Rebuild Procedure for a RayMarine (Autohelm) ST-50/Early ST-60 Wind Transducer

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After 18 years of use at 6 months per year, my ST-50 wind transducer has become sluggish to respond to wind speed and direction changes. This document describes how to rebuild the unit to restore original performance with new bearings and seals. I remove my transducer for the layup months so it is only in use and spinning for 6 months per year. If you leave yours in place year-round then its life may be much less than my results.

There are a few reference documents that I have gathered from the web and I will include them at the end of this document.

Here is a picture of my ST-50 wind transducer. This design was also used on the early ST-60 wind instruments as well, but later ST-60's used a transducer with a rounded body. This rebuild instruction only applies to the transducer pictured here.

The tools that you will need to accomplish this rebuild are as follows:

(2) pairs of pliers

(2) small flat screwdrivers

Allen wrench for the cups and vane

Needle-nose pliers

A plastic tipped hammer

A soldering iron

A piece of emery cloth or 1200-1600 sandpaper

A sharp utility knife

A 5/16" punch

Bench vise

The parts that are needed to rebuild <u>both the cup and vane</u> ends are:

(4) Bearings - S693ZZ 3x8x4mm Shielded ABEC-5 Ceramic Ball bearings

(4) O-rings - size 1-018

Two bearings and two O-rings are used for the cups and also for the vane.

See page 8 for the source of these parts.

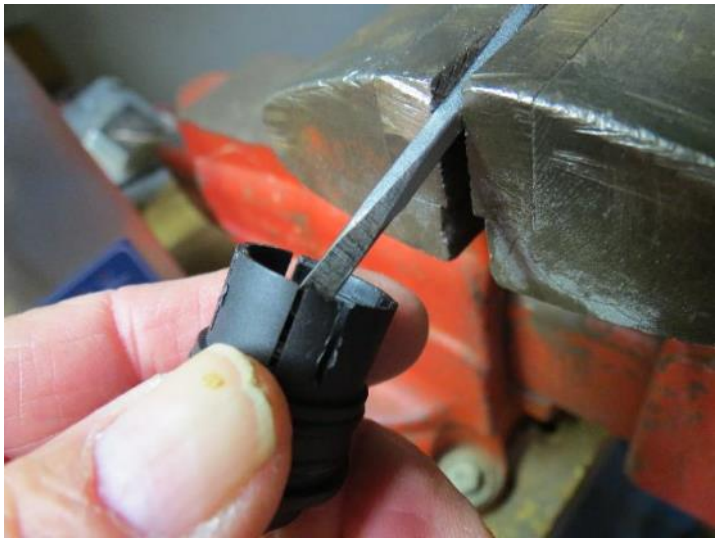
According to some information, the bearings on some transducers are held in place by a e-clip, but on both of my transducers the bearings were held by the plastic melted over the edge of the bearings. If your transducer uses the E-clip, you will need to source that item, and you will need (2) of them—one for the cup shaft and one for the vane shaft. See the parts source list on page 8.

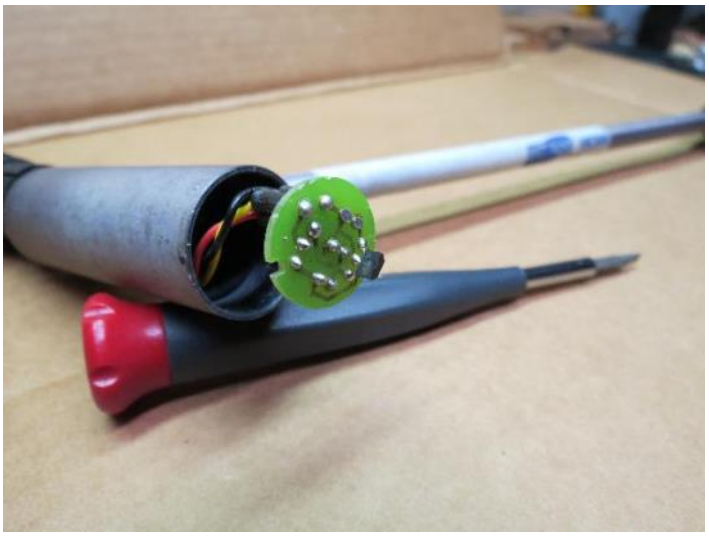
The first step is to remove the cups and the vane. Both are secured with a single set screw. Set them aside so they won't be damaged. RayMarine offers a replacement kit that includes the vane, cups, the Allen wrench, and a spare set screw. Part# E28081. About $20.

After removing the cups and vane, grip around the body of the plastic end with pliers and a small cloth (to avoid marking damage) and rotate back and forth while pulling out. The ends are only held in place by the friction of the sealing O-rings. The wiring is short so use care as the ends become loose. I suggest rebuilding just one side at a time. If only the cups are sluggish and the vane responds well, then just rebuild the cup end. In my case both were sluggish.

Start with the cup end.

The next step is to extract the small circuit board from the plastic bearing housing end. This is the most difficult part of the job and it has the greatest opportunity to damage the electronic parts. The circuit board is held into the end of the housing by three plastic tabs. The technique that I used is to clamp one of the small screwdrivers into the bench vise so that the blade can be used to push the plastic tab outward. While doing this, use the other small screwdriver to push the under-side of the circuit board out. Each tab should be worked in turn and the circuit board should be eased up so the edge of the board rests on the face of the tab. Once all three tabs are resting on the edge of the circuit board, work the board out being careful to extract the circuit board out straight. There are parts on the circuit board that can be damaged if the board comes out crooked.





This left picture above shows the clamped screwdriver in place to push on the tab. For clarity I took this picture after I had removed the circuit board.

Occasionally one of the three plastic tabs will break. This is not a disaster. The circuit board fits so snugly that two tabs are enough to hold it in place. If two of them break, then I would put a dab of silicone on the board after re-assembly to hold it in place. I did not have that issue.

Now is a good time to remove and discard the original O-rings.

A side note: If you find that the circuit boards have white corrosion on them, you can clean them up with some white vinegar and a toothbrush. Brush gently and rinse well with fresh water.

Once the circuit board is separated from the end housing, the next step is to remove the bearings and shaft.

If your bearings are held in by dimples in the plastic, simply cut the edge of the dimple that is securing the bearing. Use a new sharp blade and carefully cut using just the tip of the blade around the outside of the bearing. Only a very small amount of plastic will be removed so that the bearing can slide out of the housing.

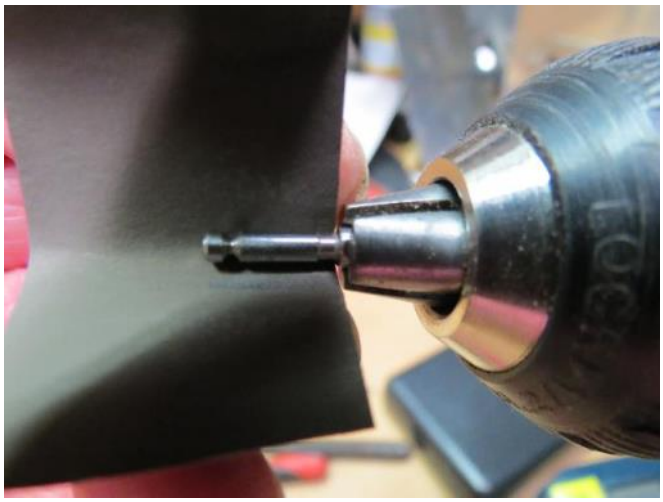
Next, using the needle-nose pliers, grasp the plastic barrel that holds the four small magnets on the inside of the housing. Pull straight out. This is a press-fit on the shaft, no glue.

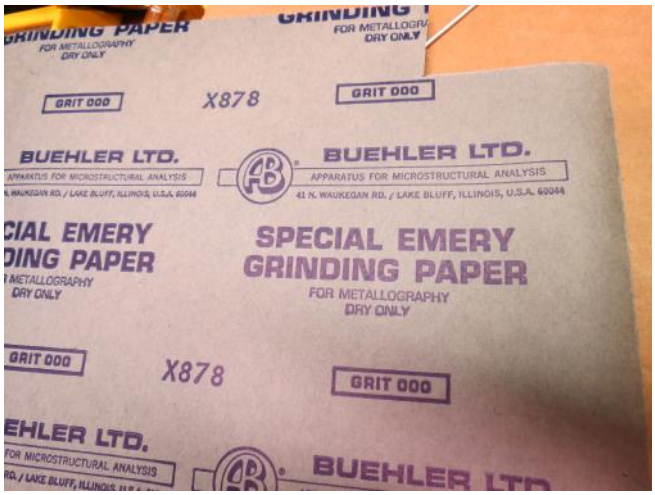
Once the magnet assembly is removed, push the inside end of the shaft. Both bearings and the shaft will push out easily. If they are not coming out, recheck that the securing dimples are fully removed.

Now you have the shaft with both bearings in place. These bearings simply slide onto the shaft and you can remove them with your fingers.

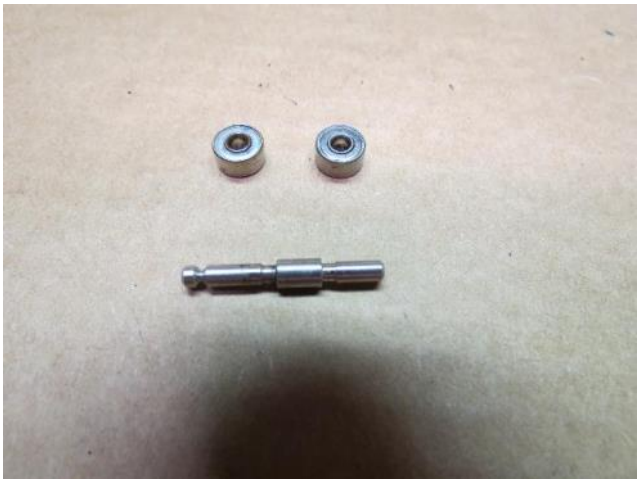
Discard them immediately so you don't get them mixed up with the new bearings.

The shaft will probably have some dirt/debris/rust on the surface, so I chucked up the shaft using the middle area where the bearings don't ride using my battery drill. Holding the emery cloth or super fine sandpaper I cleaned both ends of the shaft.





Now you are ready to re-assemble.



Slide a new bearing on each end of the shaft. The bearings are symmetrical so you can just put them on. Then push the shaft with the bearings into the end of the plastic housing. Place the plastic housing on a flat surface and gently tap the end of the shaft with the plastic hammer to ensure that the bearings are fully seated. Press on the outside edge of the outer bearing with the small screwdriver to ensure that the outer bearing is fully set. When the shaft and bearings are fully installed, the edge of the housing will stand just slightly proud of the bearing.

Placing the protruding end of the shaft on a flat surface, push the plastic barrel with the four magnets onto the inner end of the shaft. It should push on by hand, but I used the punch and gave the magnet barrel some light taps to be sure it was fully seated.

Next you need to use the soldering iron to carefully melt the edge of the plastic to hold the outer bearing in place with the shaft and inner bearing. The plastic melts quickly so just a quick touch will secure the bearing. I used four touch points like the factory. Verify that the shaft turns freely. I attached the cups and tested that they spun with the slightest air movement. An light exhale is a good test. Then remove the cups before completing the assembly.

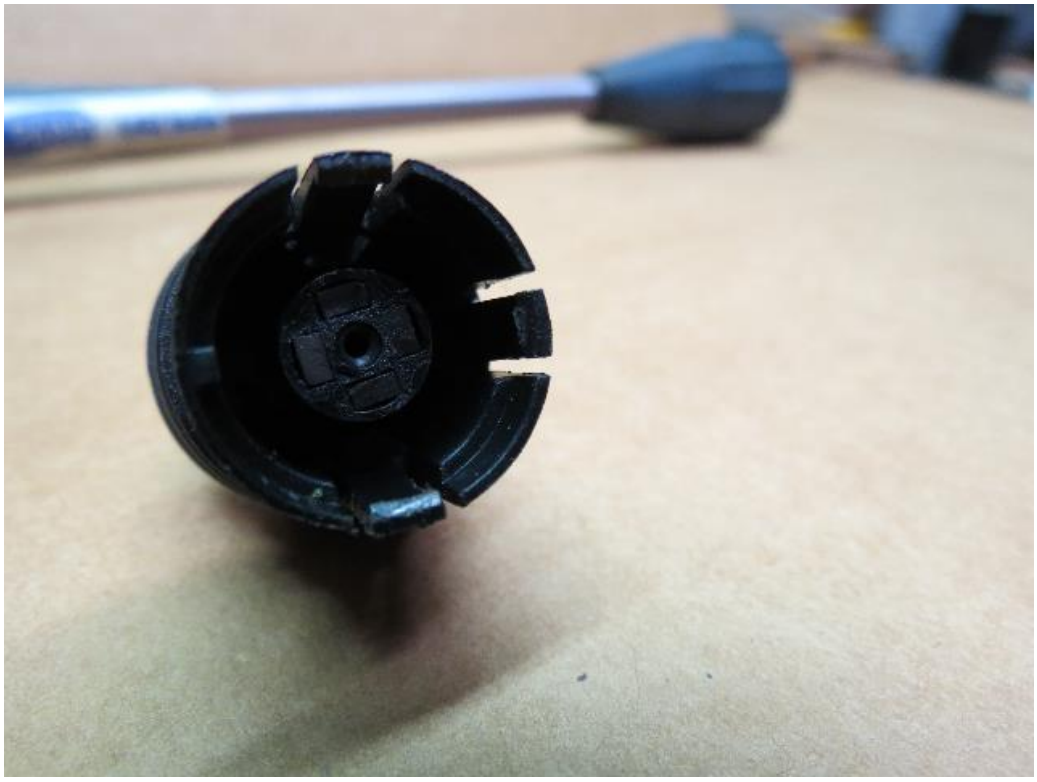
Install the new O-rings on the plastic end cap.

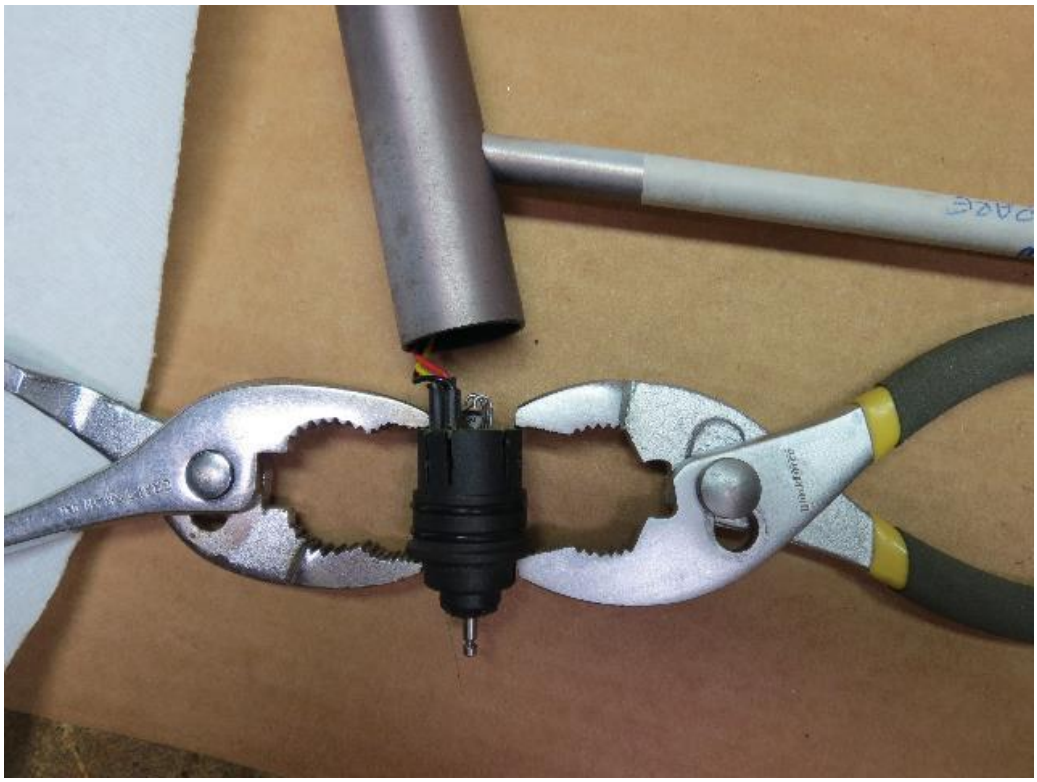
Insert the circuit board square with the end of the housing. Note that there is a locating boss opposite the three plastic clips. Using both of the pliers on opposite sides of the circuit board, squeeze lightly and evenly so the circuit board is pushed straight into the housing. The completion of this task can be done with your fingernails.

Finally rub a trace of liquid soap on the O-rings - just enough to wet them. Look at the wires and twist the housing to wind the wires in the original direction. This makes them shorter so the assembly will go together easier.

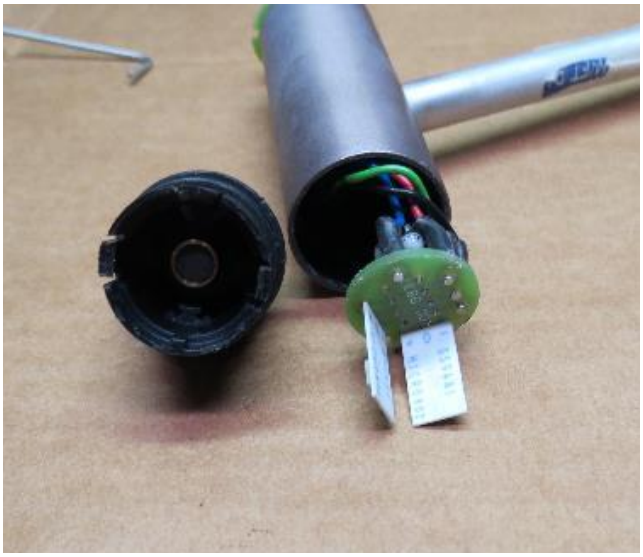
Grip the outer edge of the plastic assembly with the pliers and a small cloth and while turning back and forth push in on the plastic assembly until it is flush with the edge of the metal tube.

This completes the rebuild of the cup end.



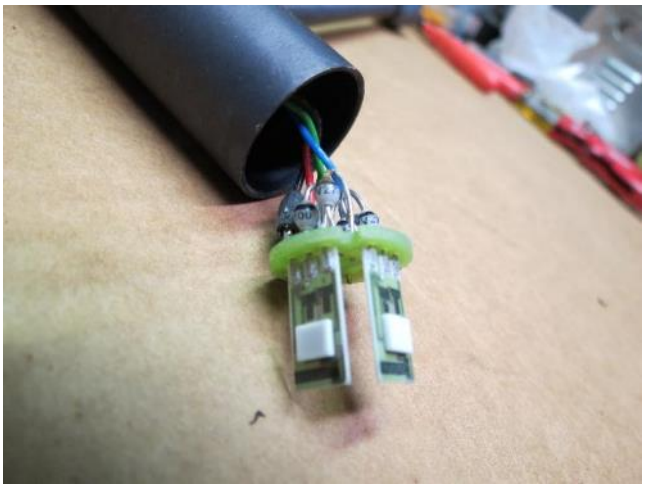


The rebuild of the vane end proceeds much the same way. However there are some differences.



The electronics on the vane circuit board are different. There are two flat Hall effect sensors that slide into slots on the inside of the plastic end. These can be broken if the circuit board is not extracted straight. So use extreme caution!

Once the vane circuit board is extracted, cut the plastic dimples so that the bearings and shaft can be pushed out. On this end, the interior brass barrel magnet is smaller than the bearings, so you can simply push on the inside barrel magnet. The shaft with the bearings and the magnet will come out of the end of the housing.



Remove and discard the old O-rings.

I found that this magnet barrel that is pressed onto the shaft was hard to remove. This is probably because the barrel is brass and not plastic. Unlike the magnet barrel for the cups, this barrel has just one magnet. The method I used to remove the magnet barrel was to first remove the outer bearing. Then grip the shaft in the middle area with the bench vise, and using the needle-nose piers under the brass barrel magnet, lever it up to release.

Clean the shaft as before, push new bearings in place, and replace the brass magnet barrel. Tap the brass barrel gently with the plastic hammer to ensure that it is fully seated.

Insert the shaft and bearing assembly into the end of the plastic end cap and fully seat in place. Use the soldering iron to melt the plastic as before to hold the bearings and shaft in place. Again I tested the assembly <u>with the cups</u> (even though this is the vane assembly) to be sure they spin freely.

Replace the O-rings as before.

Now look into the end of the plastic end cap. Note the two sets of slots at 90 degrees inside. The two Hall effect sensors must slide into those slots and the circuit board must be pushed in squarely to avoid damage to the sensors. Use the same technique with two pairs of pliers.

Lube the O-rings with soap, wind up the wires, and insert the end cap flush into the metal tube.

Congratulations, you are done!

On the following last page, there is an exploded view of the entire assembly to help you visualize how everything fits together.

Parts Source:

Bearings - S693ZZ 3x8x4mm Shielded ABEC-5 Ceramic Ball bearings

These bearings are available from a variety of sources, but I purchased mine from NationSkander California Corp., Anaheim, CA 92806

Link: http://www.vxb.com/SearchResults.asp?Search=S693ZZ

O-rings - size 1-018 These are 1/16" diameter, 3/4" ID, 7/8" OD

I purchased these locally from a machine supply business.

If your shaft is held into the housing by E-rings, instead of melted plastic lips, you will need these. According to a poster on the RayMarine website they are available from McMaster as part number 98317A207 for a pack of 50 pieces. I have not personally verified this source or the accuracy of the part.

E-rings—Side-Mount External Retaining Ring (E-Style), Stainless Steel, for 3-4MM Shaft Diameter

Prior to my rebuild effort, the following links and documents were my only reference:

http://raymarine.ning.com/forum/topics/autohelm-st50-wind-mast-head-system-bearing-replacement-technique

ST50 Early ST60 Wind Vane Transducer Service (Available on the web)

ST-50 Micrio Wind Sensors

(This was a document that I stumbled upon and it has useful information in addition to offering replacement sensors for the ST-50 and ST-60

Z080 Masthead Transducer General Assembly