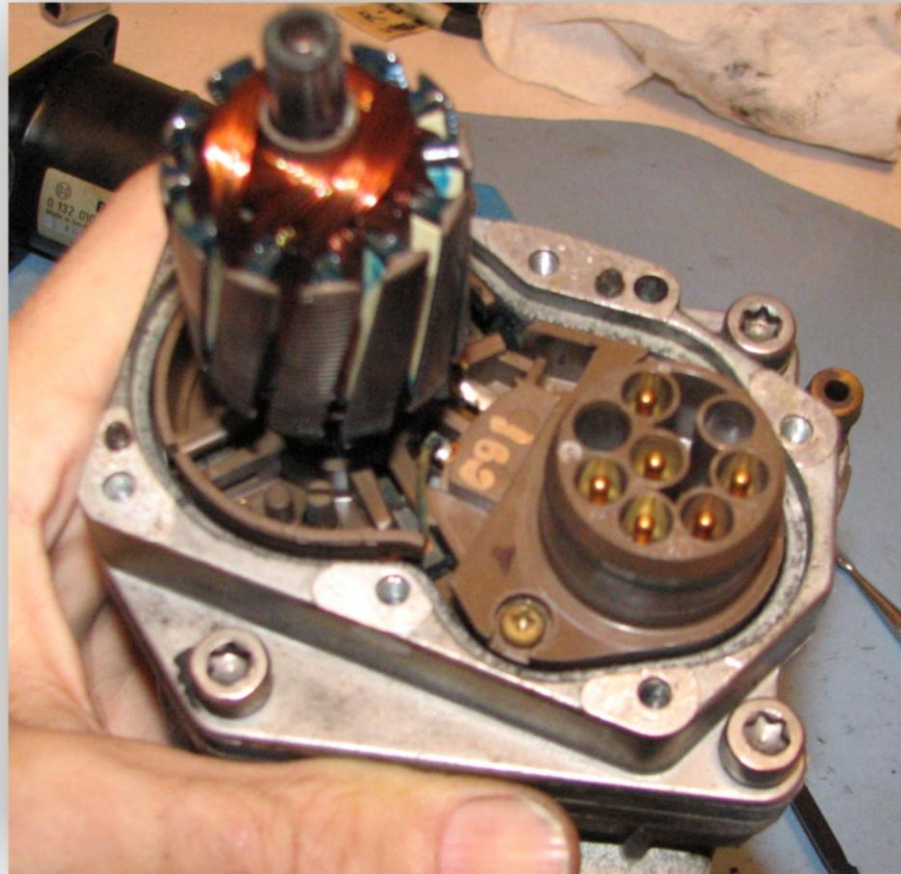


2010

1991 BMW 750iL

George Fontes
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DK MOTOR REMOVAL & RECONDITION

Recondition the DK motors to eliminate EML warning lights and "limp mode" episodes.

DK Motor Clean & Recondition

Car: 1991 BMW 750iL, mfg 4/91

Symptoms:

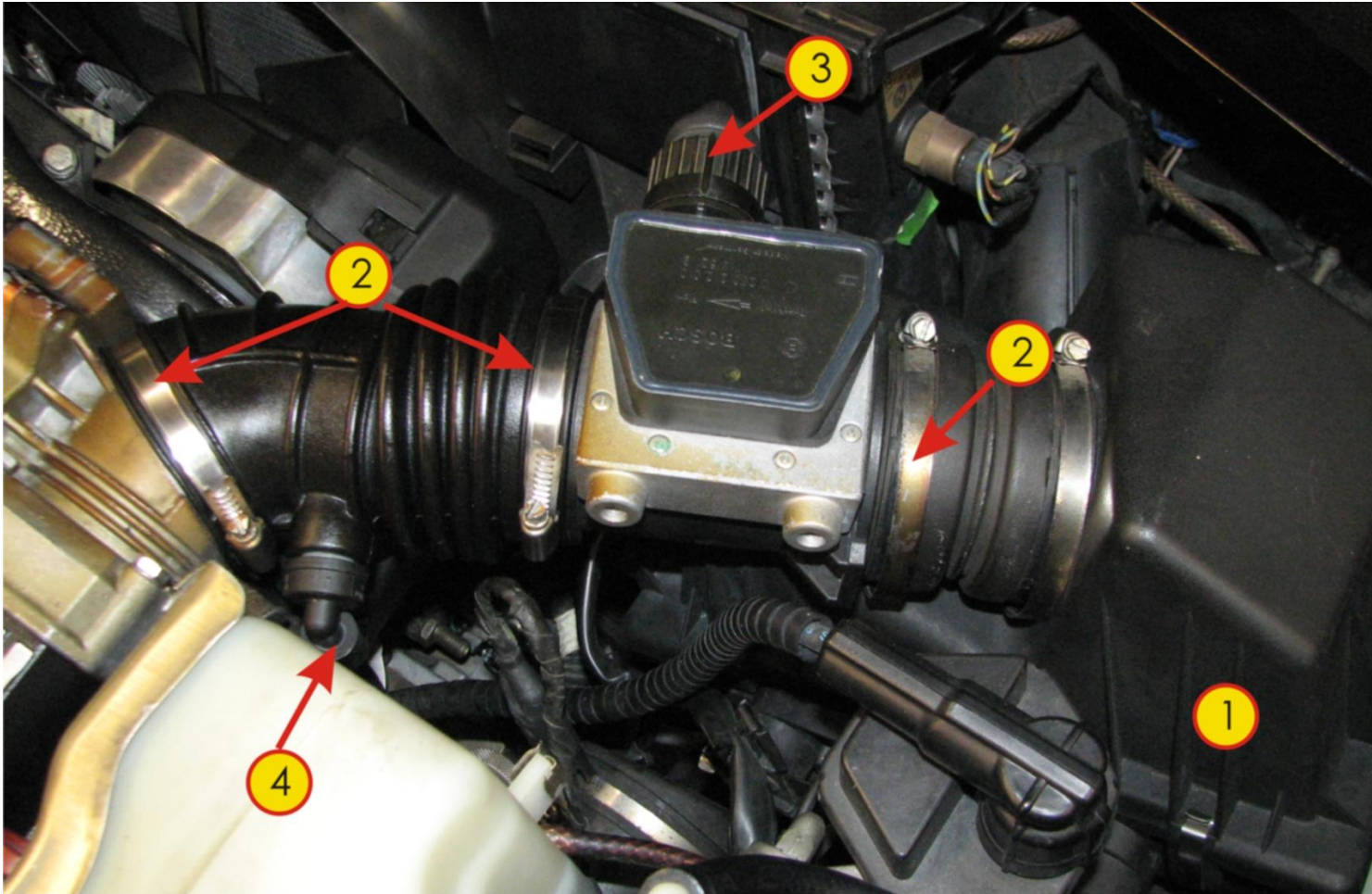
The EML warning light comes on and the engine only runs on one bank upon start up on cold mornings – this typically resulted in multiple start-up/shut-down cycles until the engine ran on both banks.

I won't be going into the technical aspects of working on these or delve into voltage readings & circuit analysis, but will only illustrate the steps I followed to disassemble, clean and reassemble, pointing out any lessons learned or interesting points along the way.

DK Motor Removal

- ①. Unclip the four air cleaner cover retainer clips.
- ②. Loosen the hose clamps
- ③. Disconnect electrical connector, (unscrew counter clockwise) Pull off the Air cleaner cover and the hose.
- ④. Pull out the MAF with air hose, making sure to pull the check valve (4) from breather hose.

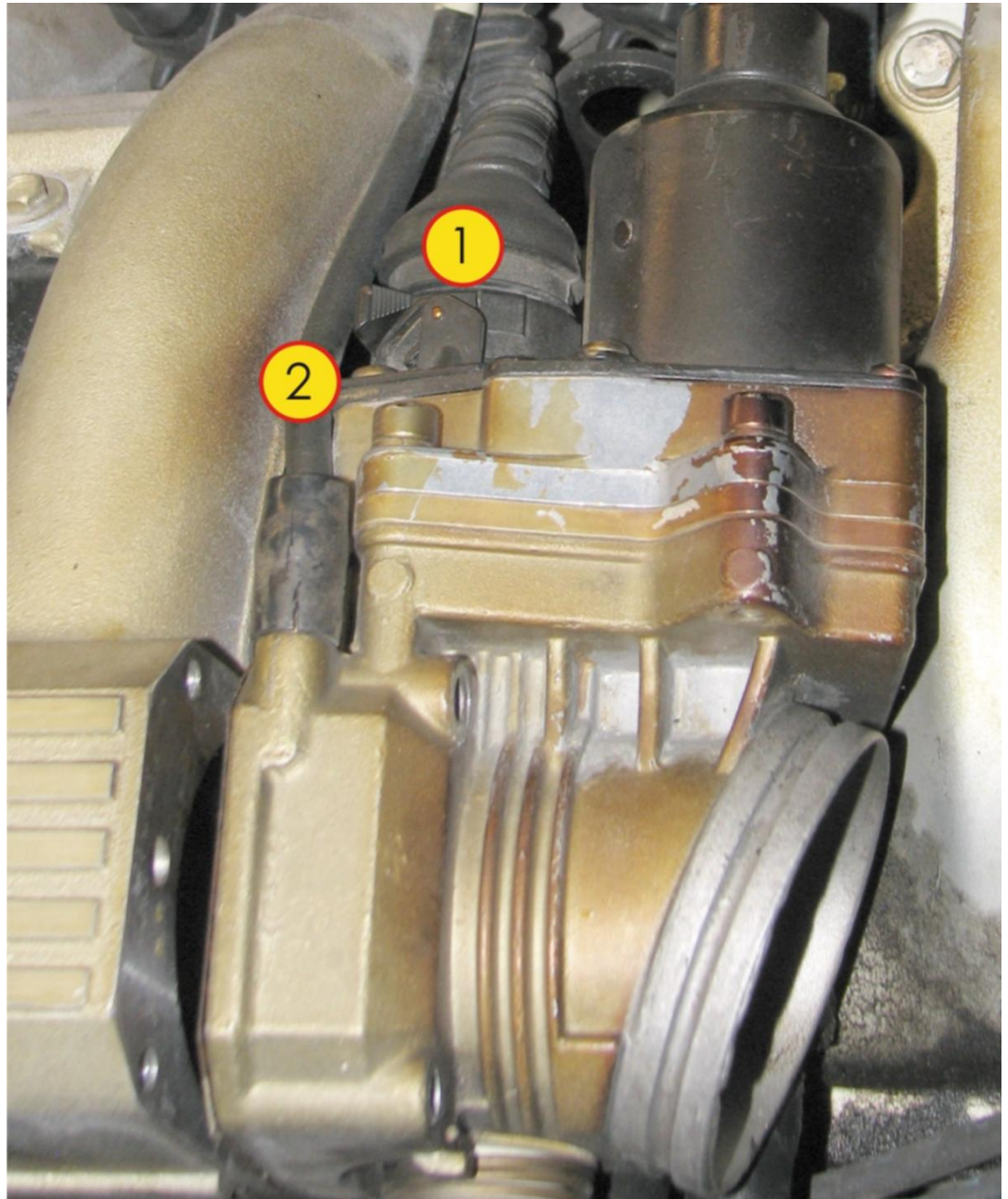
Note: when disassembling or assembling these hoses, it may helpful heat them with a heat gun or hair dryer to make them more flexible.



DK Motor Removal

Remove the Qty 4, 10 mm socket (M6) bolts holding the throttle body to the intake plenum. The top ones are easy to reach, the bottom ones require a little more effort.

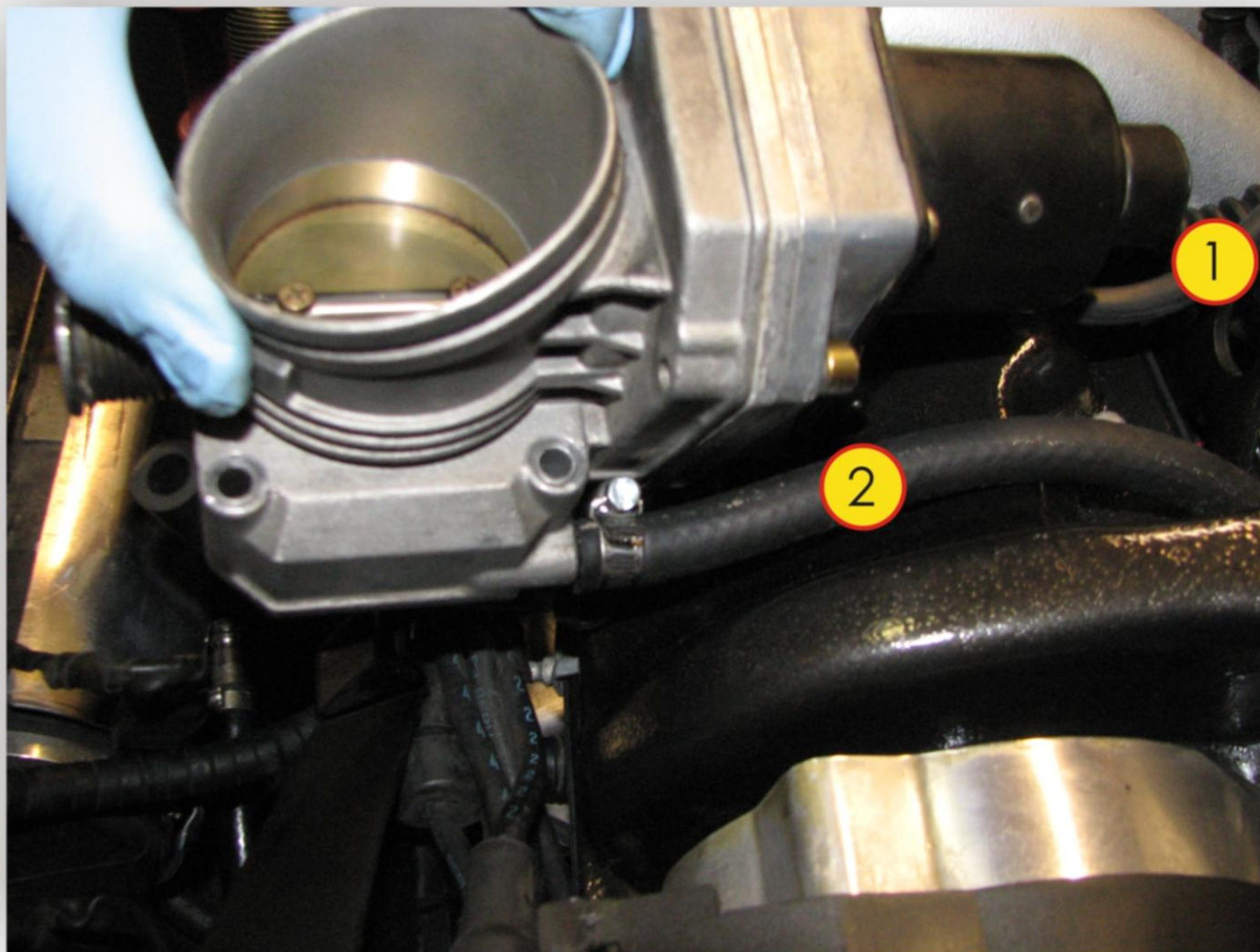
View to the right shows the bolts removed and the DK still attached by the plug ① and a vacuum hose ②. At this point, it's easiest to lift up the assembly slightly so you can grasp both tabs on the electrical connector and twist it off counterclockwise.



DK Motor Removal

This view shows the electrical connector removed and the vacuum hose ① and fuel vapor hose ② still connected.

Remove both at this time. My hoses were new, but I still used a heat gun to warm them up where they attached to the throttle body. They then slipped off with no fuss. (When I reassembled, I put a light coating of silicone grease on both ferrules to make removal at a later date easier..)

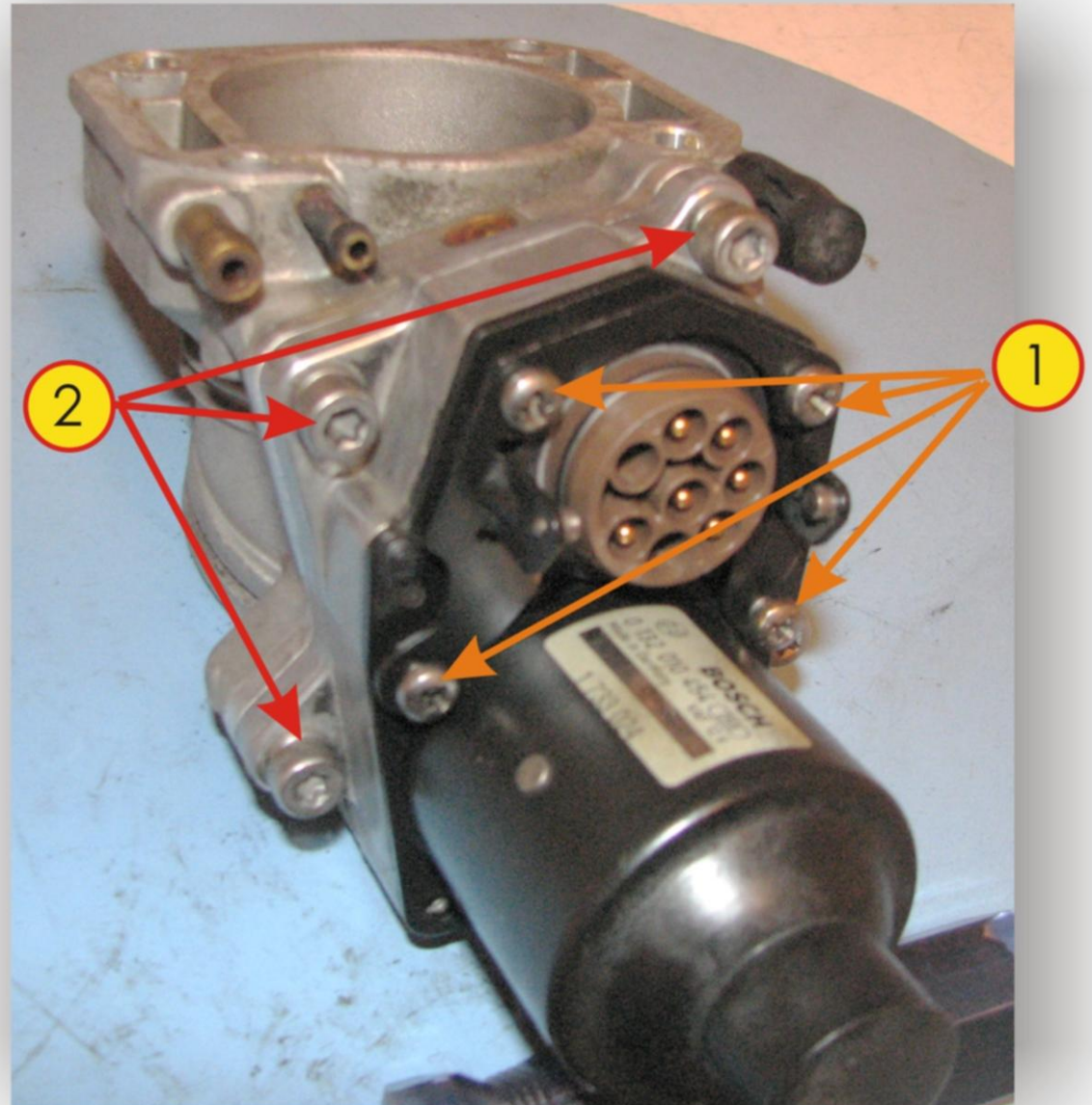


Loosen the assembly fasteners

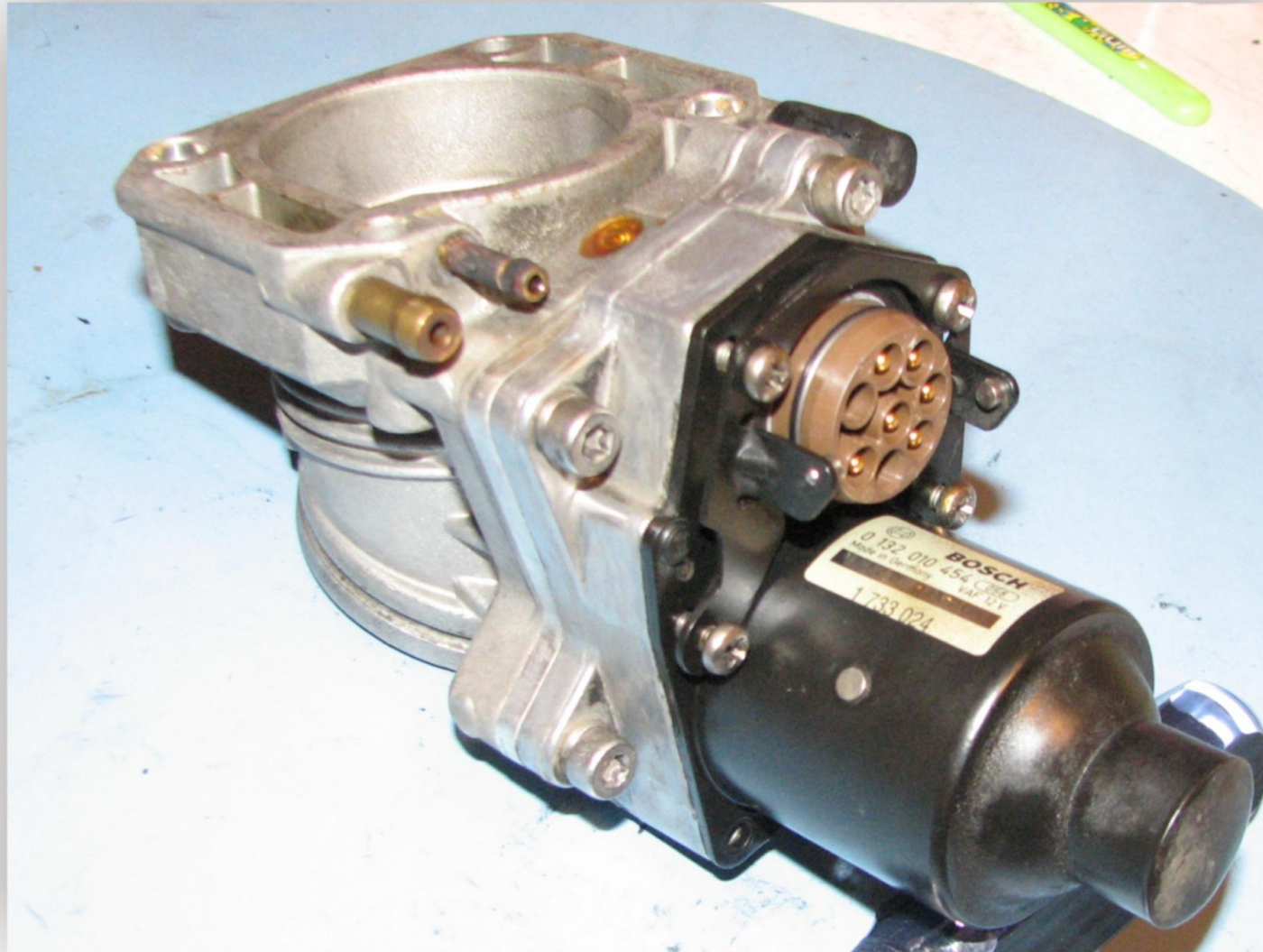
This view shows the throttle body/DK motor assembly removed and on the work bench.

Next break free (loosen) the 6 Phillip's head screws ① (2 are hidden beneath the DK housing) and 4 torx socket head cap screws ②

Electrical Connector Bracket removal

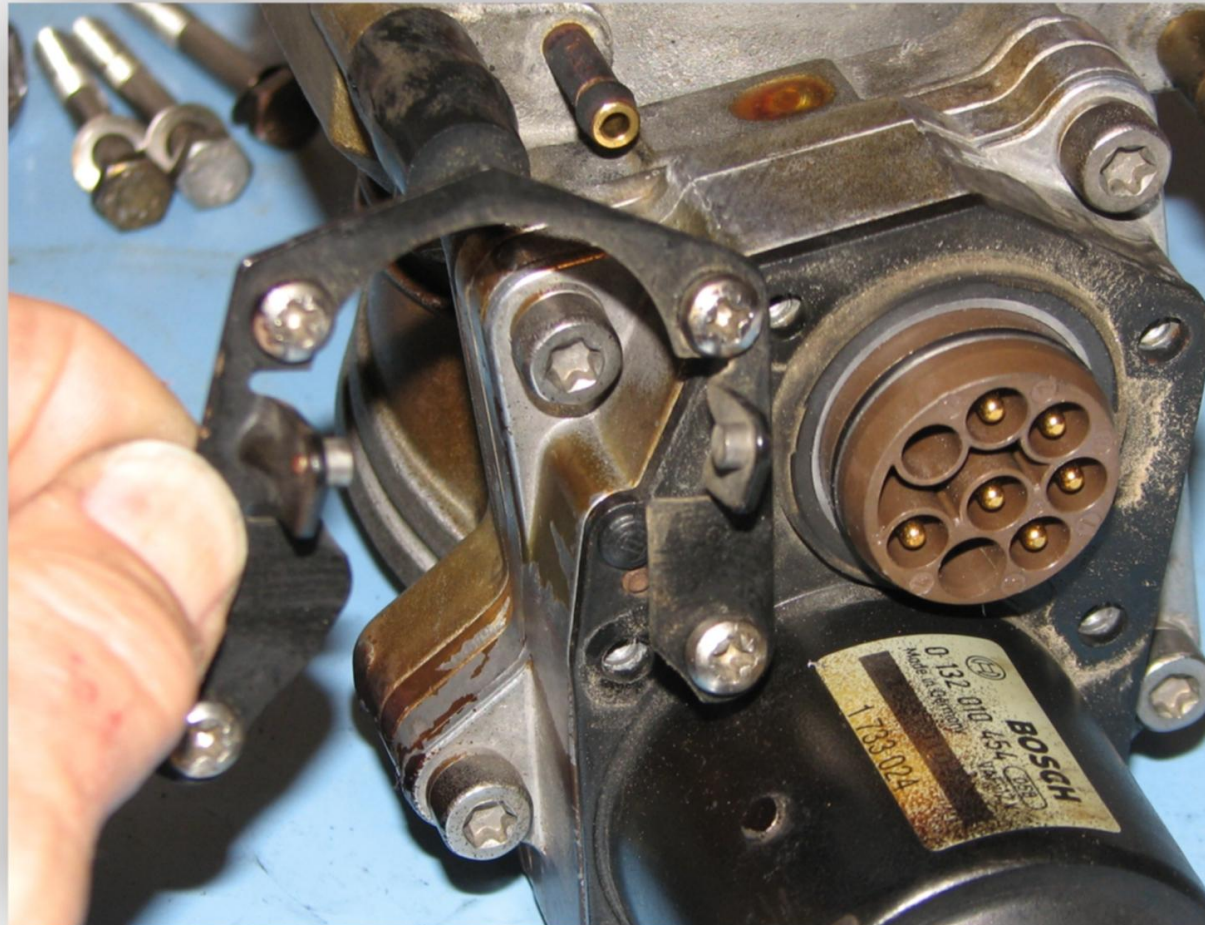


Note the top 4 Philip's head screws mount the electrical connector bracket.



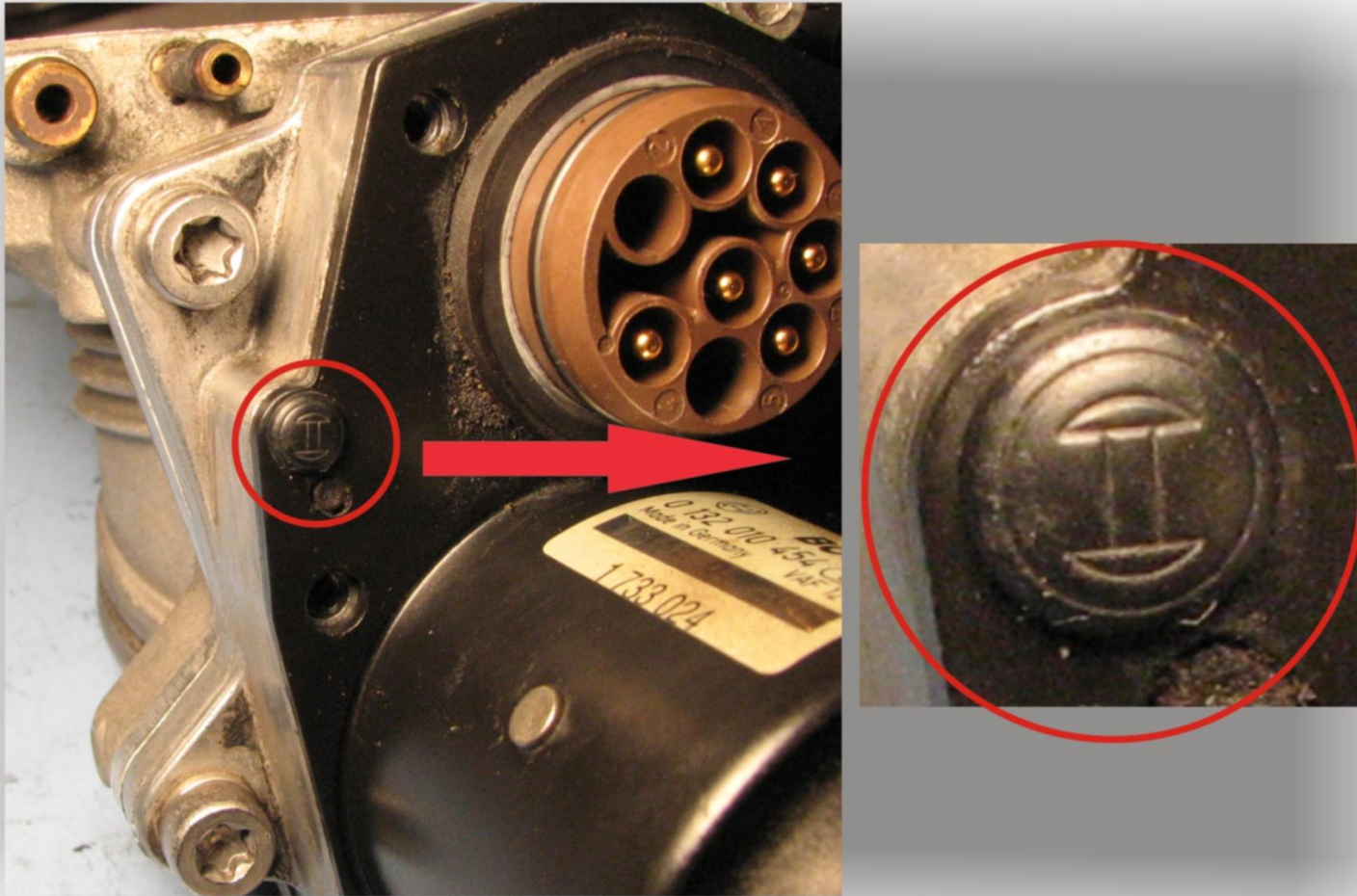
Electrical Connector Bracket removed

Electrical connector bracket.



Anti-Tamper Seal?

Both my DK/Throttle assemblies had what appeared to be a plastic anti-tamper seal. Once all 6 screws were removed, I put a blade screwdriver between the black housing and the aluminum base and twisted, this broke off the plastic head.



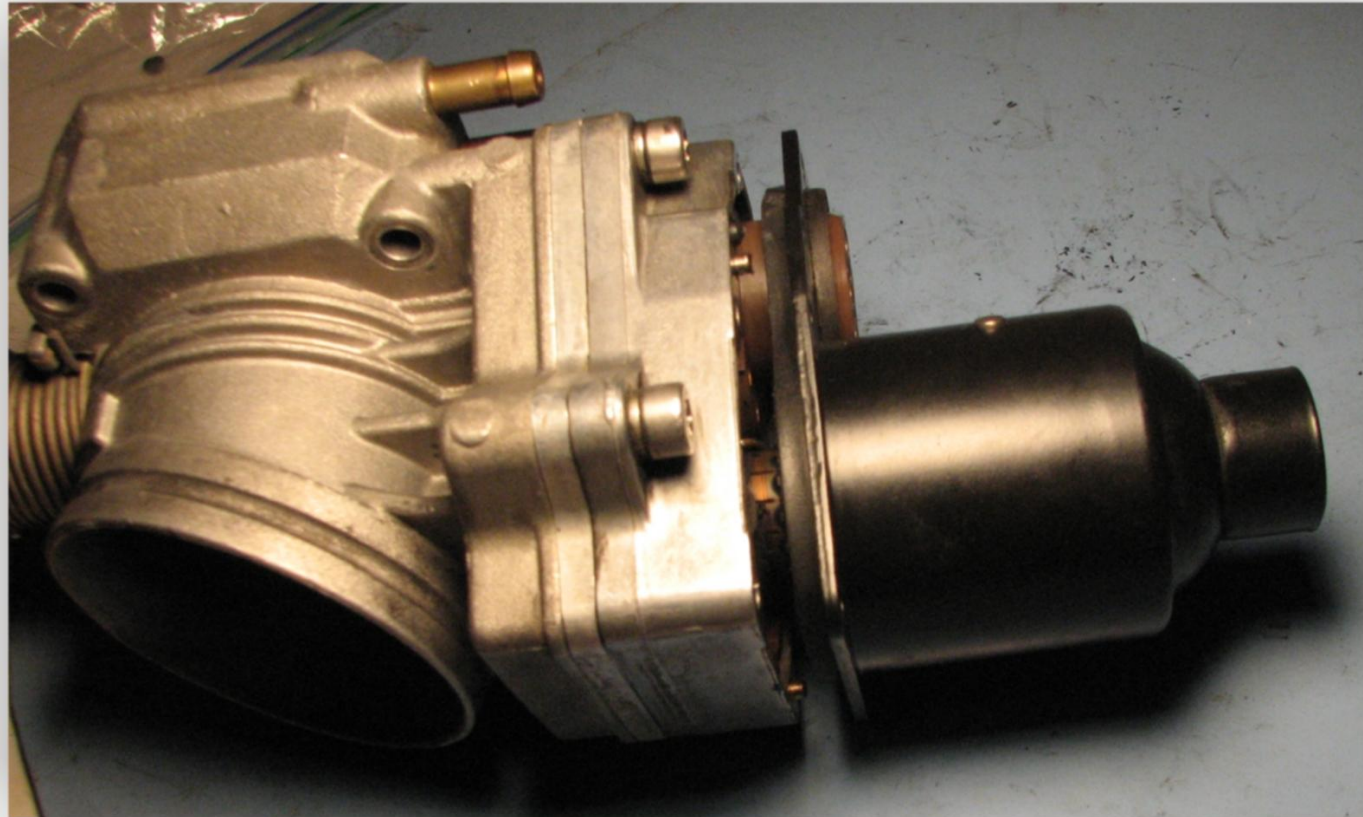
Removing DK Motor (Armature) Cover

Note: there are very strong magnets in the black cover, if you just pull the cover off, it will pull out the armature along with it. THIS CAN POSSIBLY DAMAGE THE BRUSHES.

Update 9/2012: Reader **Adam Jefferson** suggests another approach he found far easier to remove the cover. Adam split the opposite side of the housing first (remove the torx screws) and used a cloth to hold the armature worm gear in place while removing the black cover.

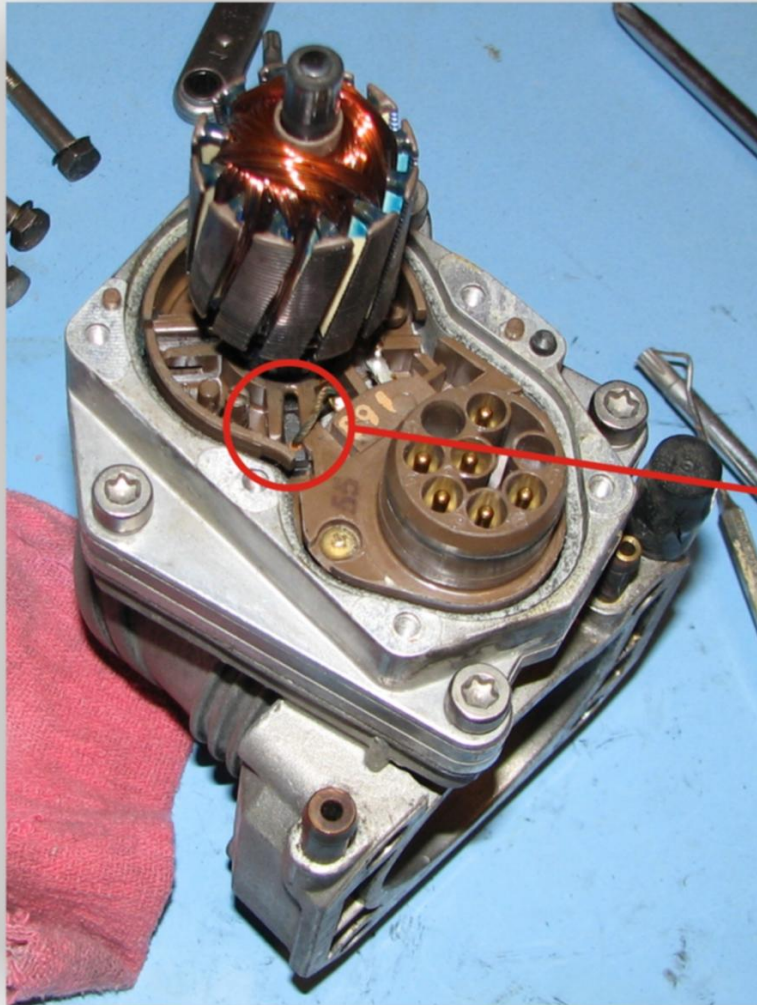
~ I think this is a safer route to take over what I did below - George

With the housing removed as shown, use a wood dowel or similar tool to reach in and hold (stabilize) the armature in place, then pull off the housing.



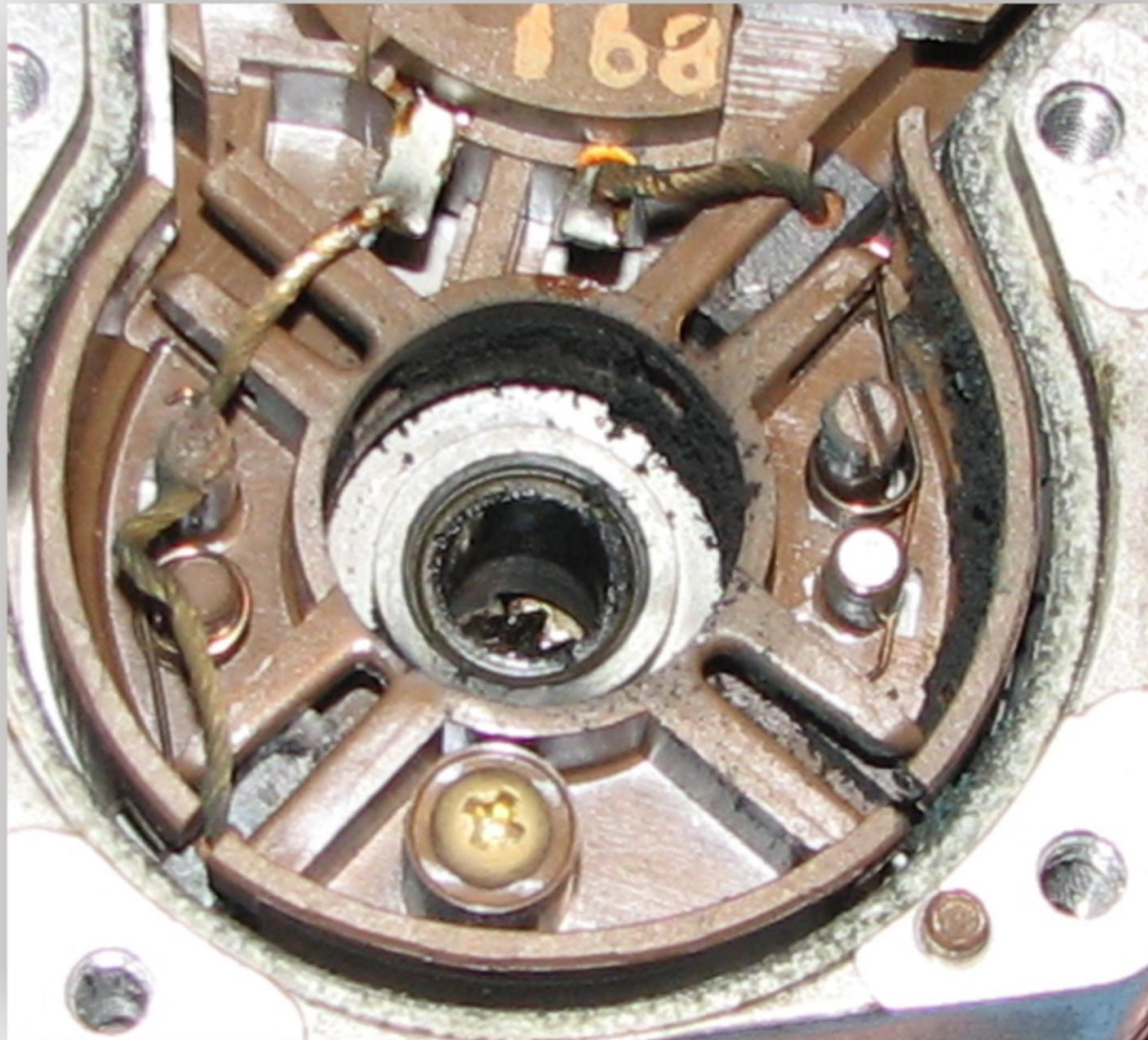
Removing the Armature

With the housing removed, use a very small screw driver or probe and slide both brushes away from the armature commutator. See the picture below right. This view shows one brush pulled away.

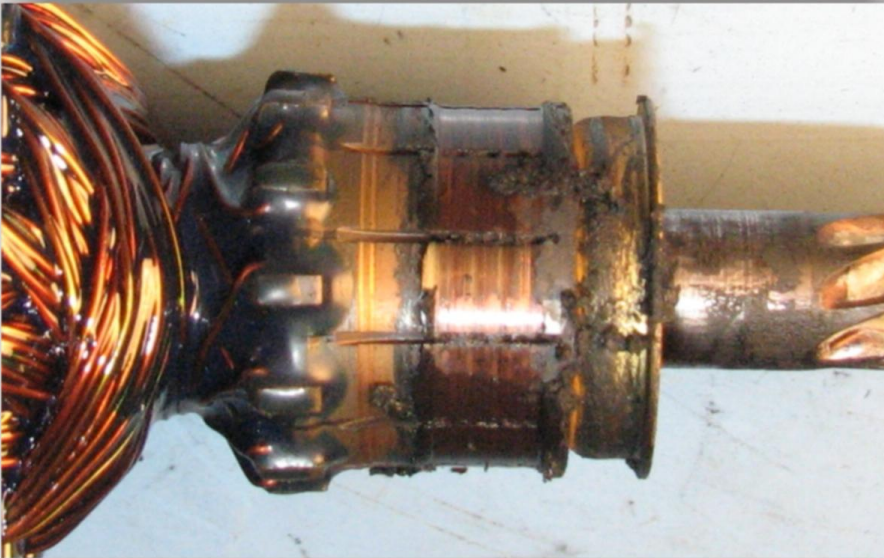
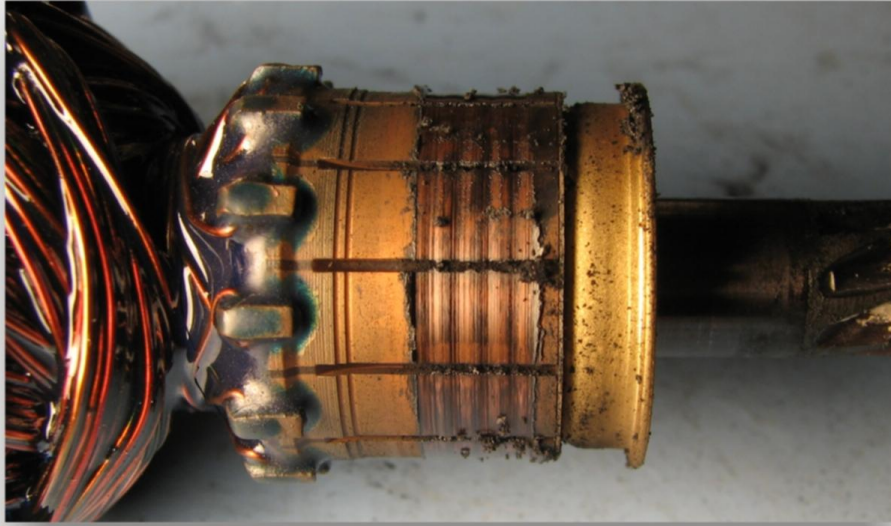


Armature Removed

View showing the armature removed and close up of the debris from the wear of the brushes.



Armatures, cleaning



Note the dirty condition of the commutators. I was previously getting the EML light on cold mornings when I started the car. I believe this is the culprit.

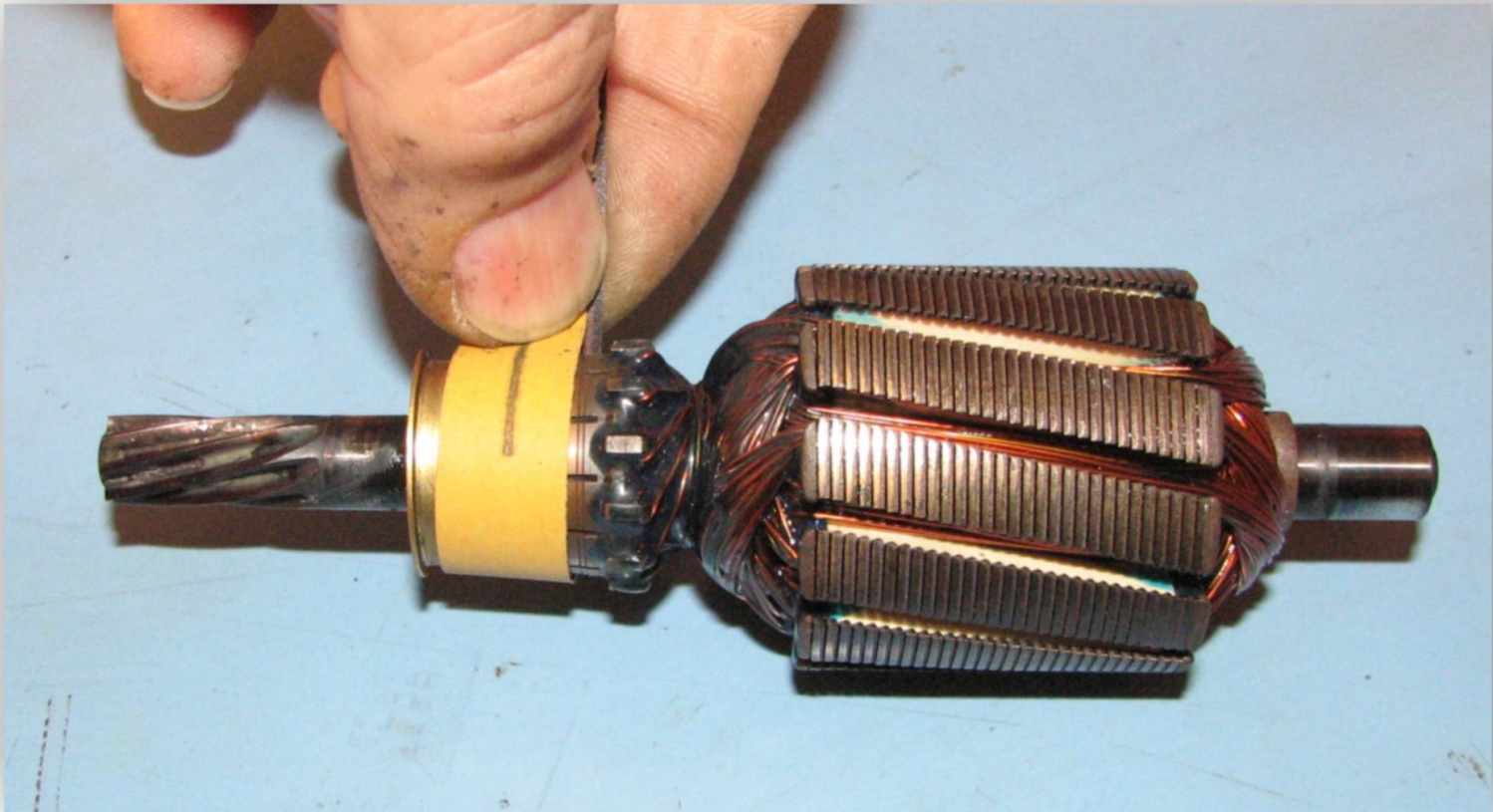
I sprayed with contact cleaner and thoroughly scrubbed using a soft toothbrush to clean off the gunk.

Resurface the Commutator

Using either very fine emery cloth or 600 grit silicon carbide sand paper, lightly "sand" the commutators until they are clean.

Do not grasp the emery cloth or sandpaper around the commutator as this will round the copper bars. They need to maintain sharp 90 degree corners.

Another option would be to use an armature lathe to properly dress the commutators. Hobby stores with a big RC department typically have these types of lathes and can do the job for you.

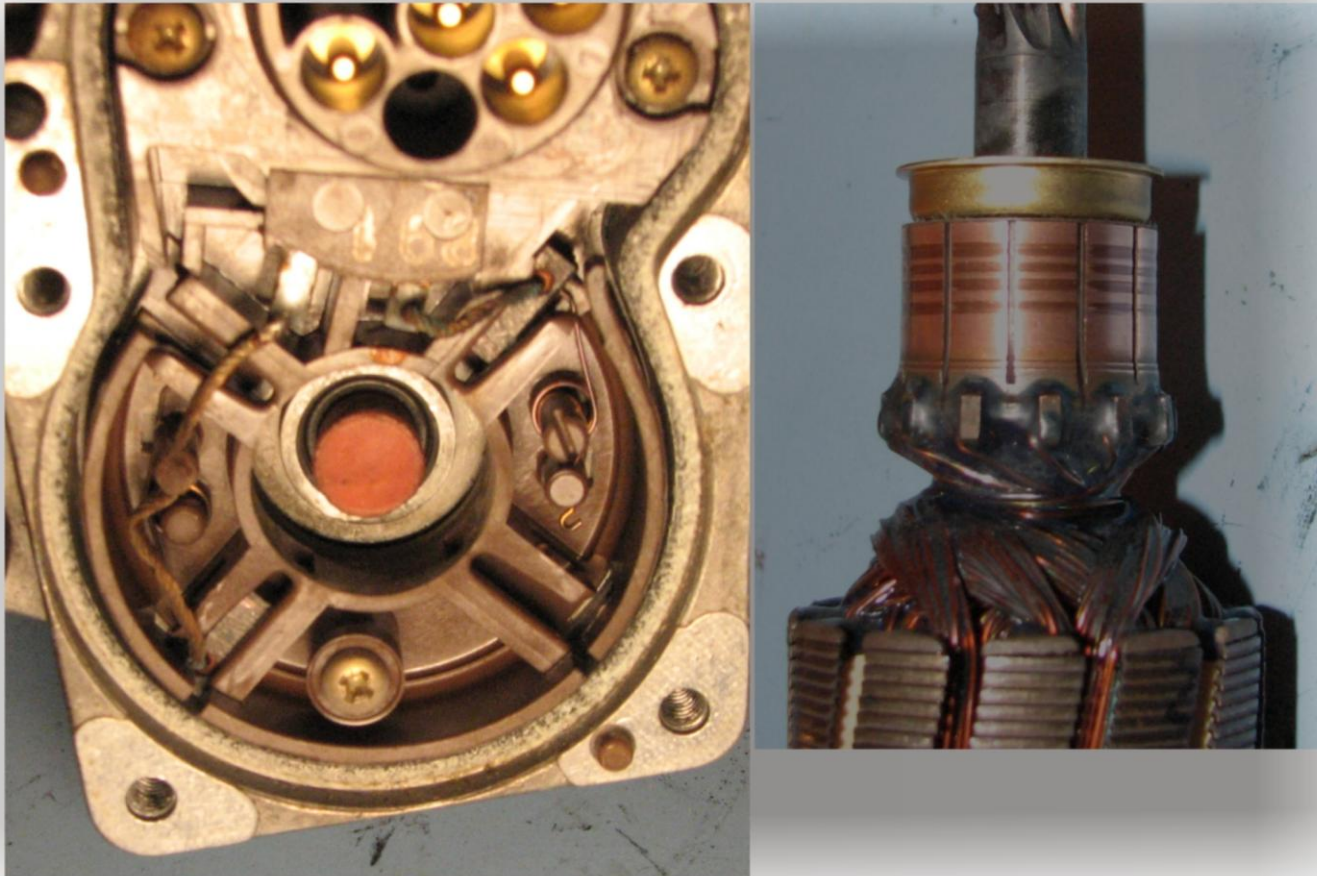


Cleaning

Update 9/2012: *Caution must be taken when cleaning. Reader **Adam Jefferson** found using contact cleaner made a "black slushy mess" which was difficult to clean out. I'm guessing this was due to the formulation of the cleaner. Adam used paper kitchen towels and cocktail sticks as cleaning swabs.*

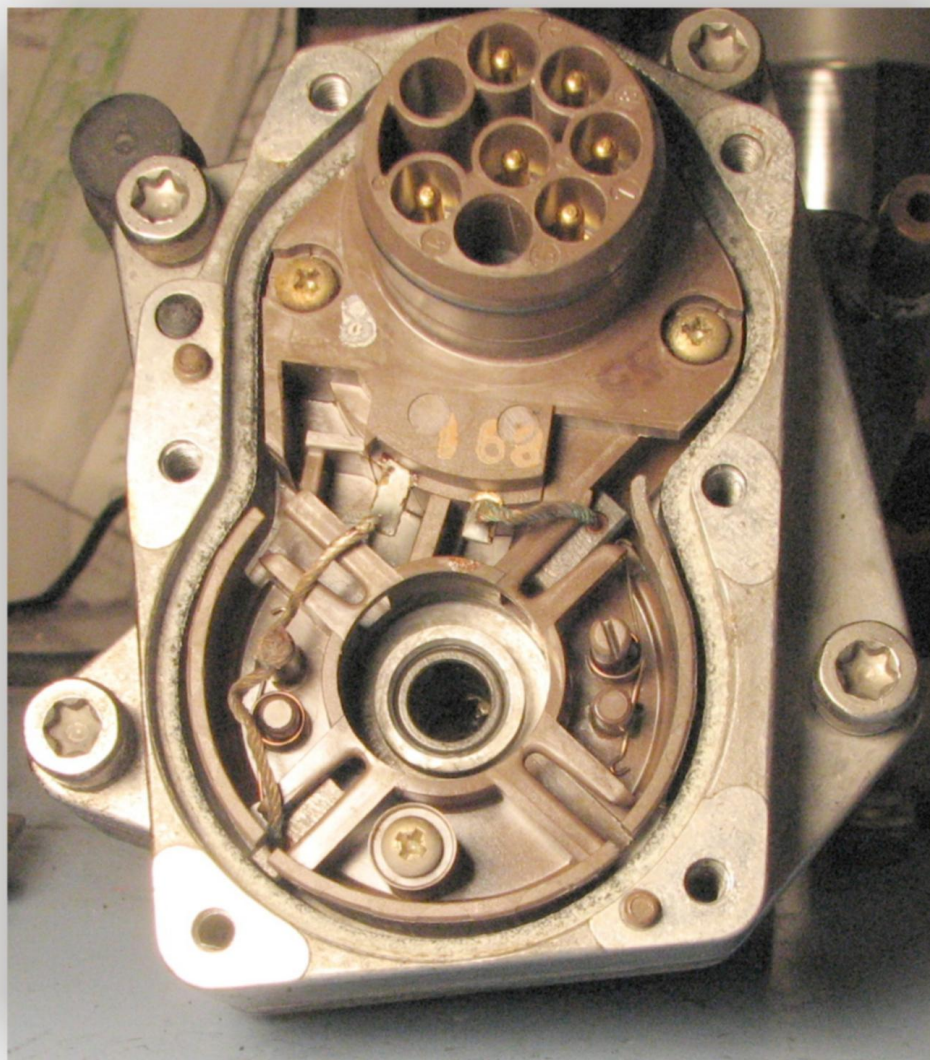
View of commutator after light sanding and cleaning well with aerosol contact cleaner. When cleaning the brushes, I plugged the armature shaft hole with a silicon plug and sprayed with the contact cleaner until all the grime was removed and the brushes moved easily in their slots.

Insure the mica, (gaps between bars on the commutator) are free of any debris.



Removing the Brush Assy Base

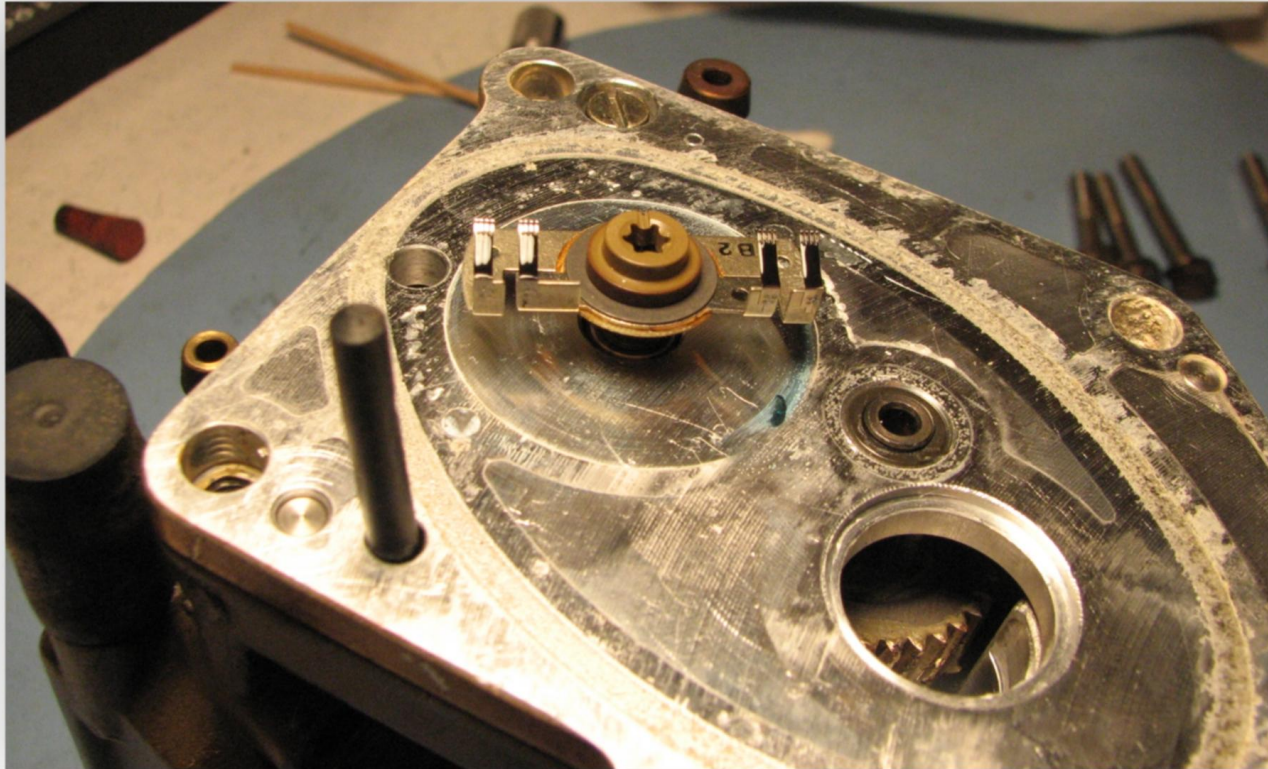
Remove the pre-loosened torx screws and pull off the base.



Encoder Wipers

I went no further than this level, just cleaning the encoder wipers with Deoxit.

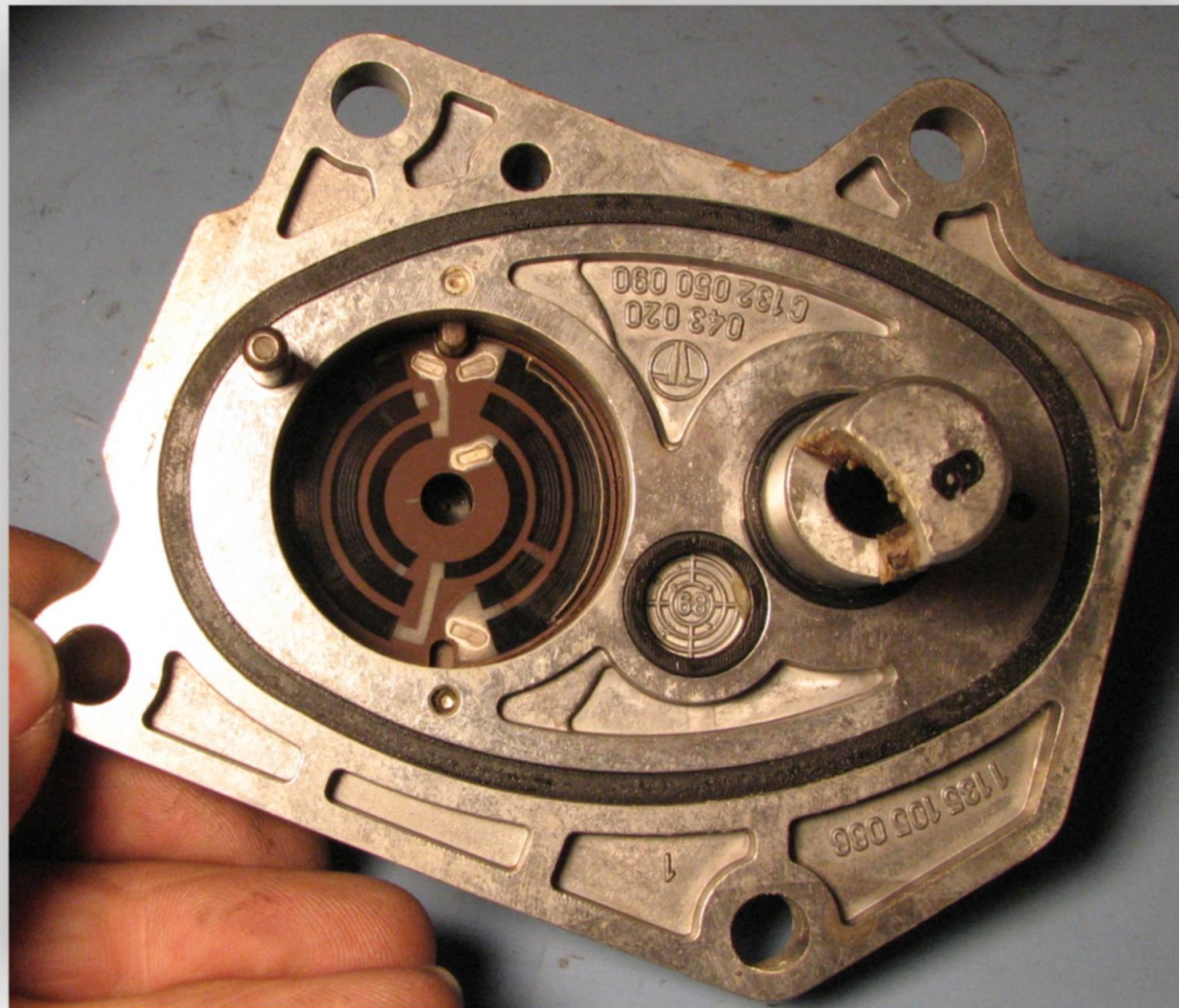
Note the black rod in the lower left. This is part of the tamper "button" that was popped off earlier when the disassembly began.



Encoder Wheel

I cleaned the encoder wheel with a swab and contact cleaner, finishing off with Deoxit.

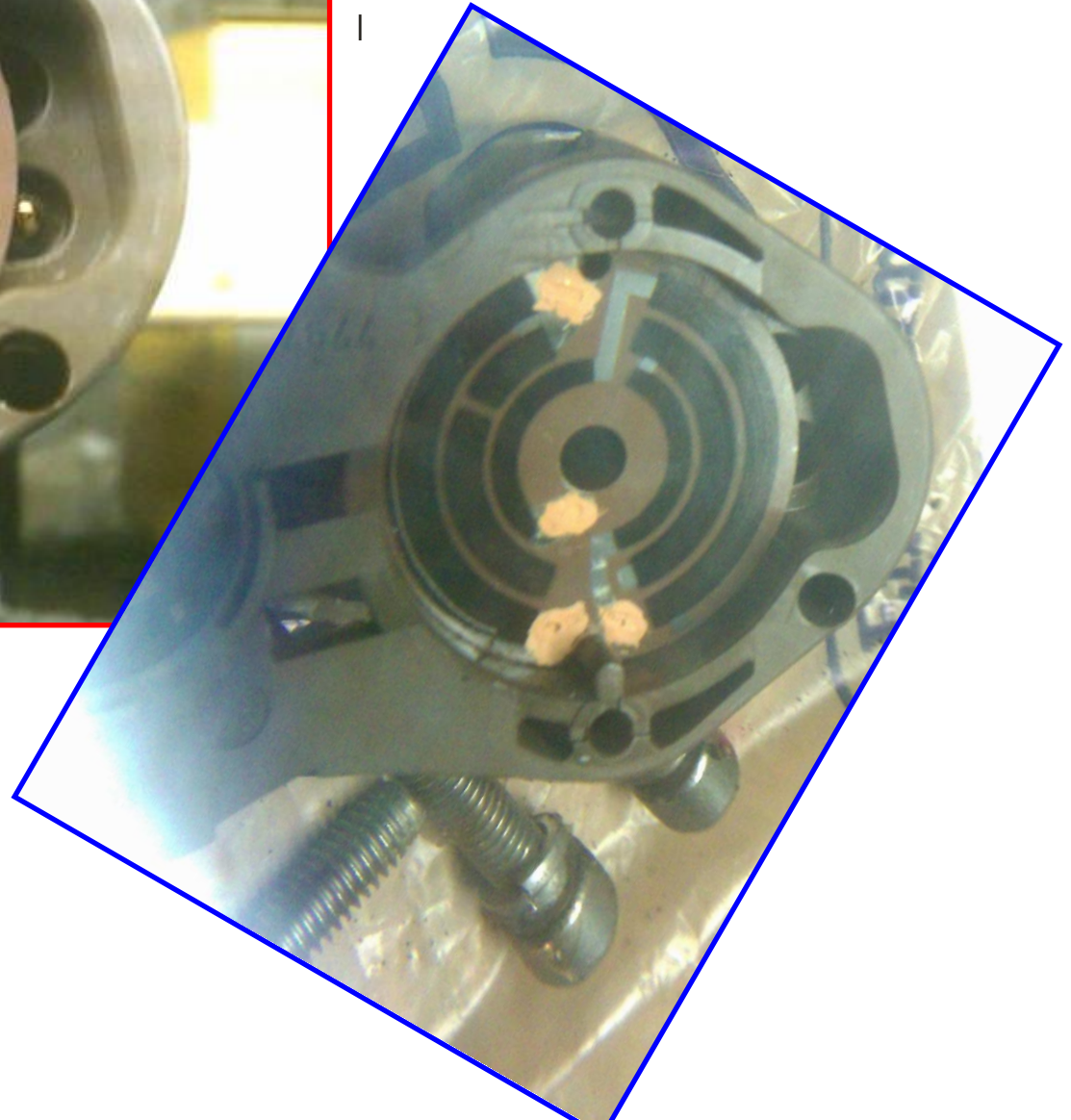
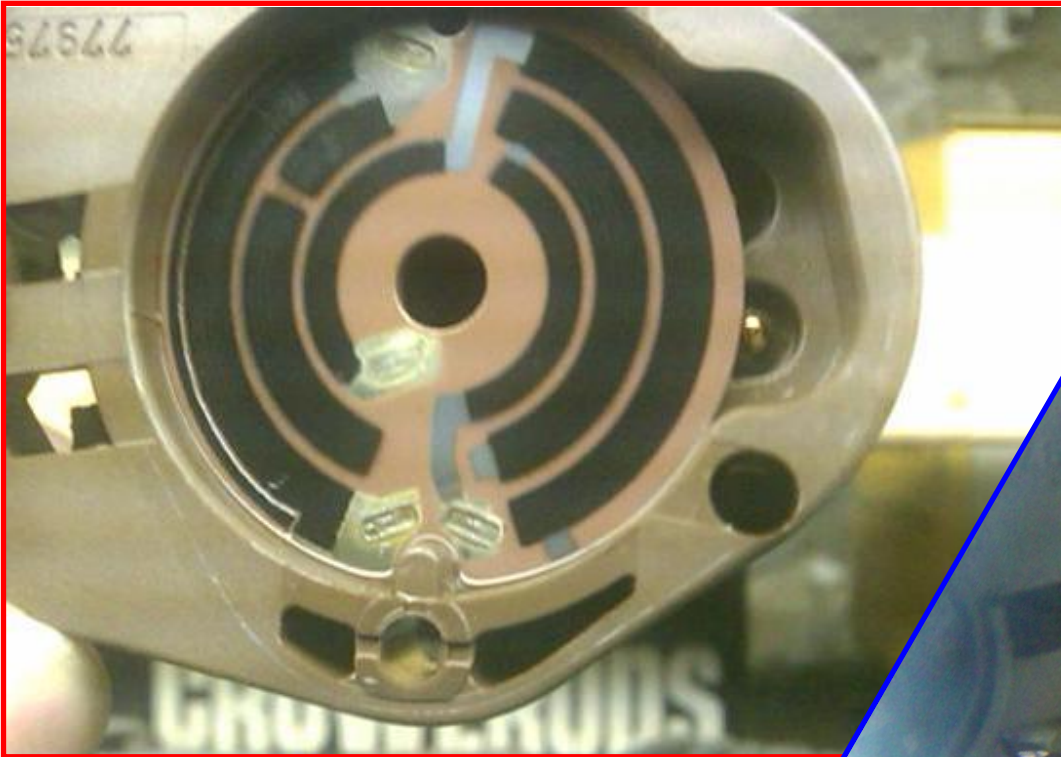
I also cleaned the rubber gasket and applied a thin film of silicone grease to it.



Encoder

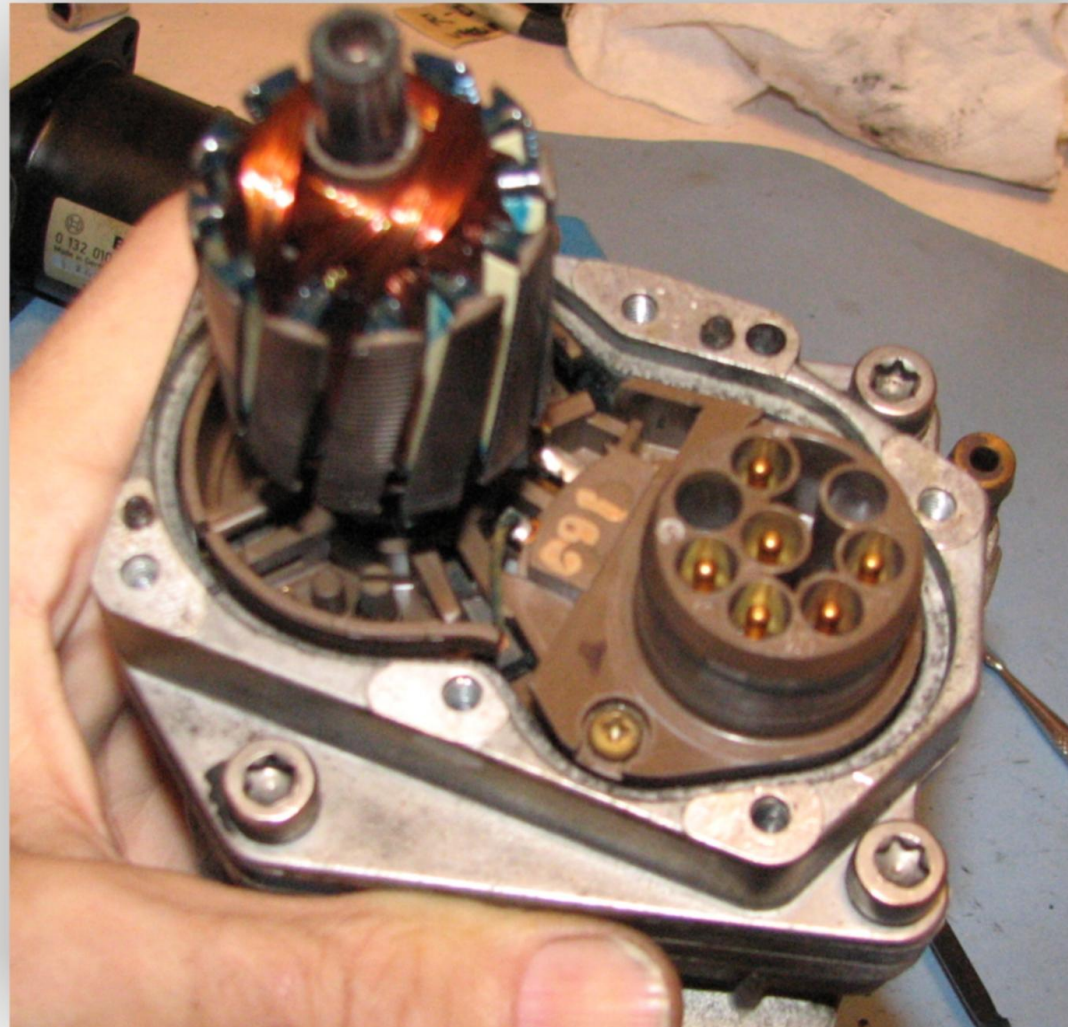
Wheel Contact Repair

Update 9/2012: Reader **Anthony Ray** experienced signal integrity issues due to faulty connections at the solder joints of the encoder tracks. Anthony used rear window defogger repair paint on these joints. If you're brave enough and have the skills, I believe these joints could also be reflowed using some solder and soldering iron.



Re-install the Armature

Re-install the armature and then push the motor brushes toward the commutator until they touch. The springs will engage the rear of the brushes, keeping pressure on the commutator.



Re-install the DK Motor Housing

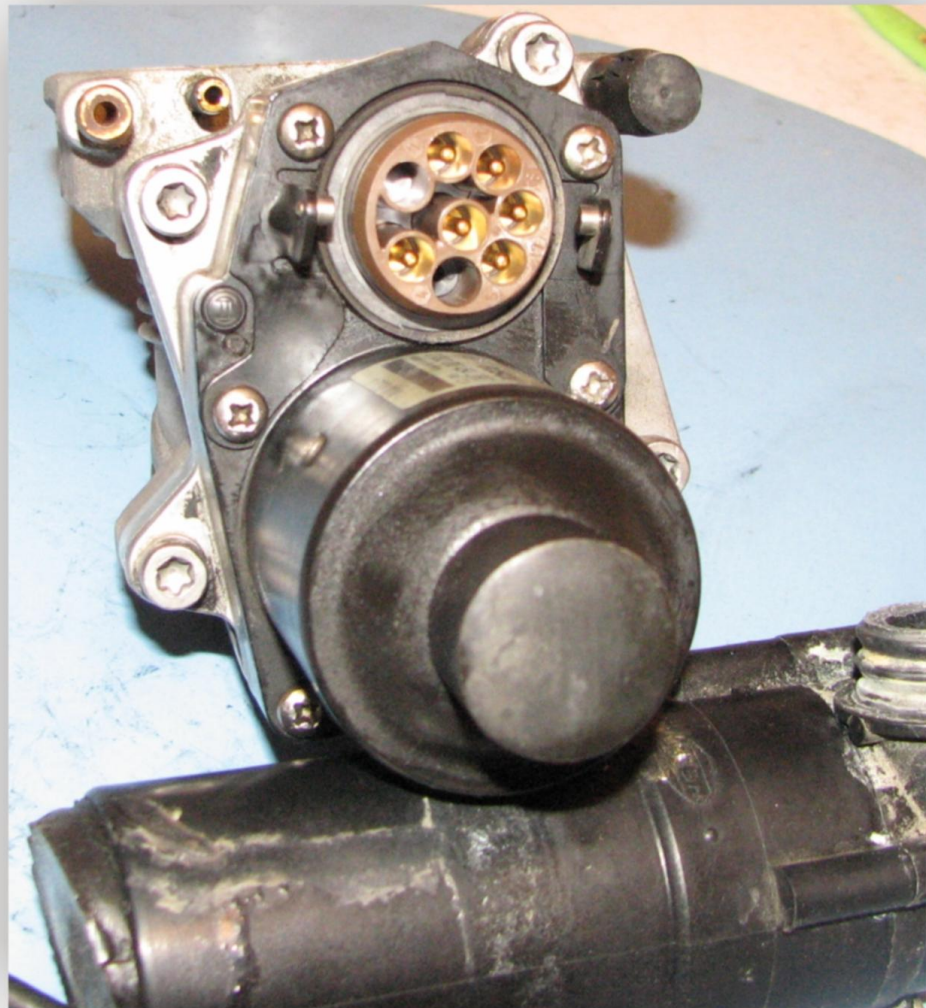
Clean off the gasket on the motor housing, I also treated it with a thin film of silicone grease.

Re-install the motor housing, keeping in mind that the magnets in the housing will try to pull the armature out of the throttle body. Use the same tool as previous to hold the motor armature in place until the housing is almost seated.

Then remove it and seat the housing and button it up.

Synchronize the Banks

Installation is the reverse of removal, after the DK/Throttle assemblies have been installed, the engine cylinders will need to be synchronized. Run the engine



to operating temperatures and drive the car. In first gear, drive the car until the engine RPM increases above 5,000 then drop to idling (approx 10 sec.)

Repeat two more times, then run the engine at idle speed in Park or Neutral at least 5 minutes.