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APPLICATION NOTE NO. 75

Revised February 2010

Maintenance of SBE 5T, 5P, and 5M Pumps

This application note is intended to assist you in maintaining your pump:

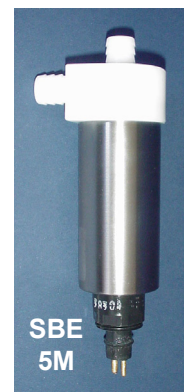
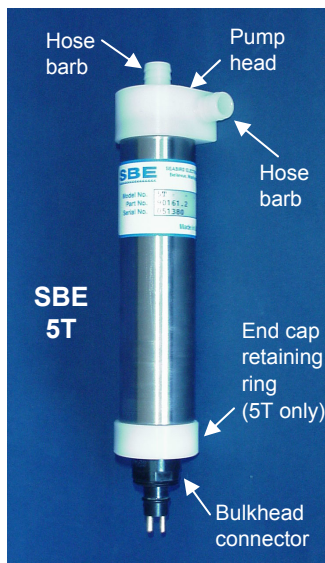
- SBE **5T** Titanium Submersible Pump – titanium housing (depth to 10,500 meters).
- SBE **5P** Plastic Submersible Pump – plastic housing (depth to 600 meters).
 Note: The SBE 5P’s *operational* characteristics (power requirements, flow rate, etc.) are identical to the SBE 5T. However, the SBE 5P’s construction is similar to the SBE 5M; therefore, the **maintenance procedures for the SBE 5P are grouped with the SBE 5M.**
- SBE **5M** Miniature Submersible Pump – available in titanium housing (depth to 10,500 meters) or plastic housing (depth to 600 meters).

A properly maintained pump will provide constant flow for your CTD and any pumped auxiliary sensors, resulting in high quality data. The main symptom of a non-functioning or poorly functioning pump is bad conductivity data, because the pump is not pulling water through the conductivity cell.

CAUTION: Do not run the pump dry. The pump is water lubricated; running it without water will damage it. If testing your system in dry conditions, remove the Tygon tubing from the hose barb at the top of the pump head, and fill the inside of the pump head with water. This will provide enough lubrication to prevent pump damage during testing.

The application note is organized as follows:

- Routine rinsing after recovery (applies to all pumps)
- SBE 5T -
 Periodic cleaning for SBE 5T
 Yearly maintenance for SBE 5T
 Non-functioning or poorly functioning SBE 5T
- SBE 5M or SBE 5P -
 Periodic cleaning for SBE 5M or SBE 5P
 Yearly maintenance for SBE 5M or SBE 5P
 Non-functioning or poorly functioning SBE 5M or SBE 5P



SBE 5M with titanium housing

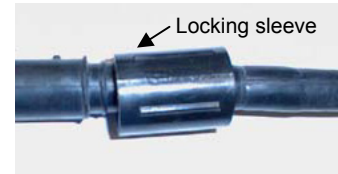


SBE 5M with plastic housing

Routine Rinsing after Recovery (applies to all pumps)

At the end of a day of taking casts:

1. Remove the Tygon tubing from the pump head's hose bars.
2. Leaving the pump head on the housing, thoroughly rinse the inside of the pump head, pouring clean, fresh water through a hose barb. If the pump head is not rinsed between uses, salt crystals may form on the impeller. Over time, this may *freeze* the impeller in place, preventing the pump from working.
3. Replace the Tygon tubing on the hose bars.
4. Unscrew the cable locking sleeve from the bulkhead connector, and slide it up the cable. Thoroughly rinse the cable connection (still mated) with clean, fresh water. This will prevent premature cable failure.
5. Slide the locking sleeve back into place, and screw it back onto the bulkhead connector. Do not use a wrench or pliers to tighten the locking sleeve.

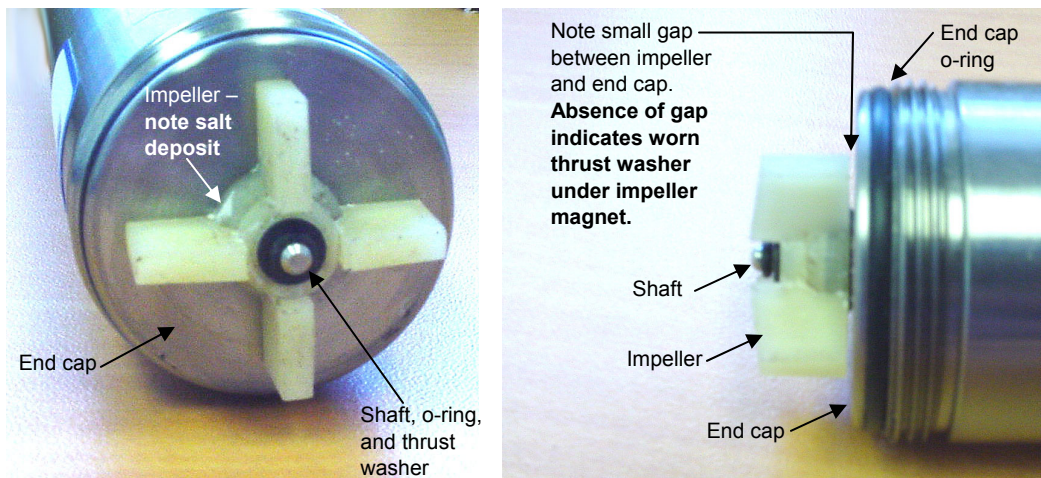


SBE 5T

Periodic Cleaning for SBE 5T

If you are going to store the pump for more than 1 week, or have removed the pump from a mooring, perform a more thorough cleaning:

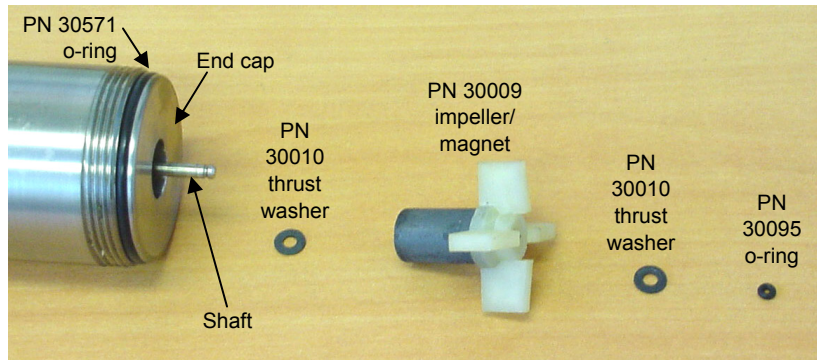
1. Unscrew the pump head from the housing.
2. Using clean, fresh water, thoroughly rinse the pump head and impeller.
3. Inspect the impeller for salt deposits. Clean any deposits with clean, fresh water and a toothbrush. Verify that the impeller can turn freely.
4. Inspect the shaft, and the o-ring and thrust washer holding the impeller on the shaft. There is another thrust washer underneath the impeller magnet, inside the housing. If this thrust washer is in good condition, you should observe a small gap between the bottom of the impeller and the end cap. If there is no gap, the thrust washer is worn and needs to be replaced (see *Yearly Maintenance for SBE 5T* for replacement procedure).



SBE 5T with Pump Head Removed

Yearly Maintenance for SBE 5T

1. Unscrew the pump head from the housing.
2. Replace the o-ring and 2 thrust washers on the shaft:
 - A. Remove the o-ring from the shaft. A pair of tweezers works well for this.
 - B. Pull the impeller and attached magnet off the shaft. The thrust washer above the impeller will come off at the same time. Inspect the impeller for salt build-up, and clean if

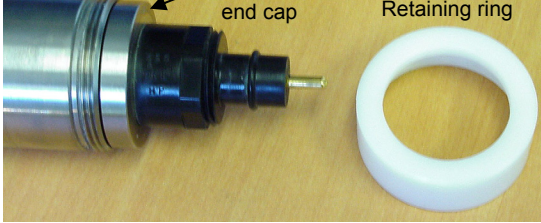


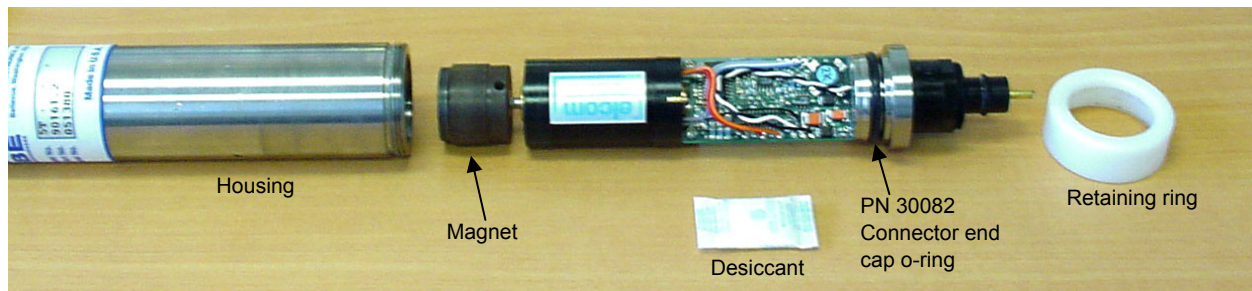
SBE 5T with Pump Head and Impeller Removed

- C. Remove the second thrust washer from the bottom of the shaft. A pair of tweezers works well for this.
 - D. Inspect the shaft for wear.
 - E. Rinse the shaft and depression in the housing with clean, fresh water. Allow to dry.
 - F. Using new thrust washers (2 of PN 30010) and o-ring (PN 30095), replace the thrust washer and impeller / magnet on the shaft. Replace the other thrust washer and o-ring on the shaft, above the impeller, pushing hard with your fingertip to seat the thrust washer and o-ring in place.
3. Inspect the end cap o-ring and the mating surface on the pump head for dirt, nicks, and cuts. Clean or replace as necessary. Apply a light coat of o-ring lubricant (Parker Super O Lube) to the o-ring and mating surfaces.
4. Reinstall the pump head on the pump housing.
5. Inspect the bulkhead connector for corrosion, which is a sign of seawater leakage between the bulkhead connector and cable. If there is corrosion, thoroughly clean the connector with water, followed by alcohol. Inspect the bulkhead connector for chips, cracks, or other flaws that may compromise the seal. Inspect the mating cable's connector for cuts, nicks, breaks, or other problems that may compromise the seal. Give the connector surfaces a light coating of **silicon** grease, and remate the connector properly; see *Application Note 57: Connector Care and Cable Installation*.
 - If the bulkhead connector is severely corroded or damaged, it must be replaced. Sea-Bird recommends that this work be performed at the factory, because the pump's physical configuration makes customer-replacement of the connector difficult.

Non-Functioning or Poorly Functioning SBE 5T

Perform the inspection procedures listed above in *Yearly Maintenance for SBE 5T*. If you do not discover the problem there, proceed as follows.

1. Unscrew the connector end cap retaining ring. Install a 2-pin dummy plug with locking sleeve over the bulkhead connector to provide a good grip and protect the connector pins. Rotate the end cap back and forth while carefully pulling the end cap away from the housing. Pull out the end cap and attached electronics from the housing.
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- The image shows a close-up of the connector end cap and retaining ring. The end cap is a black cylindrical component with a silver-colored metal sleeve at the top. The retaining ring is a white plastic ring. Labels with arrows point to the 'Connector end cap' and the 'Retaining ring'.
2. Verify that the magnet can spin freely and is not broken or damaged.
 3. Look for other signs of damage on the electronics.
 4. Inspect the connector end cap o-ring and the mating surface in the housing for dirt, nicks, and cuts. Clean as necessary. If the o-ring or mating surface is damaged, return the pump to Sea-Bird for repairs.
 - Sea-Bird recommends that connector end cap o-ring replacement be performed at the factory, because the pump's physical configuration makes customer-replacement of this o-ring difficult to perform without special tools.
 5. Apply a light coat of o-ring lubricant (Parker Super O Lube) to the o-ring and mating surfaces. Gently place a **new desiccant bag** (PN 30558 – 1 gram) on the electronics (see *Application Note 71* for desiccant use and regeneration). Reinstall the electronics in the housing, until the o-ring has fully seated. Reinstall the retaining ring on the connector end cap.



SBE 5M or SBE 5P

Periodic Cleaning for SBE 5M or SBE 5P

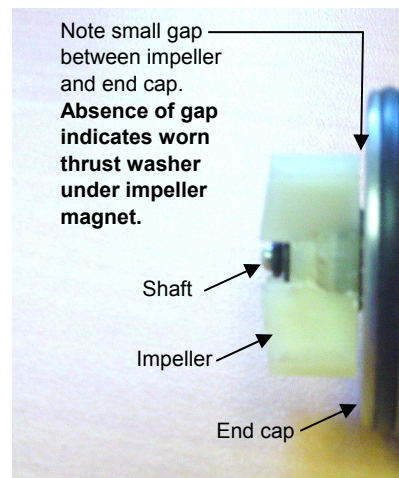
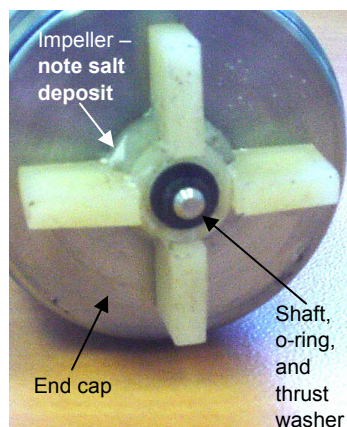
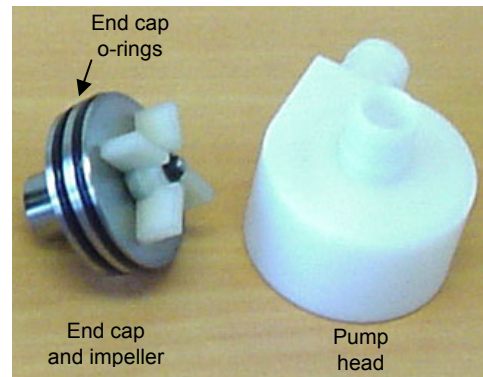
If you are going to store the pump for more than 1 week, or have removed the pump from a mooring, perform a more thorough cleaning:

CAUTION: Remove the end cap and impeller from the housing before cleaning the impeller. The end cap o-rings seal the electronics chamber. The end cap may *walk* out of the housing after the pump head is removed, allowing water to enter the electronics chamber if you clean the impeller without first removing the end cap from the housing.

1. Unscrew the pump head from the housing.
2. Pull out the end cap from the housing.
3. Using clean, fresh water, thoroughly rinse the pump head and impeller.
4. Inspect the impeller for salt deposits. Clean any deposits with clean, fresh water and a toothbrush. Verify that the impeller can turn freely.
5. Inspect the shaft, and the o-ring and thrust washer holding the impeller on the shaft. There is another thrust washer underneath the impeller magnet, inside the housing. If this thrust washer is in good condition, you should observe a small gap between the bottom of the impeller and the end cap. If there is no gap, the thrust washer is worn and needs to be replaced (see *Yearly Maintenance for SBE 5M or SBE 5P* for replacement procedure).
6. Apply a light coat of o-ring lubricant (Parker Super O Lube) to the o-ring and mating surfaces. Reinstall the end cap in the housing, carefully aligning the end cap with the housing and pushing hard on the end cap to seat the first o-ring in the housing (only 1 o-ring should now be visible).

CAUTION: If you are not careful, you may pinch the o-ring, which may allow water to enter the housing, damaging the electronics.

7. Reinstall the pump head on the end cap.

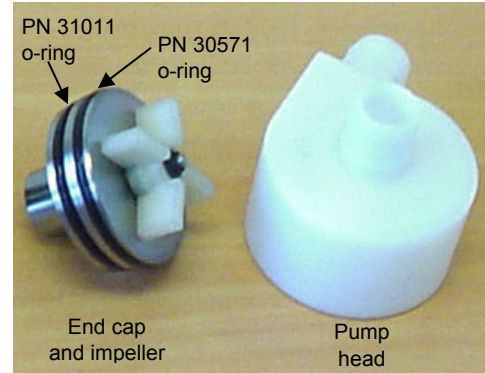


SBE 5M or 5P with Pump Head Removed

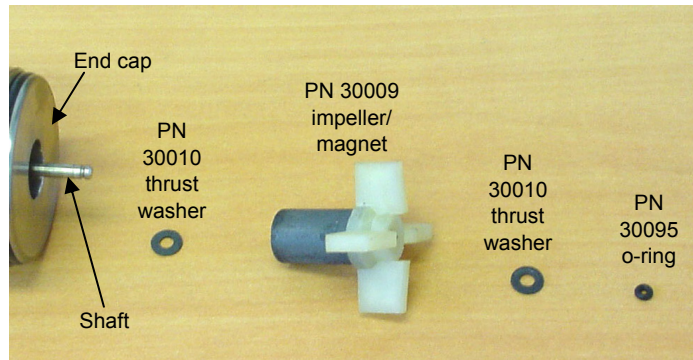
Yearly Maintenance for SBE 5M or SBE 5P

CAUTION: Remove the end cap and impeller from the housing before cleaning the impeller. The end cap o-rings seal the electronics chamber. The end cap may *walk* out of the housing after the pump head is removed, allowing water to enter the electronics chamber if you clean the impeller without first removing the end cap from the housing.

1. Unscrew the pump head from the housing.
2. Pull out the end cap from the housing.



3. Replace the o-ring and 2 thrust washers on the shaft:
 - A. Remove the o-ring from the shaft. A pair of tweezers works well for this.
 - B. Pull the impeller and attached magnet off the shaft. The thrust washer above the impeller will come off at the same time. Inspect the impeller for salt build-up, and clean if necessary. Inspect the magnet for wear. Particularly in sandy coastal environments, the magnet may be worn down from abrasion. If necessary, replace the impeller / magnet assembly (PN 30009).



SBE 5M or 5P with Pump Head and Impeller Removed

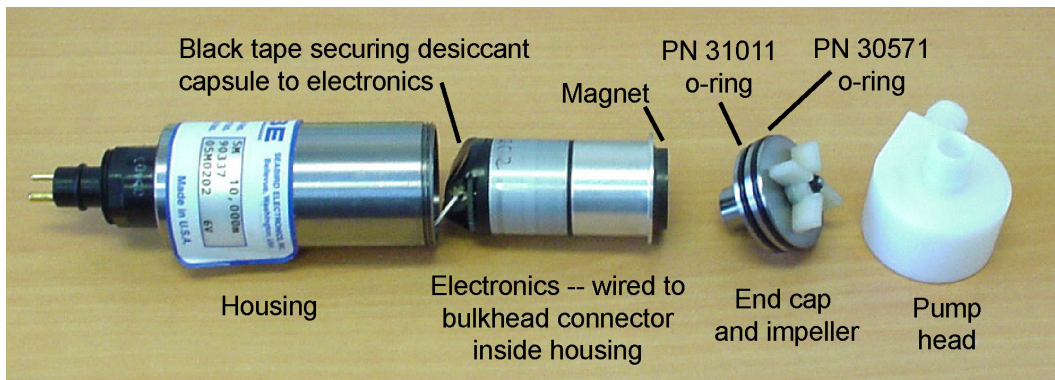
- C. Remove the second thrust washer from the bottom of the shaft. A pair of tweezers works well for this.
 - D. Inspect the shaft for wear.
 - E. Rinse the shaft and depression in the housing with clean, fresh water. Allow to dry.
 - F. Using new thrust washers (2 of PN 30010) and o-ring (PN 30095), replace the thrust washer and impeller / magnet on the shaft. Replace the other thrust washer and o-ring on the shaft, above the impeller, pushing hard with your fingertip to seat the thrust washer and o-ring in place.
4. Inspect the end cap o-rings and the mating surface on the pump head for dirt, nicks, and cuts. Clean or replace as necessary. Apply a light coat of o-ring lubricant (Parker Super O Lube) to the o-rings and mating surfaces.
 5. Reinstall the end cap in the housing, carefully aligning the end cap with the housing and pushing hard on the end cap to seat the first o-ring in the housing (only 1 o-ring should now be visible).

CAUTION: If you are not careful, you may pinch the o-ring, which may allow water to enter the housing, damaging the electronics.
 6. Reinstall the pump head on the end cap.
 7. Inspect the bulkhead connector for corrosion, which is a sign of seawater leakage between the bulkhead connector and cable. If there is corrosion, thoroughly clean the connector with water, followed by alcohol. Inspect the bulkhead connector for chips, cracks, or other flaws that may compromise the seal. Inspect the mating cable's connector for cuts, nicks, breaks, or other problems that may compromise the seal. Give the connector surfaces a light coating of **silicon** grease, and remate the connector properly; see *Application Note 57: Connector Care and Cable Installation*.
 - If the bulkhead connector is severely corroded or damaged, it must be replaced. Sea-Bird recommends that this work be performed at the factory, because the pump's physical configuration makes customer-replacement of the connector difficult.

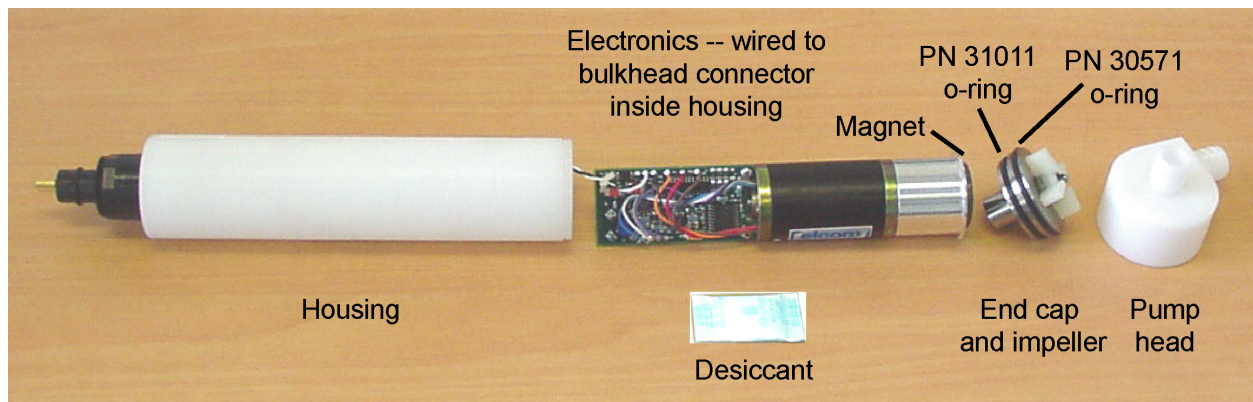
Non-Functioning or Poorly Functioning SBE 5M or SBE 5P

Perform the inspection procedures listed above in *Yearly Maintenance for SBE 5M or SBE 5P*. If you do not discover the problem there, proceed as follows.

1. Unscrew the pump head from the housing.
2. Pull out the end cap from the housing.
3. Pull out the electronics from the housing. Note that the electronics are wired to the bulkhead connector inside the housing.
4. Verify that the magnet can spin freely and is not broken or damaged.
5. Look for other signs of damage on the electronics.
6. Reinstall the end cap in the housing:
 - A. Apply a light coat of o-ring lubricant (Parker Super O Lube) to the o-ring and mating surfaces.
 - B. **SBE 5M** – Gently place a **new desiccant capsule** (PN 31044 – 0.4 gram) on the electronics, and replace the black tape to secure it in place.
SBE 5P - Gently place a **new desiccant bag** (PN 30558 – 1 gram) on the electronics.
(see *Application Note 71* for desiccant use and regeneration).
 - C. Reinstall the electronics in the housing.
 - D. Reinstall the end cap in the housing, carefully aligning the end cap with the housing and pushing hard on the end cap to seat the first o-ring in the housing (only 1 o-ring should now be visible).
CAUTION: If you are not careful, you may pinch the o-ring, which may allow water to enter the housing, damaging the electronics.
7. Reinstall the pump head on the end cap.



SBE 5M with Electronics Removed (titanium version shown; plastic version similar)



SBE 5P with Electronics Removed