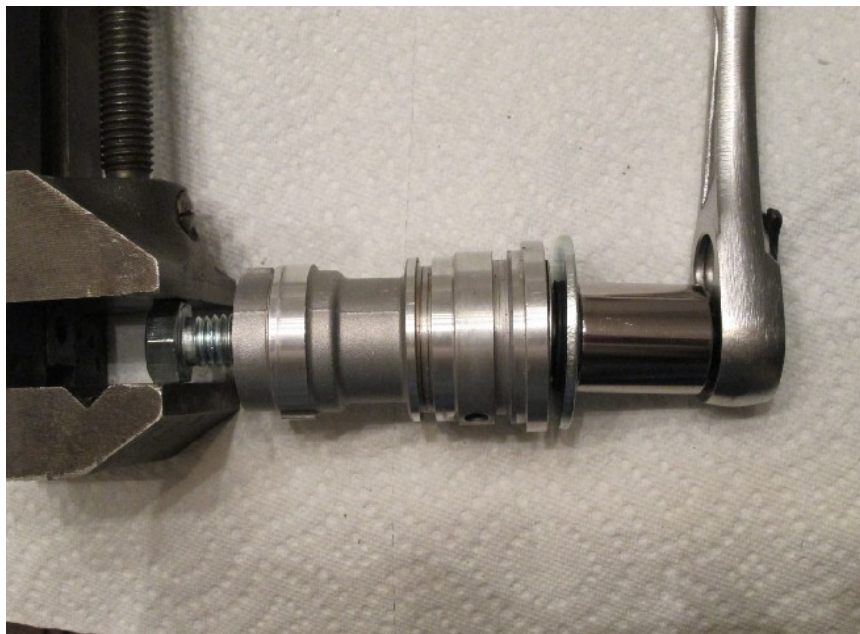
- a 1/2" nut for \$0.20
- a 1/2" by 4" long bolt for \$1.02
- and, a large washer intended for a 5/8" diameter bolt for \$0.33

A hole 13/64" diameter hole is drilled though the 1/2" bolt about 1 1/4" from the end that accepts the nut. A 10-32 screw is cut to a length of 1.1". The 1/2" bolt is inserted into the pump holder like the pump shaft. Taking advantage of the weep hole provided by Honda in the pump holder, the cut 10-32 screw is inserted into the weep hole and through the 13/64" hole drilled into the 1/2" bolt. The washer and nut are placed over the end of the bolt as shown in figure 33 below.



*Figure 33*

The reason for the long bolt is so the head of the bolt can be held by a vise as shown in figure 34. No tools grip the pump holder which is fairly soft aluminum.



*Figure 34*



The ceramic surface of the seal and the spring assembly was removed as shown in figure 25. The large washer fits over the face of the pump. The 10-32 screw under the mechanical seal pulls the seal out as the nut is tightened against the large washer but the seal will stop moving once it hits the bottom of the large washer. With the the ceramic surface and spring removed, the formed shaft can rise up through the center hole of the washer which measures about 3/4" in diameter until it hits the 1/2" nut. It is possible that two washers might help. One washer worked for me but it was close. The seal's formed shaft is shown rising up into the washer below.



*Figure 35*

Note: Be careful that the 10-32 bolt is cut shorter than the diameter of the seal as shown below and that the hole in the 1/2" bolt be sufficient in diameter that the 10-32 screw will slide out on its own. I almost made the mistake of leaving the 10-32 screw a bit long and the hole in the bolt a bit tight. Once the 10-32 screw is pushed through the weep hole, there is no easy way to pull it back out if it is not loose enough to come out on its own.



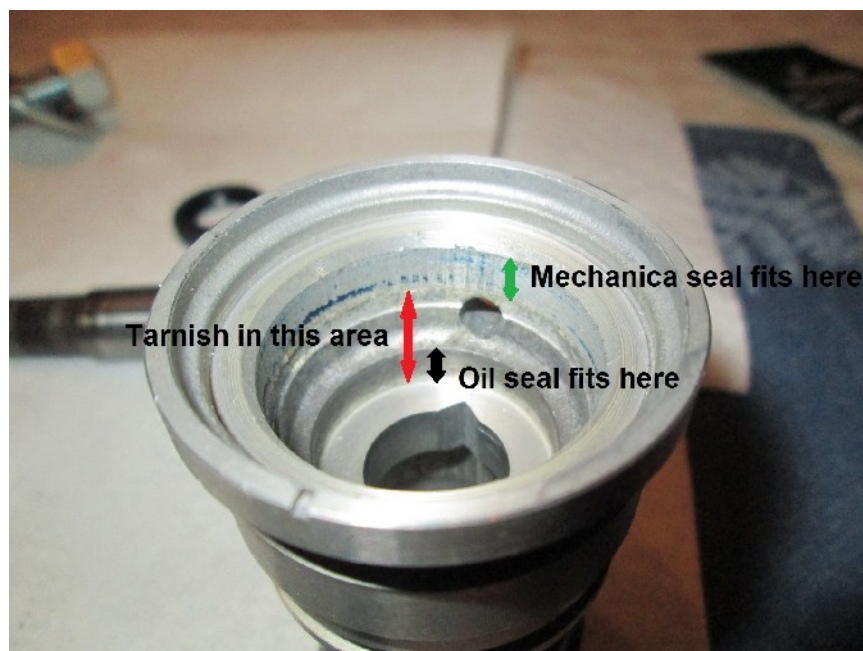
*Figure 36*

The oil seal is removed next. In my case, the oil seal was so deteriorated that when I grabbed it with needle nose pliers to pull it out, the top portion tore off as shown in figure 37. Notice the brown color in the pump holder. That is the remaining part of the oil seal. The black rubber of the seal had turned brown after it hardened and became like cardboard. An X-Acto blade was used to remove most of it leaving a layer against the body of the pump holder which was removed with the cleaner shown in figure 39 and cotton swabs so the soft aluminum did not get nicked by the X-Acto blade.



*Figure 37*

Figure 38 shows what the cavity for the oil seal looks like after it was removed and the area cleaned up. Blue sealant visible in the area where the mechanical seal was



*Figure 38*

removed. A new mechanical seal comes with this sealant applied to its exterior. This is visible in figure 24 and remnants of the old sealant are visible in figure 36. The old sealant was removed with cleaner.

There was tarnish found in the area between the mechanical seal and the cavity for the oil seal. I suspect that some leakage of coolant mixed with oil reacted with the aluminum to create the tarnish. No tarnish was found where the mechanical seal was pressed into the pump.

PureTronics Extra-Strength contact cleaner was used for cleaning but it is not to be used on rubber, plastic, or painted surfaces. It works well for the aluminum pump holder and will dissolve remaining blue sealant left over from the original mechanical seal.



*Figure 39*



## Re-assembly

Figure 40 shows the parts purchased for this project. Shayne Hodgson donated the new pump gasket all the way from Australia. Thanks Shayne.



*Figure 40*

Shayne's pump gasket is at the top. The lower left has the two "O" rings that go around the outside of the pump holder. The new oil seal is directly below the pump gasket, and the two parts of the new mechanical seal are at the lower right.

The parts that were not replaced were the pump holder, pump shaft, impeller, two snap rings, and the ball bearing.

Oil was applied to the new oil seal on the surface coming in contact with the pump holder, inserted, and tapped into place using a 17 mm socket as shown below.



*Figure 41*

The portion of the mechanical seal that inserts into the rear of the impeller was pressed in by hand after wetting the rubber with a bit of oil as recommended by Honda.

The mechanical seal portion that presses into the pump holder was not oiled in any way since it has a blue sealant already applied from the factory. It was inserted and tapped into position with a 1 1/16" socket.



*Figure 42*

Next the ball bearing was placed over the pump shaft and locked into position with the small snap ring. The pump shaft was inserted into the pump holder and the larger snap ring inserted to lock it in place.

The impeller was reattached as shown in figure 29 but using a torque wrench set to 9 ft-lbs. This completes the re-assembly of the water pump.

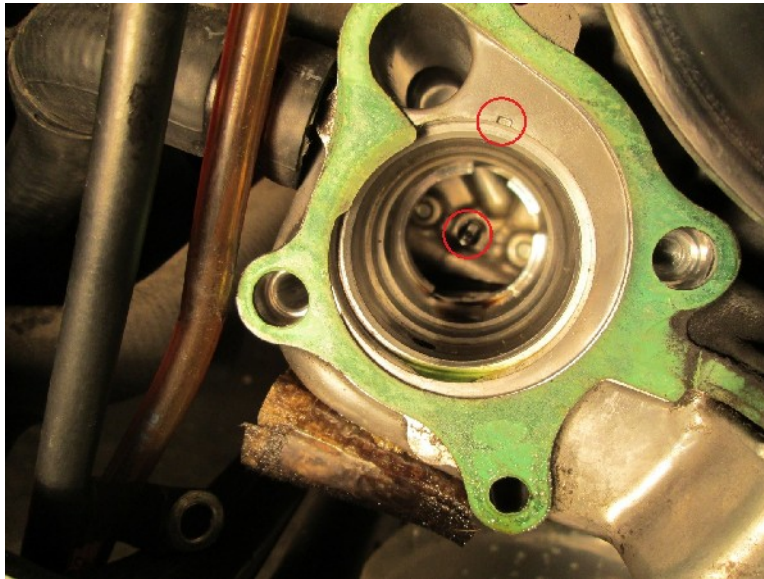
Next are the steps to replace the pump in the Reflex. This is a bit different than the method described in the Honda manual since the impeller has already been reattached.

The pump holder has a notch as shown in figure 43 that needs to be aligned with the groove at the end of the pump shaft. The two new O rings are placed over the pump holder with some oil as recommended by Honda also shown in figure 43.



*Figure 43*

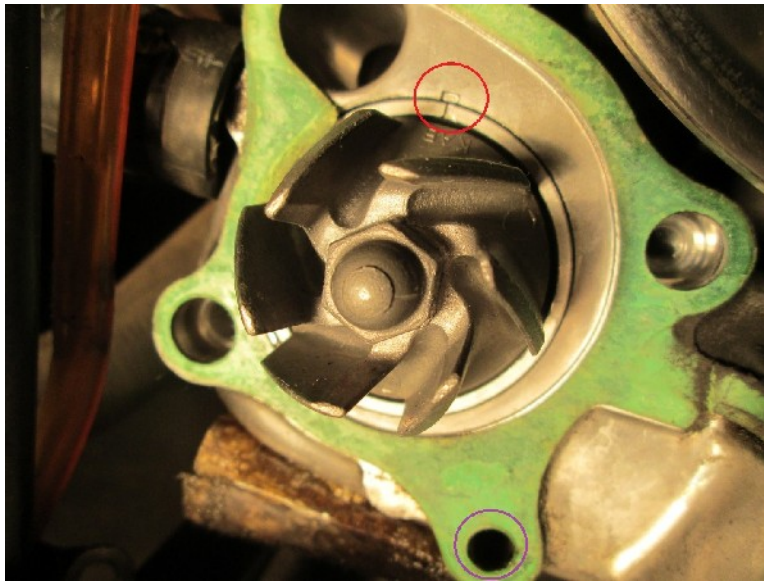
The tab at the end of the oil pump shaft also needs to be aligned with a notch on the crankcase as shown in figure 44. This can be done by rotating the variator pulley.



*Figure 44*

Figure 45 shows the water pump re-inserted into the crankcase with the notches aligned. It was pretty easy sliding the pump back in until about 1/8" was still stuck out. A rubber hammer was used to tap it all the way in. Try to avoid the temptation to tap the impeller. The impeller and the pump shaft are held to the pump holder only by the large O ring at the back so the O ring is what gets hammered. Honda uses special tool that looks like a deep socket to fit over the impeller and drive on the visible edge of the pump holder. Pushing the pump all the way end is not that difficult since it is just the two O rings on the outside that are creating the friction.

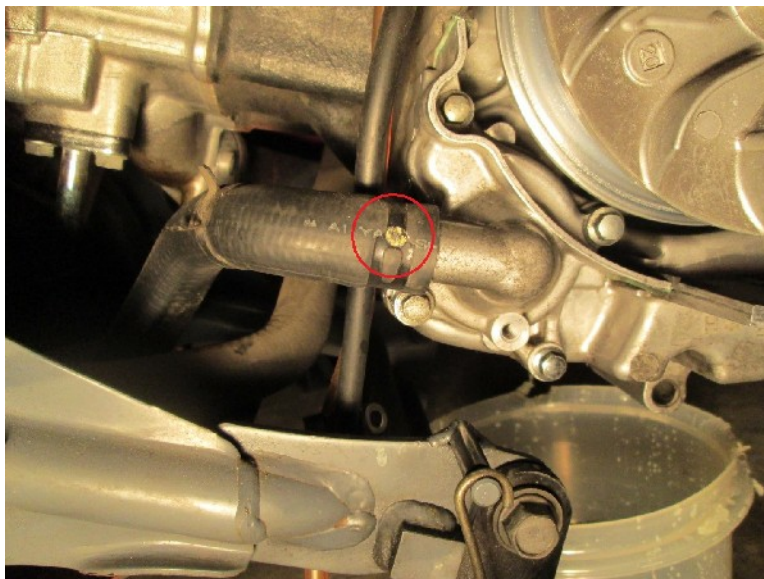




*Figure 45*

Also, notice the screw hole circled in purple at the bottom of figure 45. That screw hole ended up filled with oil after a small amount of oil gushed from opening after the pump was pulled out.

After the pump cover is re-attached, Honda wants a white dot on the water hose to be located as shown below.



*Figure 46*

Honda recommends replacing the drain screw washer shown in figure 47 below. I did not do that but had no problem. It does not appear to be a compression washer just a plain washer.



Figure 47

The radiator can now be filled with a 50/50 mixture of coolant and distilled water as recommended by Honda. The Honda manual also says to avoid coolant with silicates. Peak extended life coolant was used in this case. Some sources say it is the same product as Walmart's SuperTech extended life anti-freeze.



Figure 49



Figure 48

This completes the re-installation of the water pump. The remaining steps are to replace the left crankcase cover, cover protector, belt case air cleaner, and left side skirt by reversing the steps outlined at the beginning of this article.

## **Costs**

The cost of material for this project was,

Mechanical seal	\$32
Oil seal	\$5
O rings	\$4
Gasket	free from Shayne

Sub total	\$41
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Cost for tools,

Snap ring pliers	\$4
Home made seal puller	\$3

Sub total	\$7
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<b>Total cost</b>	<b>\$48</b>
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The price of a new water pump is about \$122 plus the price of a new gasket about \$3 or \$125.

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A2012reflex