

Module 17

**Basic
Maintenance of
Sea-Bird
Equipment**

Overview



**Basic Maintenance of
Sea-Bird Equipment**


- Annual maintenance
- Hardware lubrication
- Handling opened instruments
- Handling / replacing O-rings and seals
- Pump maintenance
- Replacing bulkhead connectors



We are going to discuss how to perform basic maintenance on your Sea-Bird equipment in this module.

Of all of the maintenance that can be performed, the most crucial is cleaning, which we discussed in the previous module.

Annual Maintenance



Annual Preventive Maintenance

- Inspect all cables and connectors.
 - Replace as required (usually good for up to 5 years).
- Inspect all anodes.
 - Replace as required.
- Inspect the housing for corrosion.
 - Remove all installed sensors and clamps for cleaning and inspection.
 - Replace Teflon Tape as required
 - Remove, re-lubricate, and re-install the hardware (use DC4 and Blue Moly).
 - Ideally done after each cruise.
 - Replace jack-screw plugs as required.


Inspect cables for cuts, abrasions, cracking, and corrosion. Sea-Bird recommends that you replace *worn* cables, even if they are still functional (save working cables as spares).

For anodes, Sea-Bird recommends that you replace them when more than 50% of the material has eroded.

Minor exterior housing corrosion (pits) can be *patched* to extend housing life. Keep in mind that patching is not a *cure*; once corrosion has started it will continue.

- Remove loose oxide.
- Clean and dry with alcohol.
- Apply a light coat of epoxy.

Lubricating Hardware



Re-Lubricating Hardware

- Place DC4 in the screw hole to fill the *blind* end of the hole.
 - This prevents sea water from filling the space and causing hardware and housing corrosion.
 - It also prevents the growth of salt crystals, which can cause stuck hardware.
- Coat the screw with Blue Moly to prevent corrosion and prevent binding of the hardware.
- Wipe up any excess from the instrument.
- These coatings dissipate with use, and require periodic replacement.

- DC-4 is a silicone-based electrical insulating compound.
- Never-Seez® Blue Moly is a lubricating and anti-seize compound containing molybdenum sulfide, nickel, and zinc oxide.
- Never use copper-based anti-seize products.
- A hypodermic syringe is the easiest way to apply the DC-4 to the screw holes.
- You may want to wear latex gloves when applying Blue Moly.

Lubricating Hardware

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Hardware Lubrication


- When installing hardware in titanium housings:
 - DC4 -- No Blue Moly -- Yes
- When installing hardware in plastic housings:
 - DC4 -- Yes Blue Moly -- No
- When attaching the ground strap screw and anodes:
 - DC4 -- No Blue Moly -- Yes

Electrostatic Discharge Precautions

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Handling *Opened* Instruments

- All electronics have varying levels of ESD susceptibility.
- When handling any electronics, observe ESD precautions.



- Avoid wearing rubber-soled shoes.
- Avoid scuffing (sliding) your feet on carpeted surfaces.
- Discharge yourself by touching a grounded object.
- Use antistatic devices, such as wrist straps and floor mats.

O-Rings



O-Rings

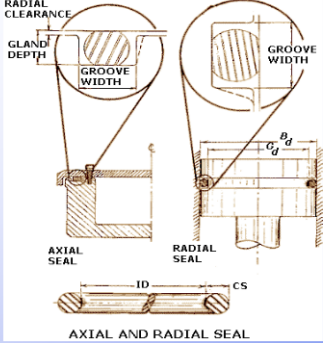
- Replace O-rings that are not normally disturbed every 3 to 5 years.
- Inspect and replace O-rings that are accessed more frequently with greater regularity.
 - For example, battery end cap O-rings.

The O-rings in your instrument are one of the least expensive, yet most important, components.

O-Rings

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Types of O-Ring Seals used by SBE




- Axial or face seal
- Radial or piston seal
- We use both seals in most of our instruments
- We also use L-seals

The face seal and piston seal are used in conjunction with each other on the battery end cap.

We also use Morrison seals to install temperature probes in our end caps.

Seals



Seals

- Axial and piston seals are usually installed in conjunction with one another.
- Other instruments use dual piston seals.
- Some instruments use an L-seal.
 - L-seals work well for uni-directional pressure, and are well suited to high pressure.
 - L-seals also use a hard Teflon backup ring.
- The rules for handling and installing the seals are the same.

- Keep clean.
- Store in sealed bags, out of direct sunlight.
- Inspect thoroughly before installation.
- Lubricate lightly.

- **O-Rings and Seals – Opening Instrument**



Open the Instrument

- Disassemble the instrument in accordance with the manual instructions.
- Remove the O-rings that are being replaced.
 - Do not use metal tools; use wood or plastic.
 - Clean the old Super O Lube residue from the instrument's sealing surfaces, and inspect for corrosion.

Make sure the instrument is completely dry before opening. **Water on the electronic circuits can severely damage the instrument.**

- Water droplets *hide* behind conductivity cells.
- Dry around O-rings before fully opening the instrument.


Alcohol can be used to clean stubborn O-ring lubricant.

O-Rings and Seals – Cleaning Surfaces

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Cleaning O-Ring Surfaces

- Use Kimwipes or the equivalent when cleaning O-ring sealing surfaces and O-rings.
 - Kimwipes are a low-lint wipe.
- Avoid using paper-towels and Q-Tips, because they may leave fibers behind that could bridge an O-ring.



Having clean surfaces is one of the most important aspects of O-ring handling and replacement.

O-Rings and Seals – Inspecting

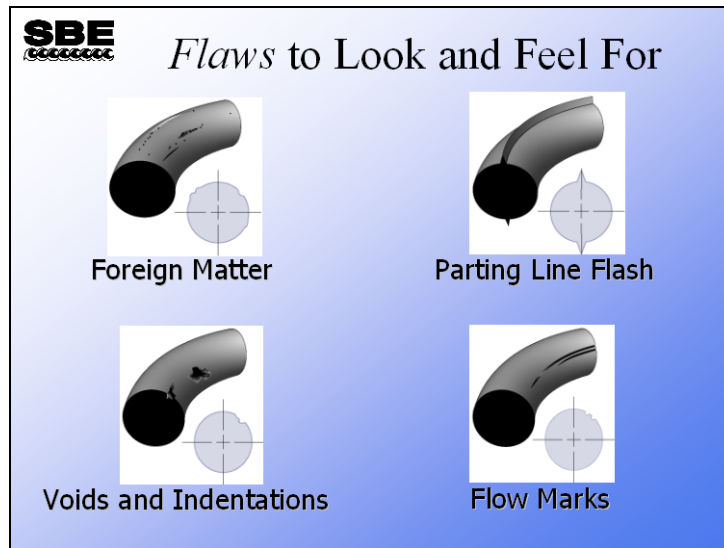


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Inspect the New Seal

- Visually inspect the seal in *good light* for any flaws or imperfections.
- Also inspect by *feel*.
 - Perform the *feel* inspection when lubricating the seal, just prior to installation.

O-Rings and Seals – Typical Flaws



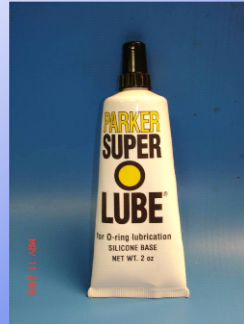
Any of these flaws may result in the instrument flooding.

O-Rings and Seals – Lubrication



Proper O-Ring Lubrication

- SBE uses **ONLY Parker Super O-Lube** for lubrication of O-rings that we install.
- The **KEY** to proper application is to use a small amount and provide a light film where it is applied.




O-Rings and Seals – Lubricating O-Ring

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Applying the Lubricant

- Apply a **thin** continuous film of lubricant over the entire O-ring surface by *running* it through your fingers, checking one last time for flaws.
- Install the O-ring in the O-ring groove.



Excessive lubricant is worse than too little!

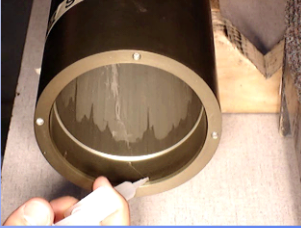
The lubricant on your finger tips will actually enhance your ability to detect flaws in the O-ring.

O-Rings and Seals – Lubricating Housing

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Lubricate the Housing


- Inspect the housing O-ring surface.
- Apply a **light** coating of Parker O-ring lube.
- This prevents the O-ring from binding during installation.



Again, excessive lubricant is worse than too little!

Inspect for pits, scratches, corrosion, and foreign matter.

O-Rings and Seals – Closing Instrument




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SCIENTIFIC BIRD EQUIPMENT

Closing the Instrument

- Replace or re-condition the desiccant bag.
- Back-fill the instrument with a dry gas if possible (for example, dry Nitrogen or Argon).
- Properly lubricate and re-install the hardware.
- Verify operation of the instrument before reassembling into cage, etc.

See *Application Note 71: Desiccant Use and Regeneration* on our website.

Pump Maintenance



Pump Maintenance

- The pump drive motor is magnetically coupled to the impeller.
- The shaft has an upper and lower thrust washer, with the impeller mounted in-between. The thrust washers and impellers are retained by a single O-ring installed on the shaft.
- Avoid running the pump when *dry*.

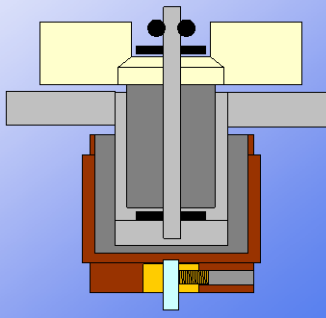
See *Application Note 75: Maintenance of SBE 5T, 5P, and 5M Pumps* on our website.

Pump Maintenance

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Pump Impeller

- Periodically inspect the impeller thrust washers and the pump impeller housing.
- Replace the thrust washers and impeller retaining O-ring annually or as required.

A cross-sectional diagram of a pump impeller assembly. It shows a central vertical shaft with a grey impeller mounted on it. The impeller has two curved vanes. Above the impeller, there are two black circular thrust washers on the shaft, with yellow rectangular components on either side. Below the impeller, there is a grey housing with a brown O-ring seal. At the very bottom of the shaft, there is a yellow O-ring seal. The entire assembly is shown in a cutaway view to reveal internal components.

There is a groove for the impeller retaining O-ring in the tip of the shaft. Push down with your fingertip until the ring slips into the groove.

Pump Troubleshooting




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What if the Pump isn't Running?

- The pump impeller can become bound by sand, sediment, and salt crystals.
- If the pump is not running, remove the pump head and inspect the impeller and thrust washers to determine if a clogged impeller is the problem.

It may be necessary to remove the O-ring and thrust washers to properly clean the pump impeller and impeller housing.

Replacing Bulkhead Connectors

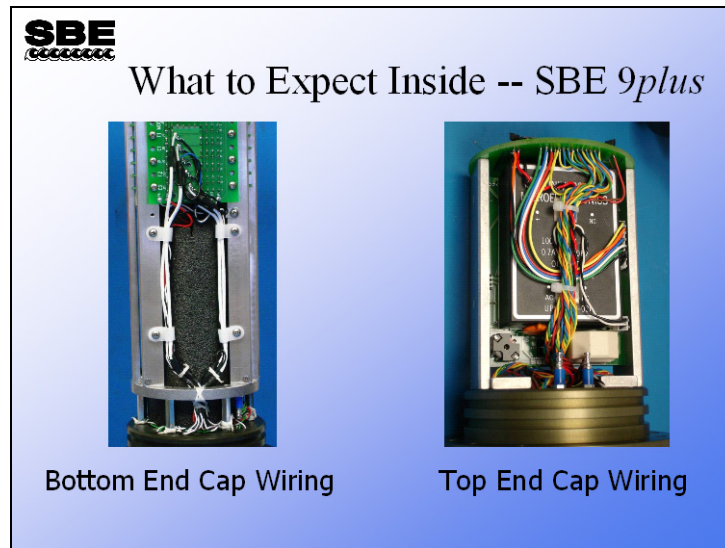


Emergency Maintenance

- Replacing a damaged bulkhead connector is the most common emergency.
- Re-wiring of CTD connectors is difficult. We recommend that maintenance on the instrument's electronics be left to SBE.
- Connector replacements on modular sensors are easier to perform.

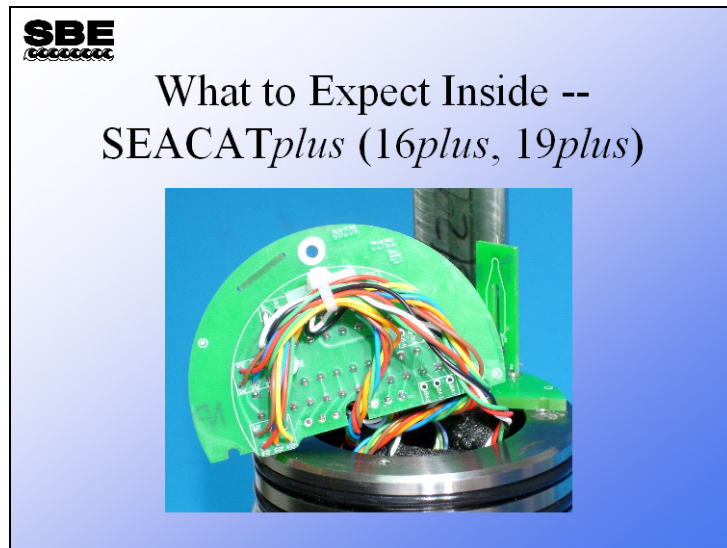
As electronics have become more and more miniaturized, it is difficult to perform board level repairs without specialized tools.

SBE 9plus Bulkhead Connector Wiring




Note that the wiring from all of the connectors joins together to form large bundles.

SBE 16*plus* and 19*plus* Bulkhead Connector Wiring



The leads solder directly to the motherboard.

Replacing Bulkhead Connectors – Overall Procedure



If you Decide to Replace a Connector

- Remember to observe ESD precautions.
- After removing the damaged connector, remove all LocTite® residue.
 - Use wooden or plastic tools if a tap isn't available.
- Prepare the new connector for installation.
 - Trim and terminate ends before installing.

- The connectors use a 1/2"-20 thread.
- Never use metal tools around the O-ring surfaces.
- It is best if the ends of the replacement connectors leads are trimmed and tinned prior to installation.

Replacing Bulkhead Connectors – LocTite

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Connector Installation

- Connectors installed at SBE are installed using LocTite® 242 (Blue).
- This LocTite® is *service removable*, but when set, will keep the connector firmly in place.
- Use LocTite® or a substitute thread-locker when replacing connectors.




If you use a substitute thread-locker, make sure that it indicates that it is *service removable* and is rated for ½” hardware.

Replacing Bulkhead Connectors – Connector O-Ring

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Install Connector O-Ring

- Lightly lubricate the connector O-ring groove.
- Inspect and lubricate the connector O-ring.
- Install the connector O-ring.



Connector with O-Ring

Remember: Only very light lubrication is required!

Replacing Bulkhead Connectors – Install Connector

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Install Connector



- Apply LocTite® 242 (Blue) to ONLY the bottom two threads of the connector.


You should stop seeing LocTite® move up the threads when there are approximately two full threads remaining on the connector.

Replacing Bulkhead Connectors – Install Connector

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Install Connector

- Check *one last time* for any foreign matter that may get caught under the O-ring.
- Feed the wires through and install the connector vertically; this will allow the Loctite® to *wick up* the length of the threads as it is screwed in.
- *Finger* tighten the connector.




The image shows a person's hands installing a connector. One hand holds a cylindrical metal connector with two wires attached. The other hand holds a metal plate with a hole. The connector is being pushed into the hole. The background is blue.

Replacing Bulkhead Connectors – Too Much LocTite!

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Incorrect use of LocTite®

- Excess LocTite® on the connector shank will cause the LocTite® to overflow the threaded hole of the end cap, allowing it to contact the O-ring.
 - Contact with the O-ring may cause damage to or *bridge* the O-ring and allow the instrument to flood.



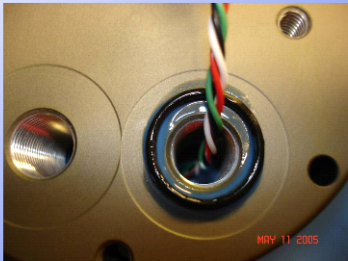
WRONG!

Replacing Bulkhead Connectors – Too Much LocTite!

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Excessive Use of LocTite®

- **No** LocTite® should overflow the threaded hole. If this occurs:
 - Remove the connector,
 - Clean the connector and spot-face,
 - Replace the O-ring and re-install.
- LocTite® that reaches the *spot-face* may bridge the O-ring, causing the instrument to flood.




Example of
EXCESS LocTite®

Replacing Bulkhead Connectors – Final Tightening

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Final Connector Tightening

- Use a socket installed on a Torque Wrench (if available) for final tightening of the connector.



- If you do not have access to a torque wrench in the correct range, tighten the connector a little past *snug*.
- Do not over-tighten, as damage to the connector may occur.
- Allow the LocTite[®] to cure for 12 to 24 hours.

Replacing Bulkhead Connectors – Torque Specifications



Torque Specifications

Connector	Torque
2-pin Impulse	18 in-lbs
3-pin Impulse	18 in-lbs
4-pin Impulse	18 in-lbs
6-pin Impulse	15 in-lbs
MCBH (all)	100 in-lbs or 8 ft-lbs

Impulse connectors are our *standard* connectors. MCBH connectors are wet-pluggable connectors, and are optional on all of our instruments.