

# Swirl Motor Replacement for Dummies

Myself Included.  
by  
Chirpz

## My Painful Discovery

I was loaded up and ready to pull out of town with my trailer when suddenly the engine light came on. I started for home and in another block, the red throttle position sensor came on, then my Jeep WK CRD went into limp mode. No weekend vacation for us.

I discovered this forum and started reading about the symptoms. Reading Tuco's experiences convinced me that I had a bad swirl motor. I was overcome with dread because although I have a nice background in home mechanics, this motor scares me. I have never touched anything so complicated.

I took the codes to the dealer and they gave me that “deer in the headlights look.” “What motor, CRD?” “Swirl Motor?” That made me feel good. The guy told me to wait and in about 20 minutes they would confirm my doom. Two hours later, the rep. came out and said, “I think we have determined that you were right. You have a bad swirl motor. The repair will cost you \$1235.00 but if the tech accidentally breaks the left manifold linkage it will be \$1600 more and if he accidentally breaks the right manifold linkage it will cost another \$2,000. If all that happens we can discount it a little.”

I thought, “Thanks, I'll break it myself.”

I went back to the forum and read everything I could read about the swirl motor and how to repair it. I especially focused on Tuco's procedure and the next day I went back to the dealer and purchased all the parts using Tuco's list.

I had a gut feeling that I did NOT want to pull my turbo as Tuco did. While at the dealer, I asked the clerk how much it cost to buy a new turbo. He said it was over \$4,000.00. Right then and there, I decided to try my best to make the repair without removing the turbo. I just didn't want to risk it. I purchased a Sprinter CD but the CD did not help much. In fact Tuco's notes and pictures are much better. The CD just scares you and shows you how dumb you are because you cannot identify the parts that they name.

Tuco encouraged me and warned me that it would be a very delicate operation that could lead to big repairs if I goofed. So I gritted my teeth and determined to be patient and not goof.

Another reader insisted that it was possible to do the repair without removing the turbo. Tuco tried it and had a stroke of bad luck breaking the linkage.

Borrowing notes and ideas from everyone, I was **successful today**. Here is a step by step guide written for dummies like me who do not know what all those gizmos are.

Do NOT proceed with this repair unless you are a very patient person and have lots of time on your hands. Although, if you take it to the dealer, it will take over a week. **Patience is the key.**

# How to replace your Swirl Actuator Motor WITHOUT pulling your turbo.

by Chirpz (c) Tom Croley 2011

(Ok to repost, Ok to link, etc)

## Necessary Tools

Screwdriver

Crescent wrench

Nippers

Garden shears

Sissors

3/8" Ratchet

3" Extention

10mm Socket

E10 Torx Socket

T20 Torx wrench

5mm Allen wrench

Pliers

Drill Motor

1/8" drill bit

3/8" drill bit (optional)

5/32" stiff wire (hardware store)

Xacto knife or pocket knife

Needle Nose plier (long)

Bend wire to various shapes especially

notice the one that looks like tweezers

Medium Dental Floss (very important)

Medium Super Glue (CYA)

Super Glue Activator in a spray applicator

Hemostats (optional)

Long surgical tool (very nice but I don't

know where to get one. I got mine at

a garage sale.)



**Ha! This looks more like a root canal than a repair job.**

**Very Important  
you must have  
GLUE**

**Glue**



**Activator**



Buy glue and activator from your local RC hobby shop. If you don't have one, shop online at Tower Hobbies. Here are the links. It is very important to note that the glue is “Medium” thickness, not “Thin”, not “Thick.” It is also important that the activator comes in a spray bottle.

Most people have a low opinion of Super Glue because they have never seen or heard of “Medium” and “Thick” glue. RC people use it all the time. You can repair **anything** with it **IF** you also have the “**Activator.**” Activator makes this fast drying glue dry absolutely instant. You **MUST** have this glue to proceed. If you don't have it, wait.

<http://www3.towerhobbies.com/cgi-bin/wti0001p?&I=LXPT42&P=7>

<http://www3.towerhobbies.com/cgi-bin/wti0001p?&I=LXPT39&P=ML>

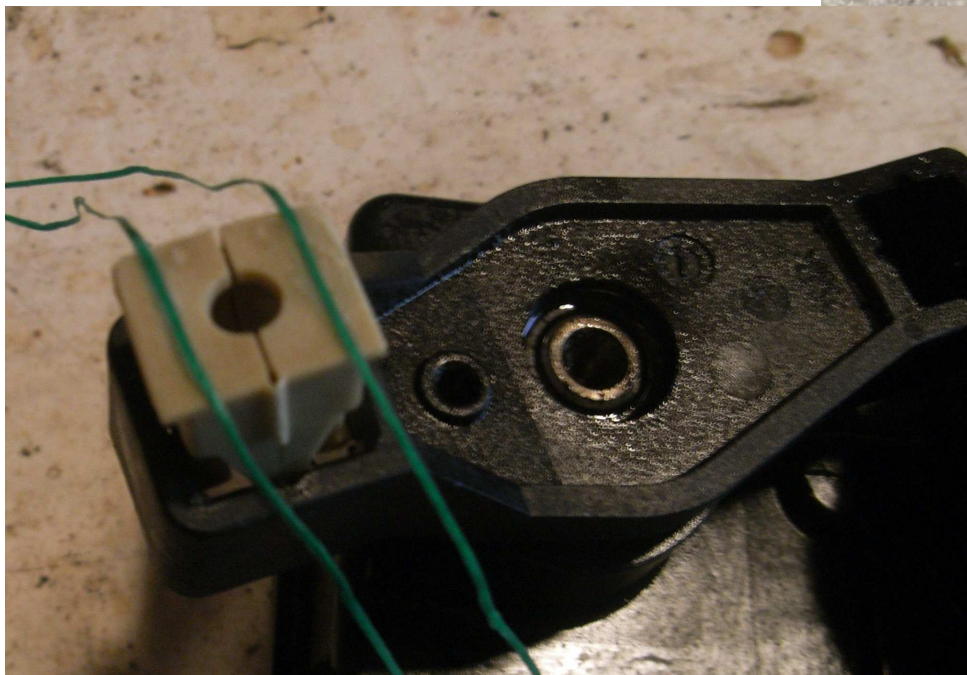
# Parts List

Go to the dealer and buy these parts. I got this from Tuco's tread on Jeepforum.com. Thanks Tuco. The parts guy will think you are a genius. Buy 8 or the swirl clips if you feel clumsy. You should only need TWO. I broke one so used THREE. The rest of the stuff is "just in case" you have to remove the turbo. I took it all back.

- 4 Swirl Clips 5175673AB \$2.60 each
- 1 Turbo to Y pipe 68004671AA \$8.00
- 1 Turbo to Y pipe (other side) 68004670AA \$8.25
- 2 EGR flex tube gaskets 05175695AA \$4.35 each
- 2 Intake Manifold Gaskets 5175645AA \$9.35 each
- 1 Turbo Base Gasket 68053124AA \$4.10
- 1 Turbo Mount Base Gasket 68053189AA \$3.85
- 1 EGR to Manifold (Driver side) 5175692AA \$2.75
- 1 Gallon of HOAT coolant.

# Parts and Mods

This is a swirl clip mounted in the swirl motor. This is your goal and biggest headache.



## **This is a Swirl Actuator Motor**

Handle the motor and the clip and get a feel for how it works. Study it carefully until you really understand what is necessary. The clip attaches to the linkage and then jamps into the bottom of the motor. Notice how hard it is to snap the clip into the motor.



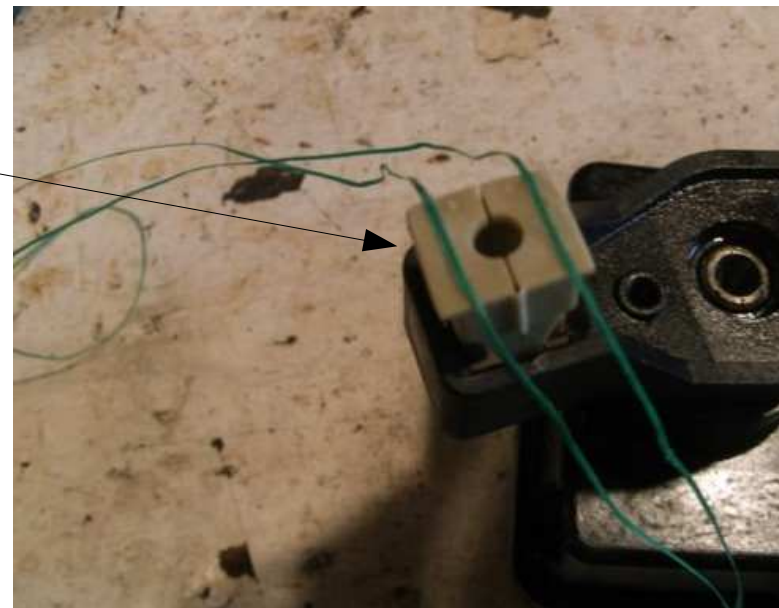
# Practice with the Glue.

Be very careful with this CYA super glue. It will bond your fingers instantly. If you get any on your fingers or hands wipe it off carefully without letting your skin touch other skin. (I did not have you buy “release agent.” It does not work too good anyway.)

Practice gluing a few things. Clean the surface, put the glue on one surface. Spray the other surface with activator. Press them together. Do not accidentally spray the activator on your glue supply. It will instantly clog your tip.

Now.... Pull off about 4 feet of medium dental floss. Use floss because it squeezes easily into tight spaces and because it is very strong. Better than any thread. Place a clip partly into your motor to hold it and glue the floss to the clip as shown.

Spray the middle of the floss (hold well away from the clip, don't get spray on the clip.) Put two tiny lines of glue along the edges of the clip. Stretch the floss over the clip and hold tight until the glue partly dries. Spray the the clip. Wait till dry. If necessary put another layer of glue over the floss and spray again. This setup is fragile, don't pull on the floss. **DO NOT GET GLUE ON THE SIDE OF THE CLIP!** If you do, start over with a new clip.





# Mod your Motor

be brave, be very brave

Of course you must first remove the old motor without breaking the linkage on the manifold. If you break it, it will cost you an extra couple days labor and \$700.00-\$900.00 for a manifold. This you CAN do if you are patient.

To pull this repair off, you have fish the swirl clip into the tight space between the manifolds and attach it to the ball on the linkage. Then you have to almost blindly jamb the clip into the bottom of the motor. Seems impossible. Well its not. But it requires great patience. If you ain't got it, stop right here.

Now turn the motor upside down, take the xacto and trim the edges off of the hole so that the holes are beveled just a little bit. Experiment using a clip. Your goal is to bevel it just enough so that the clip slips into the hole with very little resistance. Make sure you are viewing the motor exactly like this. If you bevel the other side, you ruin the motor completely.



Beveling the edges makes the clip slip easily into the arm!!

Modified motor arm. Look closely at the bevel.  
Go back to the last page and look again at the bottom of the motor. You must bevel the correct side. Practice popping the clip in and out when done, set that clip aside because you ruined it playing with it too much. It is important to get the feel of success so its worth a clip.

This is the **WRONG** side. If you cut this side you ruin your motor.



Make TWO of these string clips. Turn them over and fiddle with them. Open the clip and let the clip hang down supported by the strings that are on the bottom of the clip. You should be looking down on the clip from the top and should not be able to see the bottom. If you are doing this correctly, the clip will be like a miniature string puppet. A clip puppet if you please.

You will use this puppet to attach the clip to the ball of the linkage and then to pull the clip into the bottom of the swirl motor.

It is a tricky process and will require many tries but YOU can do it.

Don't worry about those O-rings that you may have seen on the forum. You will not need them. I'll show you an easier way to hold the clips together later.

These are the linkage balls. Unless you are very small you cannot get your hands in there to work.



OK... Here goes

**First you have to GET to the swirl motor and remove the old one.**

This is how I did it. Step by step. Take your time and be careful and you can do it too.



**Open the Hood!**



Remove oil cap.  
Remove TWO 10mm  
bolts that hold the motor  
cover. Pull the cover forward  
and up.



Remove negative battery terminal. Pad it with rags or whatever so it does not accidentally touch the battery. Drink the Coffee!





Remove engine cover  
bracket. Two 10mm bolts,  
I think.



Remove air intake channel. Loosen two clamps and pull gently. Also remove the crank case ventilator hose from the side of it. This hose caused your problem in the first place.



Clamps



Remove the foamy rubber cheeks that cover the injectors and stuff.  
Label them left and right, front and back. Use a Sharpie Pen.



I have no idea what these thingys are for.



Drain the radiator and then remove this hose. Use pliers and pull gently. Remember, all parts are made of gold!!.



The radiator drain is on the driver side. Turn the knob two turns counter-clockwise. It drains slowly, loosen the fill cap to help. You may have to remove covers, or skid plates to get to the radiator. Be sure the hose is empty before you remove it.



Remove this black hose and pull it to the right and tie it off.  
We don't want it flopping around.



Crawl under the car with your E10 Torx or 5/16 box end wrench.  
Remove this bolt that holds the turbo thingamajiggy. It is made  
of black plastic and binds the turbo pipe.  
Thingamajiggy will now flop around a little.

**This bolt**

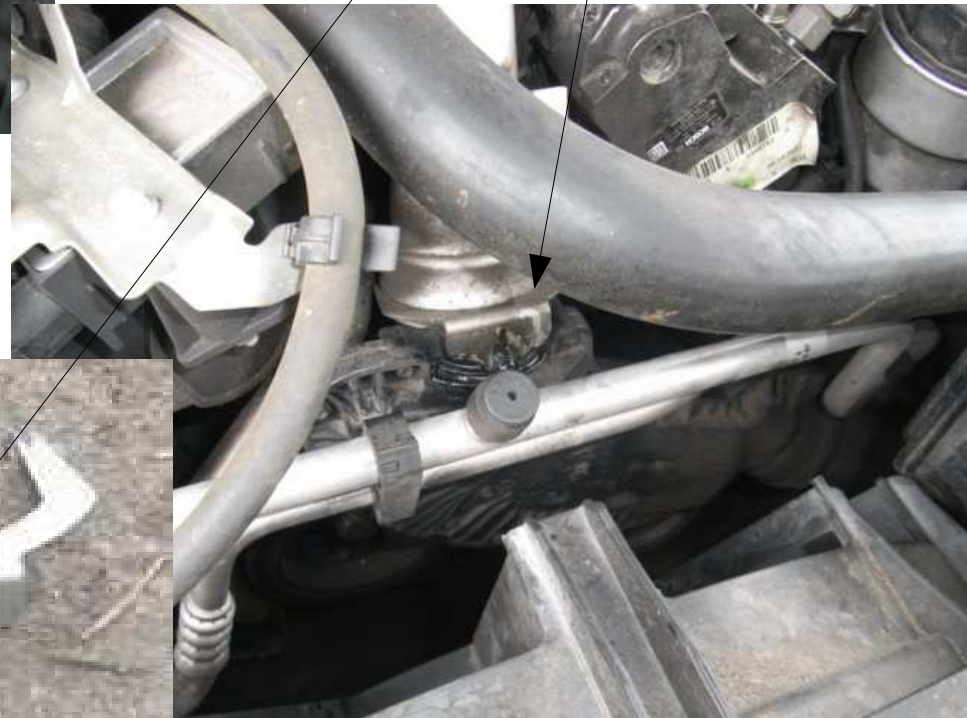
View looking up  
with coolant dripping  
in down your neck.



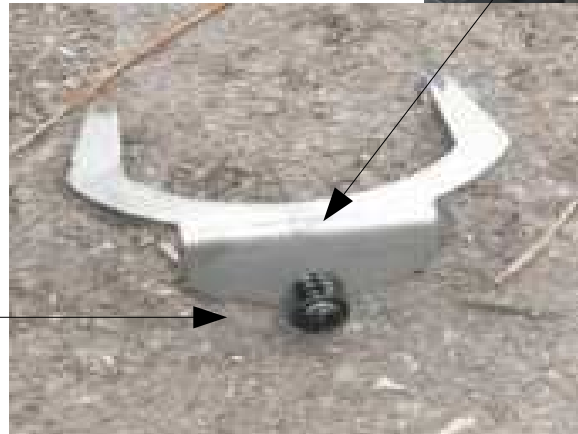
**NOT** this bolt.



Remove this turbo pipe. There is a screw and bracket down here. There are expensive O-Rings inside so be careful. I broke one. Remove lock bracket, flex the thingamajiggy and pull the top of the pipe away from the turbo.



I goofed and pulled the pipe before the hose. I also forgot to loosen the thingamajiggy. Broke expensive O-ring...bad.



T20 Torx



## Fuel Filter Removal

Remove Fuel Hoses. If you have never done this before you will have to cut off the factory clamps and replace them with screw type. Do this without damaging the hoses. I used a Drimmel tool with a tiny thin cut off wheel to cut through the clamps without even scratching the hoses. The hoses are hard to get off. Carefully force them. DO NOT damage the black thingy in the middle. It is OK to un plug the plug first.



Are we having fun yet?

If you need a new filter.

Buy one ahead of time. Napa has them.

## Fuel Filter Removal

Loosen 5mm allen nut on the filter clamp.

If you must, remove these two T20 torx and rotate the black thingy out of the way. It is your "water in fuel" sensor.

Remove 3 E10 Torx bolts that hold the filter frame. Also remove the little flipover brackets the grab the metal fuel line.

To drain water from fuel you rotate the knob. Hook up a hose and start the engine. Or use a squeeze bulb. Do this at oil changes **not now.**





Pull out the fuel filter and bracket. Might as well dump it out!



You can now peer into the engine and see the evil swirl motor!!

**Now remove the swirl bracket.**

Wiring Harness

Swirl Motor

Fuel Crossover  
Line





The next step is tricky so be careful. You must remove the fuel cross over line. Remove the 3 nuts that attach the injectors to the fuel rail on the passenger side. Remove the 2 nuts that fasten the crossover line to the fuel rail, one on each side. Be careful not to tweak the injector lines or apply any force to the injectors.



Remove the two bolts that hold down the fuel rail. The rail is now loose but cannot yet be removed.

On the driver side, remove the two bolts that hold down the fuel rail. You do not need to remove the 3 nuts that hold the fuel lines.

Both fuel rails should now be loose but the driver side one is still attached to the injectors

The previous step creates a little play in the crossover fuel line. You can push the fuel rails a tiny bit to the left and right to increase the play but be very gentle. You do not want to damage an injector.

Grasp the left side of the crossover line and pull it out of the fuel rail as you wiggle the fuel rail away from you. Be careful not to damage the ends of the crossover line.

Flip brackets

Crossover line



Unplug the wires that lead to the injectors and any other plugs that you see.  
Use a Sharpie marker to label where they go.





You can now remove the passenger side fuel rail. This is necessary because you have to move the wiring harness and some of the wires are trapped under the fuel rail.

Gently wriggle the fuel rail off of the injector lines and remove the electric plug at the end.



You now have to deal with the wiring harness. Be brave. Be bold.  
Cut the plastic wire straps that hold the harness together. There are at least three of these.

Unplug the swirl motor if you have not done so yet.





Using a screwdriver blade, carefully pry the harness apart. There is a small bottom part and a long top part. Work the wires out the front side of the harness as you pull on the bottom part. Be very careful not to damage any wires.



Bottom part of  
the harness

Pull all the wires out of the harness. Bunch them and tie them out of the way.





You now need to CUT OFF the top part of the wire harness housing. You can see in this photo how I cut mine. I used nippers and garden shears to do this. Be careful not to cut any wires.

Cut harness cover and remove



You can now see the entire swirl motor. Loosen the two swirl bolts but do not remove them. You want to be able to wiggle the motor.

Gentleness, patients, and tender loving care is now needed! Goof this up and it will cost you pain, suffering, and money.

Your goal is to remove the swirl clip from left side of the swirl motor without breaking the linkage.

You can see the clip if you peek into this hole.

This hole was not necessary

Pass an angled wire through the peek hole and use it to hold the arm of the motor to keep it from moving. Using your 1/8" bit, drill a hole through the motor. Use a sharp bit and do not use a lot of force. Don't let the bit slam into the clip!! You want to be able to pass a stiff wire through the motor and INTO the top of the clip. **DO NOT** push on the clip at this time. Do not drill the clip.

Stiff wire contacts top of clip



Using great care and as little force as possible, insert a stiff wire into the peek hole and work on the edges of the swirl clip until you finally manage to disengage it. I actually drilled a 2nd hole through the motor and passed a second wire through the motor to contact the edge of the clip. Use finesse, not force.

You can use a 90 degree bent wire to pull at the back side edge of the clip.

Keep at it until you succeed. When you get it you will feel a wave of joy.

Use the top wire to push the clip completely out of the motor arm.

We are not trying to save this clip, just remove it. It is a throw away.

Don't hurry. If you get careless and crack the fragile manifold linkage then you are doomed to a major repair effort. Take your time.

When you get the left clip off, remove the 2 swirl bolts and gently slide the motor forward a **small** amount. You can now see the right arm of the motor and the swirl clip and part of the linkage.

I managed to get this clip off using long needle nose pliers.

Don't pull on the motor too much or you will break the manifold linkage. Be gentle. Take your time. Work at the clip.

When you get this clip off, remove the motor and take a coffee break.



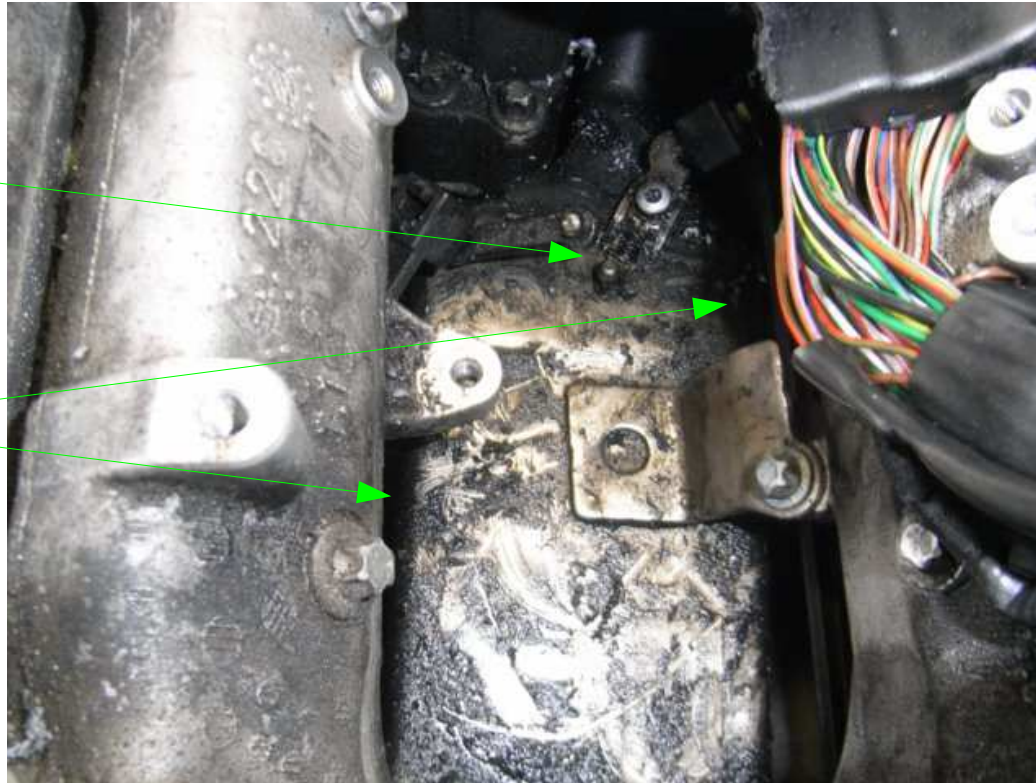


Clean up the inside of this whole area and stuff rags in every crack to prevent loosing any tools or clips.

Feel the linkage and figure out how it works. Gently work the linkage back and forth on each side to insure that it operates smoothly. Use a mirror to examine the linkage for breakage. If anything is wrong with the linkage then all bets are off. You have to pull the manifold....refer to Tuco's notes.

Notice the balls on the ends of the linkage.

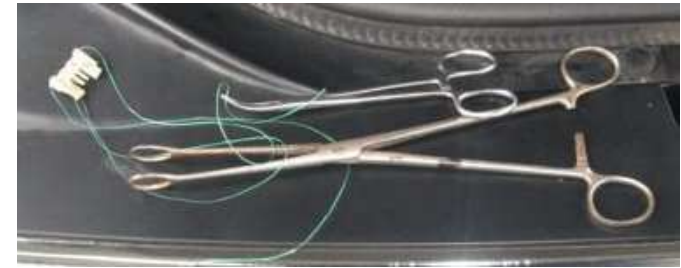
Stuff Rags





Now the fishing derby begins. I hope you are patient.

Get your little clip puppets with the attached floss. Dangle the puppets into the engine cavity and fish with them until you attach one clip to each ball!



Work the floss to position the clip on the ball then use the long wire tweezers to close the clip. It is hard to get it to snap. I used the long surgical tool to actually make the final snap. Try not to get the clips dirty or oily!!

Now here is my **BIG SECRET**. You have to keep the clips from unsnapping while you pull them into the motor arm. An O-Ring over the clip will work, but I just couldn't do it. **GLUE** to the rescue! Get your **CYA Medium** glue. Be very careful here.

Drip **ONE DROP** of glue into the top center of each clip. **ONE DROP** then spray it with activator. That will do the trick.

You are not allowed to miss. If you get glue on the outside edges of the clip you are cooked. Remove the clip and start over. One Drop in the center of the each clip. You can see a little gripper that holds the clip halves together. If you can hit that gripper it is ideal. Glue on the outside of the clip will prevent the clip from inserting into the arm so don't miss.

Set the motor in place and position it so you can see the right arm and right clip. Using your wires, fish all 4 strands of the floss through the arm hole from the bottom up. You can now gently pull on the floss and tweak with your various wires until you get the clip started into the hole. Once it starts, use a 90 degree wire to push the clip up from the bottom. You may hear it click into place.

The drop of glue should keep the clip from falling apart.

After you get the clip seated pull the floss out one strand at a time. Be gentle.

Now position the motor and replace the 2 bolts but do not tighten them.



With the motor in place, fish the floss from the left clip into the left arm.  
This one is really hard and took me over an hour, but it can be done.  
Do replace the bolts loosely to hold the motor while you work the clip.  
This picture was taken before I replaced them.

Don't drill any holes  
in your new motor.  
You have to work  
through the peek hole.

When your are done.  
Pull out all the rags and  
tighten the bolts.  
Take a coffee break.  
Try to relax.





Repair your wiring harness using the left over pieces and a little duct tape.

Put everything back together in reverse order.

Use a code reader to clear your engine codes.

Crank it up and rejoice.

It may be hard to start at first. Mine took 3 tries.

Do an elephant hose mod to prevent future problems.

