

Shimano E8000 Bearing change

There is a thread in emtbforums where some forum members are sharing their knowledge about the replacement of bearings in Shimano E8000 motor. But as the information is not in order and has been evolving during time, it is a long task to read the complete thread, understand it and extract valid conclusions, so I have compiled this document with the information provided in the original thread, and I hope it is more organized and understandable. The original thread is in:

<https://www.emtbforums.com/community/threads/steps-e8000-motor-service.16542/>.

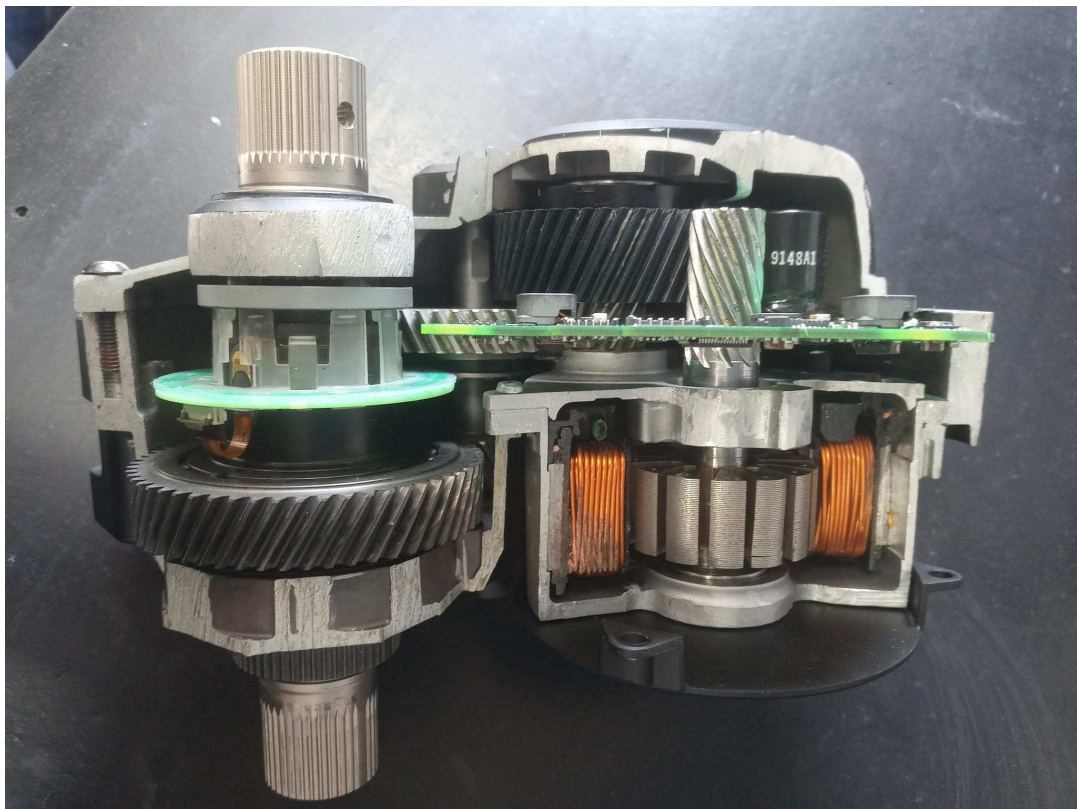
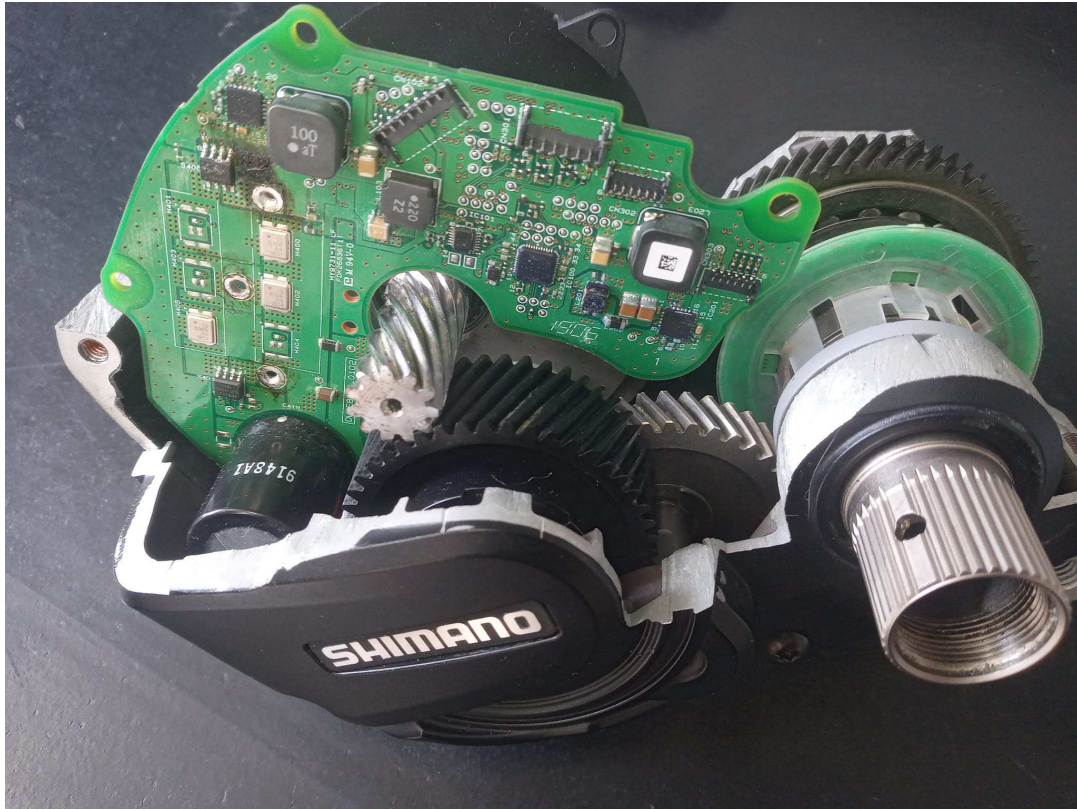
There is also a video posted in youtube that shows the bearing change:

<https://www.youtube.com/watch?v=Jf5th-WTBCI>

The Shimano E8000 motor has internal bearings and gaskets that are standard and available in stores, although there are other parts like: gears, clutch-bearings, gaskets, electronic PCBs, connectors that are not standard nor available and Shimano does not sell spare parts, so in case they break you will have to either transplant them from a broken donor motor or buy a new motor from Shimano for around €1150.

INSIDE THE MOTOR: HOW THE GEARS LOOK LIKE

The following pictures show a motor with the case cut out and it can be seen how the gear engage to reduce the high RPM out of the motor to the lower rider cadence in crankshaft.



CONSEQUENCES OF DAMAGED BEARINGS

There are 6 standard bearings and two cage bearings (all of them are listed in following pages), but the two large bearings located in the bottom bracket are the ones that suffer the most from water and dirt ingress and also from impacts when cranks hit rocks or branches, and they are more likely to break or get damaged.

So in case that you hear a grinding noise or you feel that the cranks do not rotate smoothly while rotating the cranks in any direction, then it is likely that one of your crankshaft bearings is shot.

If you replace the damaged bearing when it starts to fail and before it collapses, then you may avoid that this damaged bearing causes a bigger or even un-repairable damage to the motor. In the case below, the shot bearing damaged the housing in case, and now it is required to change the motor housing from a donor motor.



Damaged Bearing and below the damaged bearing housing in the motor case



REMOVING THE MOTOR FROM THE FRAME:

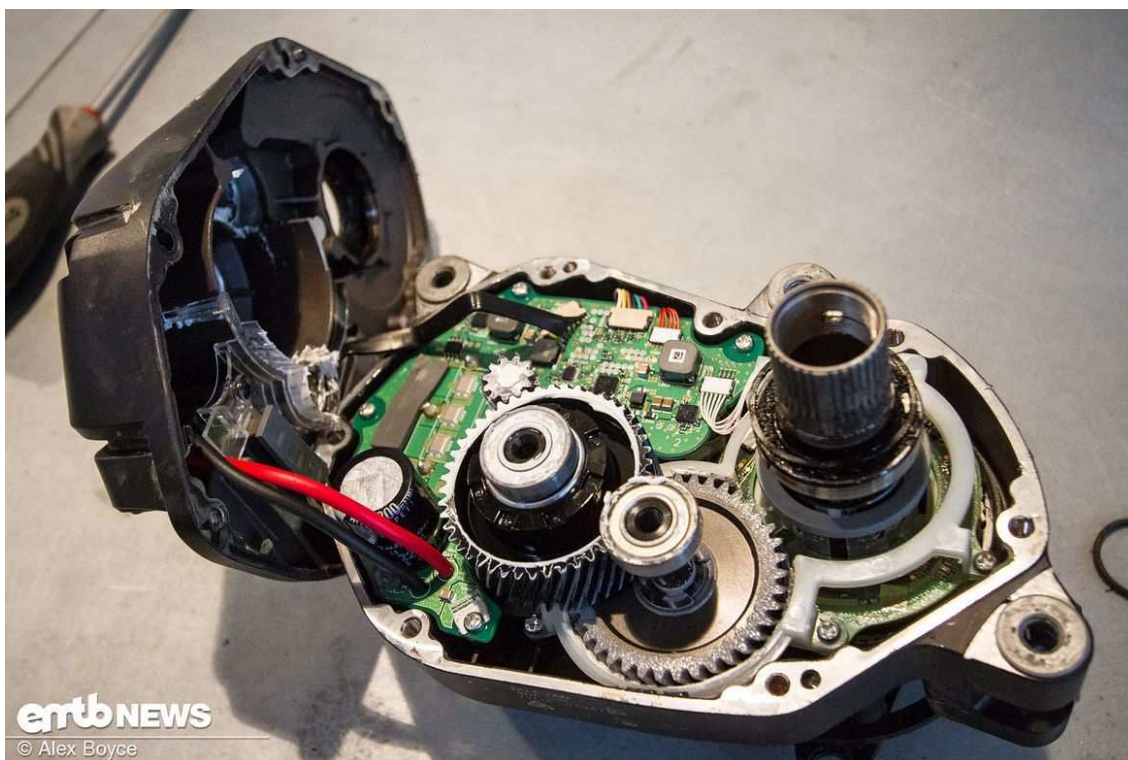
Before removing the motor from the bike frame, you must first disconnect the electrical cables to the battery, display, etc. and follow instructions in Shimano manual: **DM-E8000-10-ENG.pdf**

<https://si.shimano.com/#/es/search/Keyword?name=e8000>

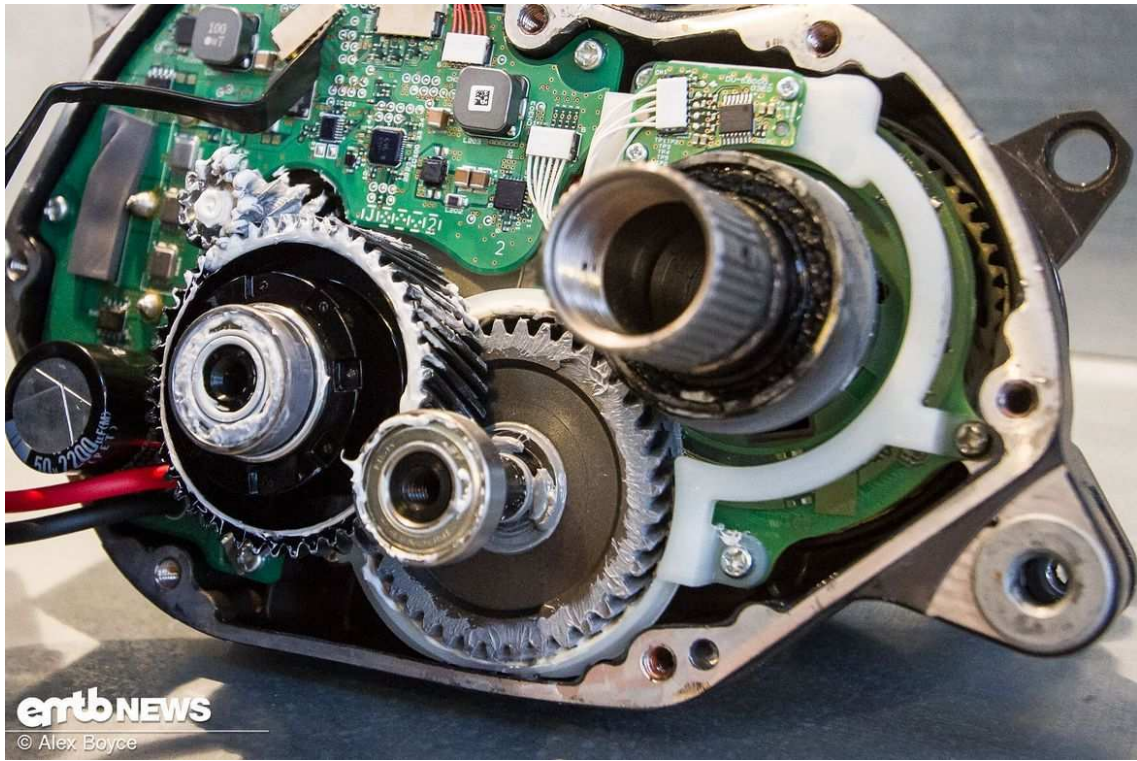
In some models of eBike, the motor fits very tight in the cradle and after removing the screws the motor is stuck in the frame cradle, one way to get it out is to loose the screws one turn and use a hammer and a screwdriver to hit gently the screw heads, mainly on the left side where there are some washers that can get stuck.

INSIDE THE MOTOR:

- Clean motor external case from mud, dust, debris.
- Remove the clip washer on bottom bracket axle, chainring side.
- Remove the case torx screws, then hit gently the motor housing perimeter using a plastic hammer and then cut the silicone gasket by inserting a blade a few mm, now the upper part of the casing can be separated, but be careful because there are cables that go from it to the Main PCB in the other part of the case, before opening it totally, disconnect the internal flat cable that runs between case upper and lower sides.

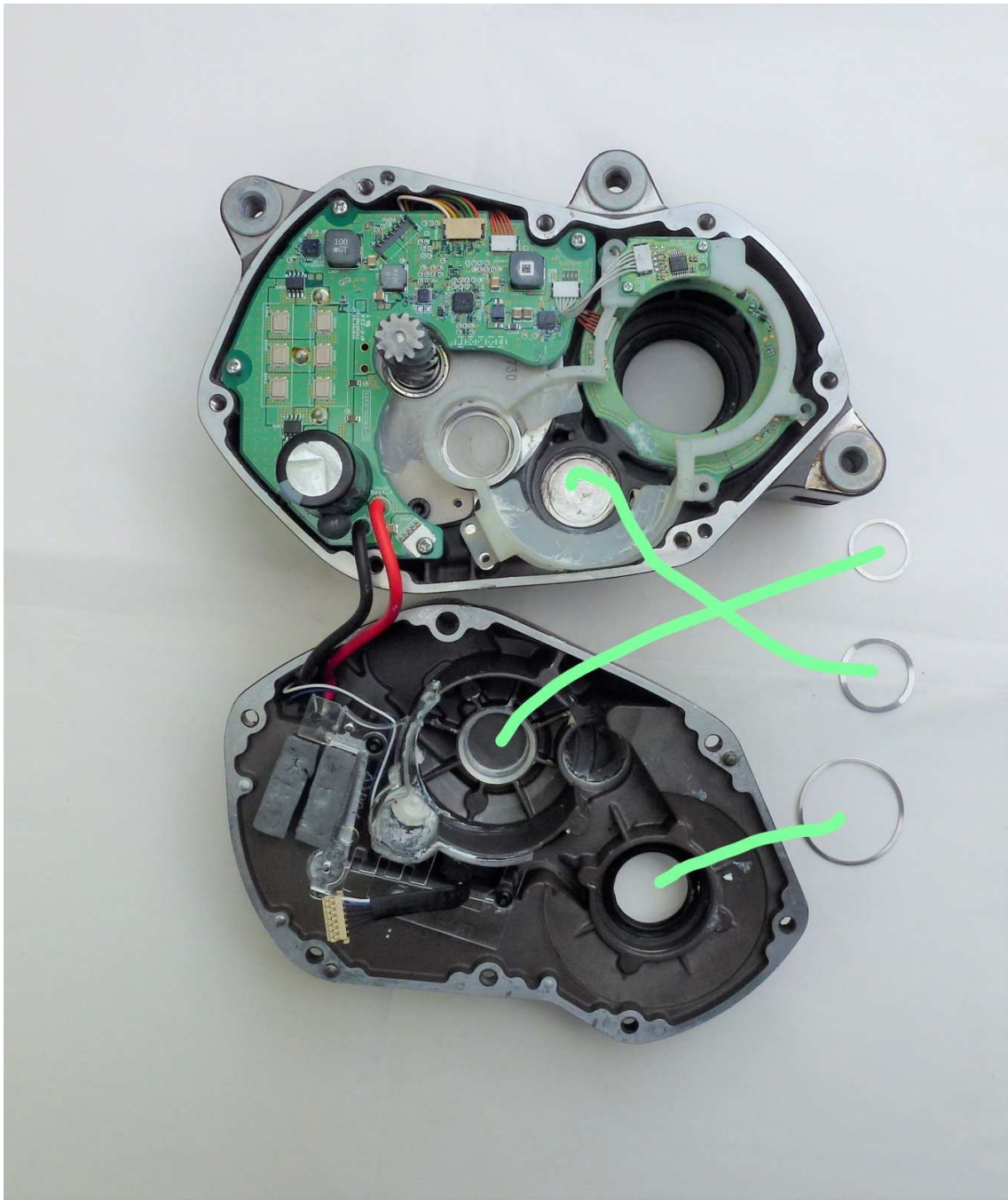


Here you can see the motor opened and the flat black cable that has to be disconnected. The RED and BLACK cables are soldered and can not be disconnected.



When opening the case the two halves are still joined by some cables, the Red and Black ones do not have to be unsoldered but the flat black cable has to be unplugged in the connector, it carries the signals from the external connector where the external cables of the display, magnet wheel and DI2 derailleur are plugged into the motor.

When opening the motor and removing the casing, keep in mind that in some bearings there are shim preload washers that lay between the bearing and the casing, in picture below you can see the washers and their position. TAKE NOTE OF WHERE THEY ARE MOUNTED!!!



Shim preload washers

Now you can remove the four screws that hold a small PCB (Printed Circuit Board) and the white plastic frame, its function is the speed and torque sensor. Once the screws have been loosened, the PCB can be moved apart so it does not bother while removing the remaining parts, try not to touch the electronics because it can be damaged by electrostatic discharges from your fingers.

Now the bottom bracket with bearings can be loosened. Rotate and lift the two intermediate gears (the black plastic one and the one next to it), this will loosen the other bottom bracket bearing housed in the shell and it can be lifted a little, but do not remove them yet.

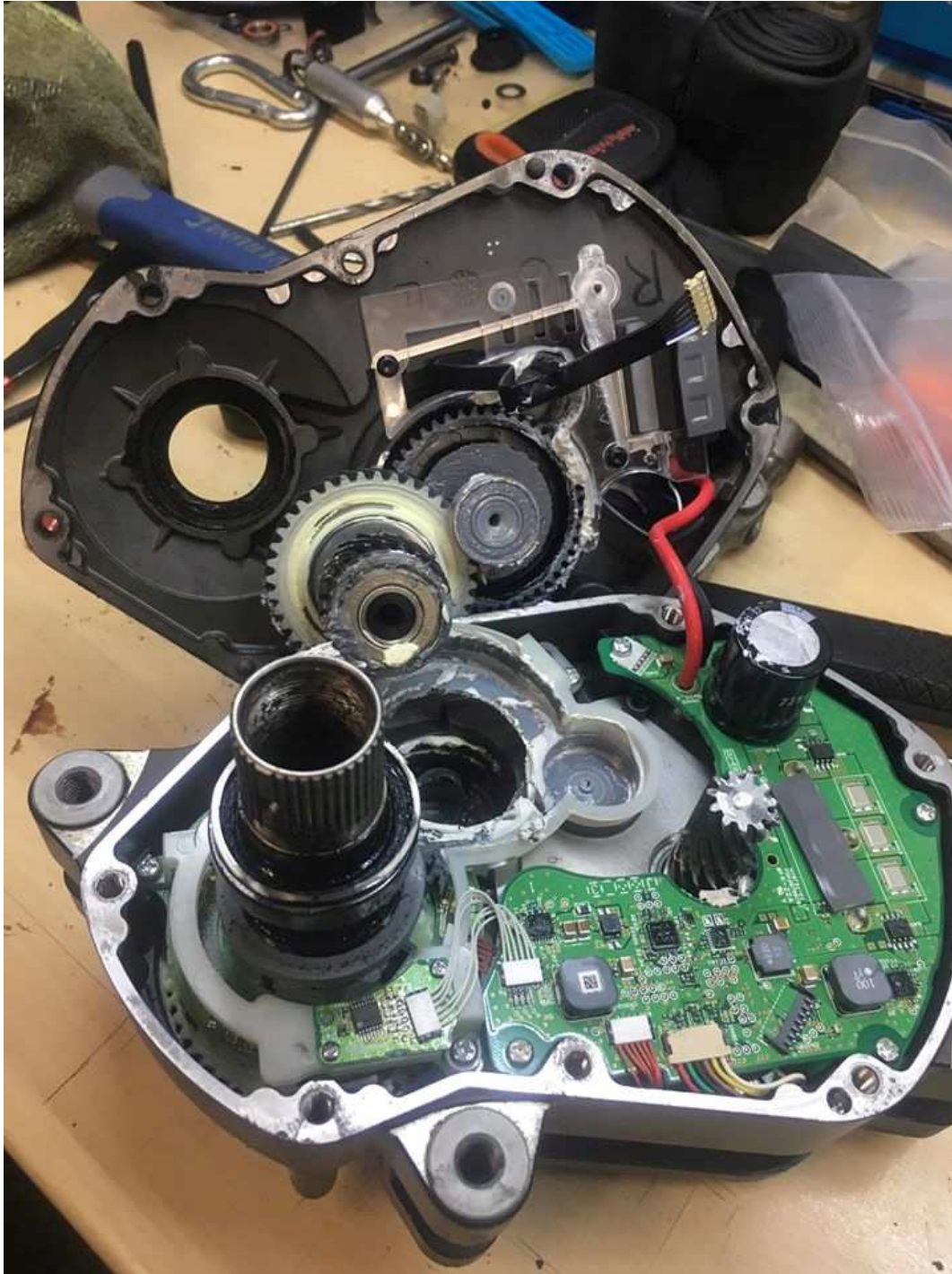
Now the two intermediate gears between the motor and the bottom bracket can be removed, maybe it is required to move them a bit until they loosen before they can be removed. Now remove the bottom bracket axle, which includes a black gear with a Sprag Clutch bearing inside, torque sensor.

Now, it can be seen the bearings on the shaft:

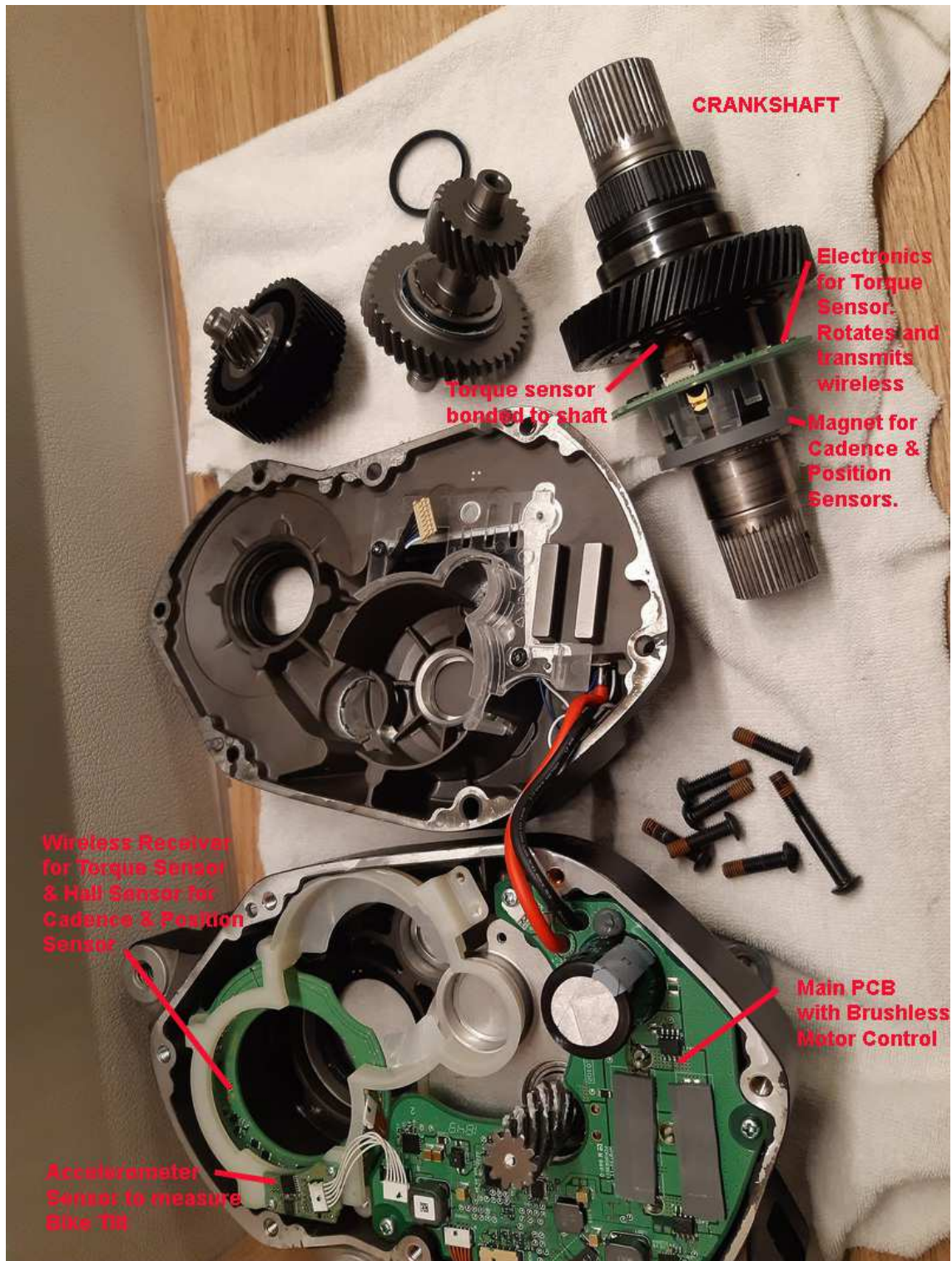
- On the right side of the bottom bracket is the NSK 6805Z bearing that has a metal sealing gasket that has less friction but also less protection against water ingress and that is the reason why this bearing usually causes problems. You will notice when it is damaged because it makes a grinding noise and doesn't turn smoothly.
- On the other side of the bottom bracket there is another large bearing with a brown (rubber) sealing gasket, it is the NSK 6808D.

To extract them, use the bearing puller extractor (the reference is below) and if there is no room for the extractor nails then you have to make a little space by lifting the bearing using a flat screwdriver to separate it from its housing.

There are other smaller bearings on the gear shafts: 3x NSK Z0069 and 1x NSK 6000Z. These don't usually get damaged.



Motor with case open



Description of Motor Parts:

- Electronics for Torque Sensor. Rotates and Transmits wireless
- Magnet for Cadence & Position Sensors
- Torque Sensor bonded to Shaft
- Wireless Receiver for Torque Sensor & Hall Effect Sensor for Cadence & Position
- Accelerometer Sensor to Measure Bike Tilt

EXPLANATION OF THE CADENCE, TORQUE AND TILT SENSORS

In image above you can see the components that make up the sensor system:

Cadence sensor:

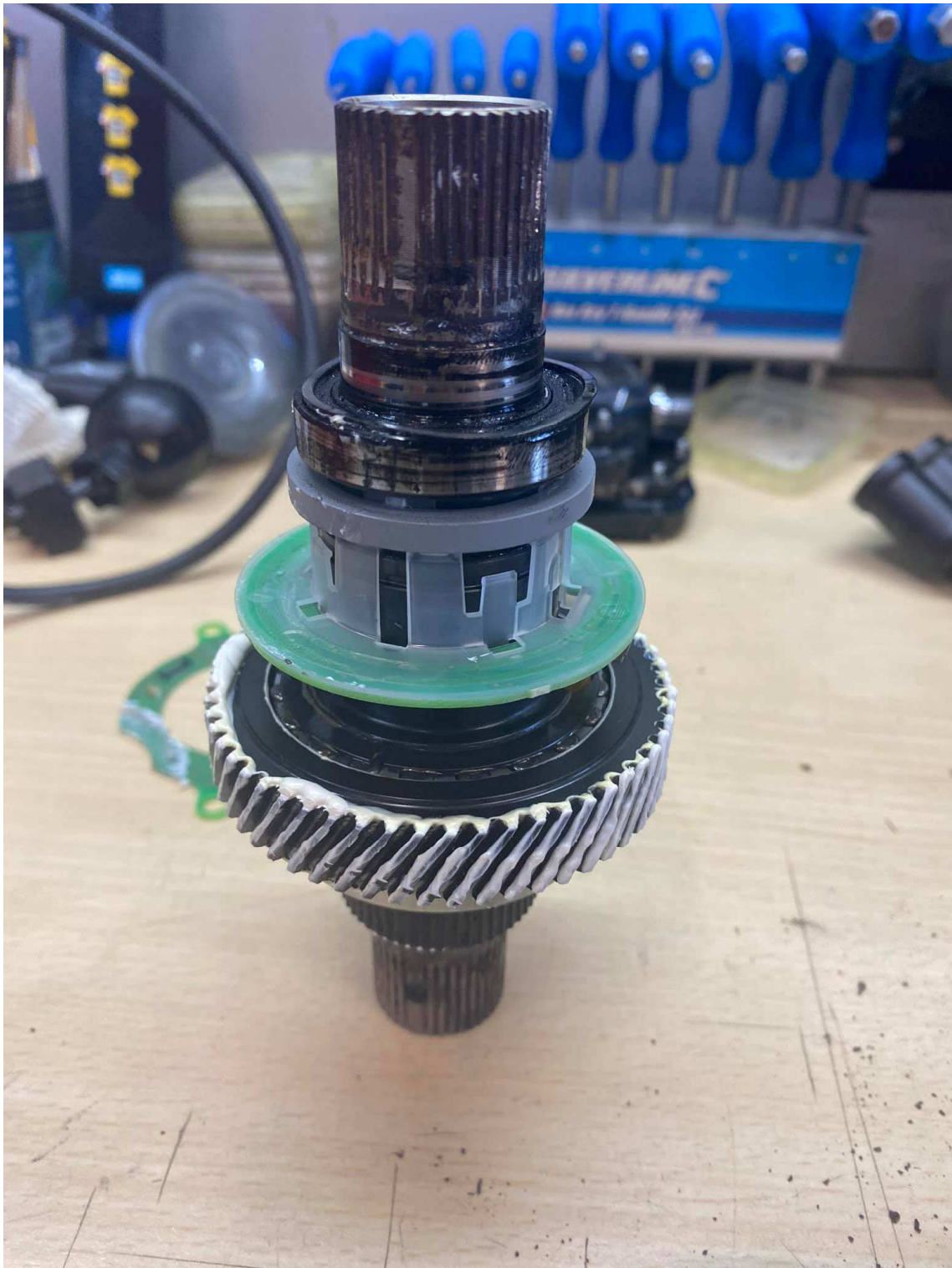
- There is a circular gray magnet on the bottom bracket.
- In the motor casing there is a green circular PCB that does not rotate. The Hall Effect Sensor is mounted on this PCB, it is the one that detects the position of the gray magnet and when the bottom bracket rotates it can measure the cadence and also the position of the cranks. It is necessary to measure the position of the cranks because during motor operation the power is modulated according to the position of the crank while the rider is pedaling.
- If the gray magnet is disassembled, it is important to reassemble it in the same position and orientation as it was originally, otherwise, the crank position measurements will be wrong.

Torque Sensor:

- While the rider is pedaling, he exerts a force and a torque that is received by the bottom bracket, this torque will deform the crankshaft very slightly and proportionally to the torque exerted by the rider.
- To measure this deformation of the bottom bracket there are two "Strain Gauge" type sensors bonded to the bottom bracket and covered with putty, they generate analog electric current proportional to the crankshaft deformation and then this current is converted to a digital data that contains the torque exerted by the rider.
- These two torque sensors are connected to a green PCB that is located on the bottom bracket axle and rotates together with it and the measured electrical data is transmitted wirelessly (It could be NFC or similar) to a second fixed PCB (Does not rotate) which is screwed to the motor case and connected by cables to the main large PCB that has the control for the brushless motor.
- It is assumed that during the motor manufacturing process, Shimano calibrates the torque sensors and stores the calibration values in processor memory on the motor's Main PCB.
- PENDING TO CONFIRM: If the above is true, this implies that in the case of wanting to fix a motor with parts from another "donor" motor, it is not possible to "transplant" the sensor from it, since the calibration data stored in the "other" Main PCB would not be correct. It would be necessary to transplant the Bottom Bracket with Torque Sensors together with the Main PCB.

Accelerometer:

- Near the circular PCB there is another small PCB with a white cable connected to the Main PCB, its function is to mount a digital accelerometer that measures the tilt of the eBike.



Bottom bracket is assembled together with :

- Bearings, Sprag-clutch inside gear
- Torque sensors, bonded to the shaft with putty and connected with a flat cable to the rotating PCB
- Gray casing that has the cadence sensor magnet inside



The main shaft with the roller bearings, where the bottom bracket is inserted



In the first photo we see the torque sensors that are of the "Strain Gauge" type and are bonded to the shaft with putty. In the second photo we see the rollers of the Sprag- clutch which us inside the black gear.

REMOVING THE BEARINGS

To extract the bearings you will need a Bearing Extractor, and you have to be careful not to damage the torque sensor and the flexible PCB cables that are inserted into the connectors.



To insert the new bearings you'll need a small hammer and a puncher to insert the bearing by gently tapping the puncher **ON THE INNER RACE OF THE BEARING** while rotating the tapping point around the perimeter every quarter turn until it settles. There may be a special tool or bearing press that would allow to make this job easier, but I don't know about it.

Inside the Main shaft there is a large cage bearing 17mm wide and next to it is a 25x29x2mm rubber gasket. The bearing is loose but the gasket presses and to remove it you can insert a ratchet socket on the side where the gear with internal clutch goes and tap it gently to push the bearing and the gasket. Care must be taken not to damage the gasket because it cannot be purchased.

Inside the torque sensor shaft there is a smaller cage bearing, 10mm wide. Normally it does not need to be replaced and instructions for removing it are not available.

These caged bearings do not usually get damaged, so you just can clean and grease them.

On the sides of the motor housing, around the bottom bracket position, there are sealing gaskets that protect the large bearings (NSK 6805Z and NSK 6808D) from water ingress.

There are also two directional roller clutches (Sprag clutches) that are mounted inside the big gears, but these are Shimano specific and not available, so if they break you have to change the motor or take them from a damaged donor motor.

CLEANING AND GREASING

If the "old" motor grease is contaminated with dirt and you clean it with solvent, then you will have to use new lube but keep in mind that there are different types. The following is a summary of opinions, but this topic is not fully agreed among forum members.

Plastic - Metal Gears

The gears have a lot of white grease, if when disassembling the gears you remove the grease and keep it, it is possible to re-use it again. If there is not enough, a specific grease for plastic and metal gears can be used. The most used among forum members is MOLYKOTE PG-75.

Metal to metal gears

It is not agreed whether MOLYKOTE PG-75 grease can be used for metal to metal gears it is required another type of grease for this type of bearings. But a metal to metal gear grease should be easier to find.

Cage bearings inside the main shaft

The bottom bracket spins inside these bearings, so it's metal to metal and I probably a standard bearing grease can be used.

Bearings - Directional Roller Clutch (Sprag Clutch)

These bearings have sprag clutches with rollers and springs inside that make the bearing only rotate in one direction. If it is necessary to grease them, be very careful because if they are greased with a non-specific grease they will get stuck. Only use the specific grease for this type of bearing: **Shell Gadus S2 V100 2**

HOUSING SEALING

When closing the motor housing, it must be sealed against water by using a specific silicone, apply a cord of silicone in one of the motor cases, close the motor with the bolts, let it dry and then remove the excess of silicone with a cutter. The silicones that are normally used are:

- Loctite 5926
- Hylomar Blue

THE LIST OF REQUIRED MATERIAL AND ITS AVAILABILITY:

BEARINGS:

- 1 x 6808DD Bearing (40x52x7mm).
- 1 x Bearing 6805ZZ (25x37x7mm).
- 1 x 6000ZZ Bearing (10x26x8mm).
- 3 x Bearing 6900ZZ (10x22x6mm).
- 1 x Needle roller bearing K25 29 17 (25x29x17mm).
- 1 x Needle roller bearing K25 29 10 (25x29x10mm)

They can be purchased here, although you may find them locally:

<https://www.ebikemotorcentre.com/shimano/>

The large bearings located in the bottom bracket are the ones that suffer the most from water and dirt ingress and also from impacts when cranks hit rocks or branches, and they are the first that break or get damaged. Normally it is recommended to change the large bearings in crankshaft: 6808DD (40x52x7mm), 6805ZZ (25x37x7mm) and check the needle bearing K25 29 17 (25x29x17mm) and replace if required.

In the bearing Reference Numbers, the suffixes ZZ and DD indicate the type of sealing in the sides, which provides the protection of the internal balls and races against water.

- DD is made of rubber and provides high protection against water but has more friction
- ZZ is metallic, has less friction but also less water protection.

The bearing that is more frequently damaged is the 6805ZZ, possibly because the seal does not fully protect against water ingress. Some people in the forum have installed a new type of bearing with suffix 2RS which has a rubber seal that has a better protection against water and has only slightly more friction than the original metallic one.

SEALS (NOT VERIFIED):

The information for the seals has provided by a forum member but has not been verified, so take it with a pinch of salt:

- Bottom bracket seal, on the motor housing, 25x32x4mm Nitrile Rubber Rotary Shaft Oil Seal Springless Design VC Style type shaft seal (garterless)).

https://simplybearings.co.uk/shop/p28291/25x32x4mm-Nitrile-Rubber-Rotary-Shaft-Oil-Seal-Springless-Design-VC-Style/product_info.html

- Bottom bracket seal, on the chainring side motor housing, 35x44x4mm (Dual lip shaft seal (garterless)). PLN242048 Polini Oil Seals used in Variomatic Yamaha T-max 500 Injection. Found in motorcycle shops
- Inside the bottom bracket and where the large cage bearing is, there is a 25x29x2mm gasket (VC type shaft seal (garterless)). Unidentified and not available.

TOOLS AND GREASES:

- Bearing puller extractor, the 40x80mm size is fine, you can buy it anywhere, Aliexpress:

[aliexpress.com/item/33046983579.html](https://www.aliexpress.com/item/33046983579.html)

- Grease for metal and plastic gears: MOLYKOTE PG-75. The 1 kilo can is €70. In some bike online stores they sell small cans repackaged by them that contain about 100g of product.

<https://www.tiendamtb.com/es/varios/2013-grease-molykote-pg-75-para-plastico-y-metal-30ml.html#/formato-150ml>

<https://www.performancelinebearings.com/product/gear-grease-for-ebike-motors/>

- Grease for Directional Clutch (Sprag Clutch). If you disassemble and clean them, you have to be very careful and use only the specific grease for this type of bearing: Shell Gadus S2 V100 2

<https://ebikemotorrepair.com/product/low-pressure-gadus-grease-for-sprag-and-clutch-bearings/>

- Blue Hylomar or Blue Loctite 5926 silicone for motor gaskets.

- Solvent to clean the gears

BEARINGS - CLUTCHES

They are of the roller type and there are two of them mounted inside the large gears. They are Shimano specific and not available to buy, if they break, then there is no replacement.

One of them allows the cranks to turn backwards relative to the chainring, this clutch is inside the big black gear on the axle. Its purpose is to allow the pedals to rotate more slowly than the chainring in case the motor rotates faster than the rider's pedal strokes.

The second clutch allows the motor to turn freely backwards relative to the chainring, it is located inside the second large metal gear. Its purpose is to allow the motor to turn more slowly than the chainring in case the rider pedals faster than the motor rotations.

They are not available to change, but if necessary they can be disassembled, cleaned and greased, but be careful that you only have to use the specific grease or they will get stuck. You have to take note of how the rollers and springs are mounted and use quality thin needle-nose pliers and tweezers to mount back the rollers and springs in place.

