

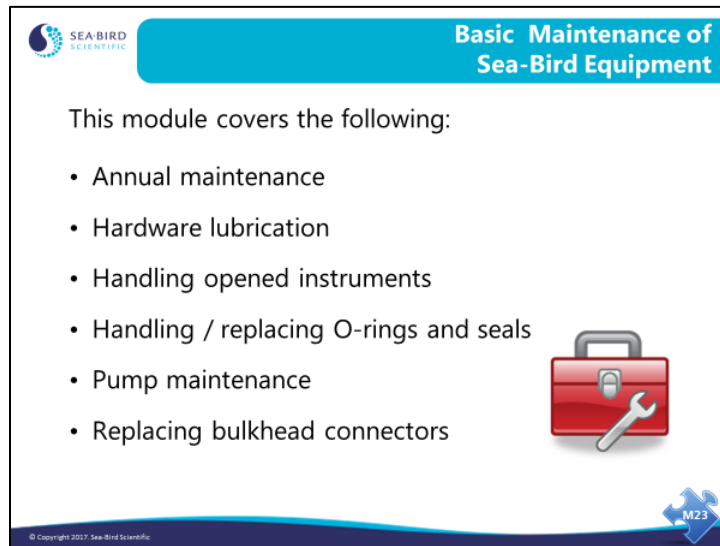


Maintenance

Sea-Bird Scientific University Module 23



Overview



The slide features a blue header with the Sea-Bird Scientific logo on the left and the title 'Basic Maintenance of Sea-Bird Equipment' on the right. Below the header, the text 'This module covers the following:' is followed by a bulleted list of six maintenance tasks. To the right of the list is a red toolbox icon with a silver wrench. At the bottom right of the slide is a blue icon with the number 'M23' and four arrows pointing outwards. The bottom left corner contains the copyright notice '© Copyright 2017, Sea-Bird Scientific'.

SEA-BIRD
SCIENTIFIC

Basic Maintenance of Sea-Bird Equipment

This module covers the following:

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

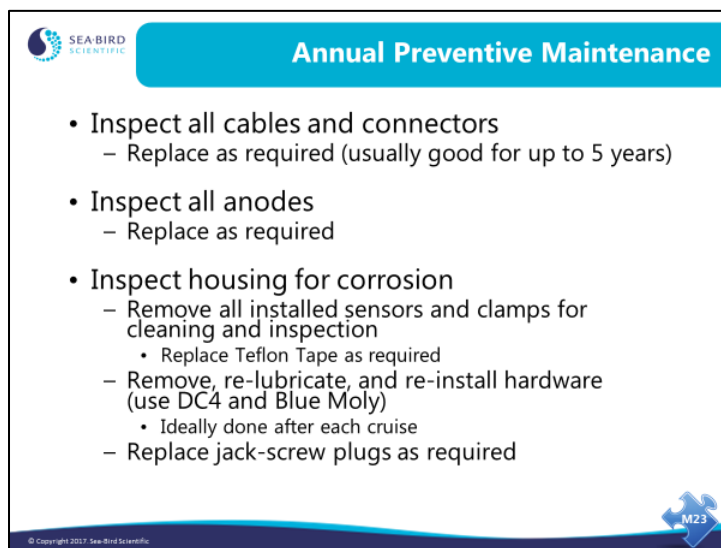
© Copyright 2017, Sea-Bird Scientific

M23

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



The slide features the Sea-Bird Scientific logo in the top left corner. A blue header bar at the top contains the title "Annual Preventive Maintenance". The main content is a bulleted list of maintenance tasks. In the bottom right corner, there is a blue diamond icon with the number "M23" inside. The footer contains the copyright text "© Copyright 2017, Sea-Bird Scientific".

- Inspect all cables and connectors
 - Replace as required (usually good for up to 5 years)
- Inspect all anodes
 - Replace as required
- Inspect housing for corrosion
 - Remove all installed sensors and clamps for cleaning and inspection
 - Replace Teflon Tape as required
 - Remove, re-lubricate, and re-install 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 screw hole to fill *blind* end of hole
 - This prevents sea water from filling space and causing hardware and housing corrosion
 - It also prevents growth of salt crystals, which can cause stuck hardware
- Coat screw with Blue Moly to prevent corrosion and prevent binding of hardware
- Wipe up any excess from the instrument
- These coatings dissipate with use, and require periodic replacement

© Copyright 2017, Sea-Bird Scientific



- 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 (*continued*)




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 ground strap screw and anodes:
 - DC4 -- No Blue Moly -- Yes

© Copyright 2017, Sea-Bird Scientific




Electrostatic Discharge Precautions




Handling *Opened* Instruments

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

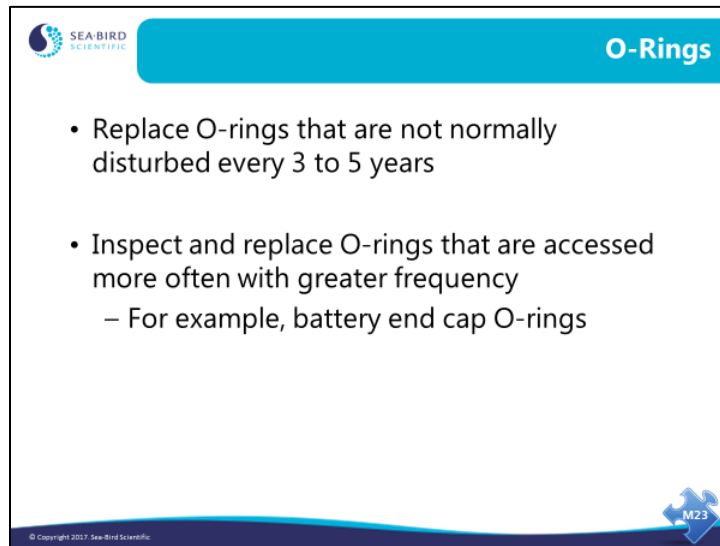


© Copyright 2017, Sea-Bird Scientific



- 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 and Seals



SEA-BIRD
SCIENTIFIC

O-Rings

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

© Copyright 2017, Sea-Bird Scientific

M23

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

O-Rings and Seals (*continued*)

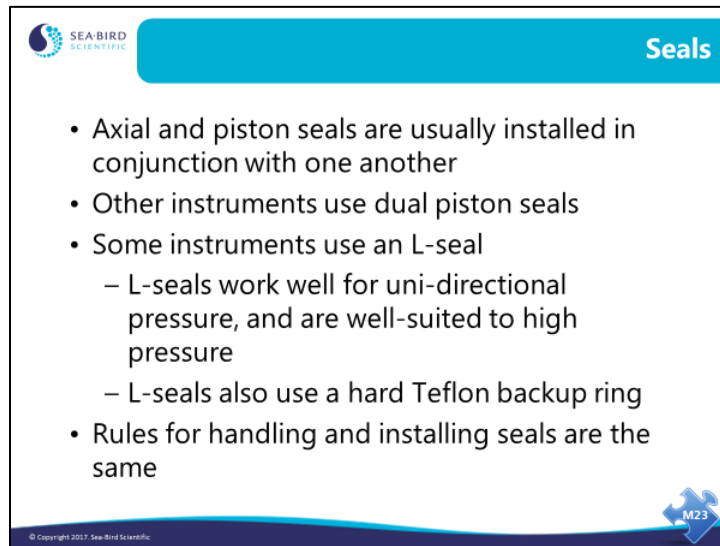
The diagram illustrates three types of seals used by Sea-Bird. The top left shows an axial seal with labels for 'RADIAL CLEARANCE', 'GLAND DEPTH', and 'GROOVE WIDTH'. The top right shows a radial seal with labels for 'GROOVE WIDTH' and 'GROOVE DEPTH'. The bottom left shows a combined axial and radial seal with labels for 'AXIAL SEAL' and 'RADIAL SEAL'. Below these are dimension lines for 'ID' (Inner Diameter) and 'CS' (Cross Section). The diagram is titled 'Types of O-Ring Seals used by Sea-Bird' and includes the Sea-Bird Scientific logo.

- 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.

O-Rings and Seals (*continued*)



SEA-BIRD SCIENTIFIC **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
- Rules for handling and installing seals are the same

© Copyright 2017, Sea-Bird Scientific

M23

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


O-Rings and Seals – Opening Instruments



Open Instrument

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

© Copyright 2017, Sea-Bird Scientific




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




Cleaning O-Ring Surfaces

- Use Kimwipes or 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



© Copyright 2017, Sea-Bird Scientific



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

O-Rings and Seals – Inspecting



SEA-BIRD SCIENTIFIC

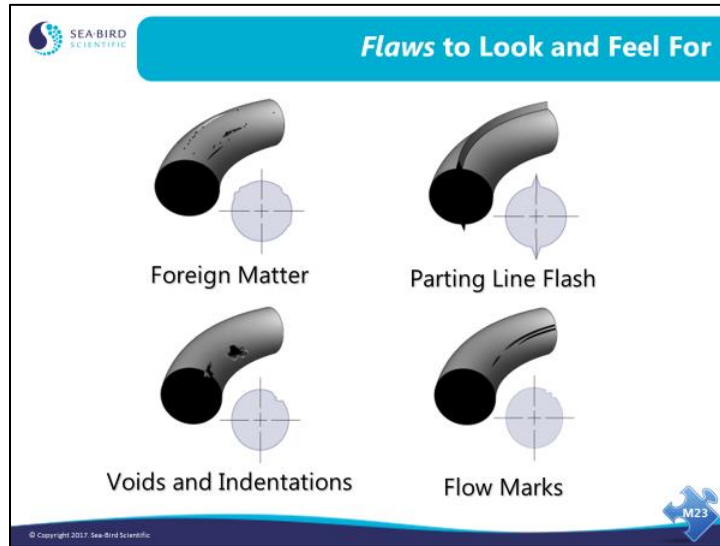
Inspect New Seal

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

© Copyright 2017, Sea-Bird Scientific


M23

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**

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



© Copyright 2017, Sea-Bird Scientific 

Do not use Parker O-Lube, which is petroleum based; use only Parker *Super* O-Lube.

O-Rings and Seals – Lubrication (*continued*)



Applying Lubricant


- Apply a **thin** continuous film of lubricant over entire O-ring surface by *running* it through your fingers, checking one last time for flaws
- Install O-ring in 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 – Lubrication (*continued*)




Lubricate Housing

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



Again, excessive lubricant is worse than too little!

© Copyright 2017, Sea-Bird Scientific



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

O-Rings and Seals – Closing Instruments

**SEA-BIRD
SCIENTIFIC**

Closing Instrument

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

© Copyright 2017, Sea-Bird Scientific

M23

See Application Note 71: Desiccant Use and Regeneration
(www.seabird.com/document/an71-desiccant-use-and-regeneration-drying)
on our website.

Pump Maintenance

SEA-BIRD SCIENTIFIC

Pump Maintenance

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


© Copyright 2017, Sea-Bird Scientific

M23

On our website, see –


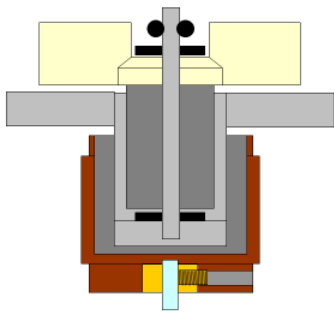
- Training video (www.seabird.com/sbe-5t-pump-maintenance)
- *Application Note 75: Maintenance of SBE 5T, 5P, and 5M Pumps* (www.seabird.com/document/an75-maintenance-sbe-5t-5p-and-5m-pumps).

Pump Maintenance (*continued*)



Pump Impeller

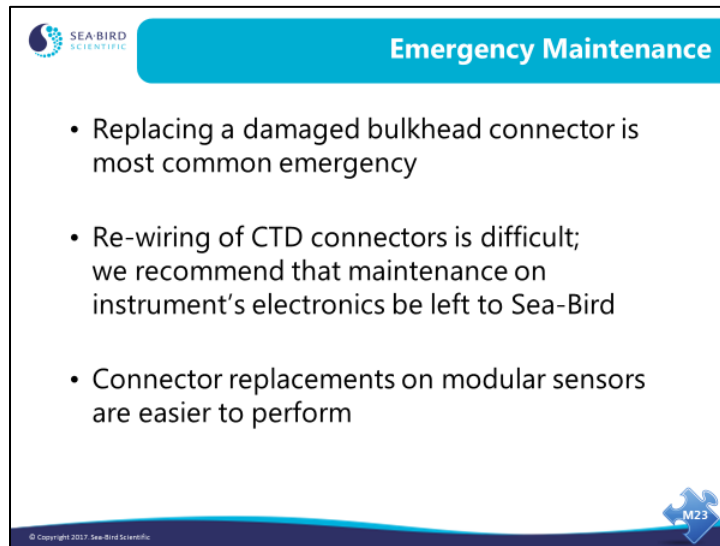
- Periodically inspect impeller thrust washers and pump impeller housing
- Replace thrust washers and impeller retaining O-ring annually or as required
 - Kits available from Sea-Bird



© Copyright 2017, Sea-Bird Scientific

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.

Replacing Bulkhead Connectors

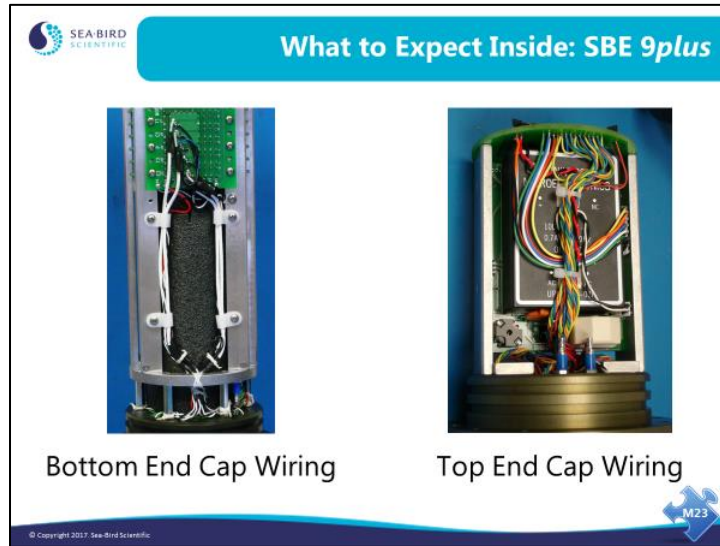


The slide features the Sea-Bird Scientific logo in the top left corner. A blue header bar at the top right contains the text 'Emergency Maintenance'. The main content area contains three bullet points. In the bottom right corner, there is a blue diamond-shaped icon with the number 'M23' inside. The bottom left corner contains a small copyright notice: '© Copyright 2017, Sea-Bird Scientific'.

- Replacing a damaged bulkhead connector is most common emergency
- Re-wiring of CTD connectors is difficult; we recommend that maintenance on instrument's electronics be left to Sea-Bird
- 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



If you Decide to Replace a Connector

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

© Copyright 2017, Sea-Bird Scientific



- 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 (*continued*)



Connector Installation

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




© Copyright 2017, Sea-Bird Scientific




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 (*continued*)



Install Connector O-Ring

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



Connector with O-Ring

© Copyright 2017, Sea-Bird Scientific

M23


Remember: Only very light lubrication is required!

Replacing Bulkhead Connectors (*continued*)





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

Replacing Bulkhead Connectors (*continued*)




Install Connector

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




© Copyright 2017, Sea-Bird Scientific


Replacing Bulkhead Connectors (*continued*)

 **Incorrect use of Loctite®**

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




WRONG!



© Copyright 2017, Sea-Bird Scientific


Replacing Bulkhead Connectors (*continued*)



Excessive Use of Loctite®


- **No** Loctite® should overflow threaded hole.
If this occurs:
 1. Remove connector,
 2. Clean connector and spot-face,
 3. Replace O-ring and re-install

- Loctite® that reaches *spot-face* may bridge the O-ring, causing instrument to flood



M09-11-2005

Example of
EXCESS Loctite®



© Copyright 2017, Sea-Bird Scientific

Replacing Bulkhead Connectors (*continued*)

 **Final Connector Tightening**

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

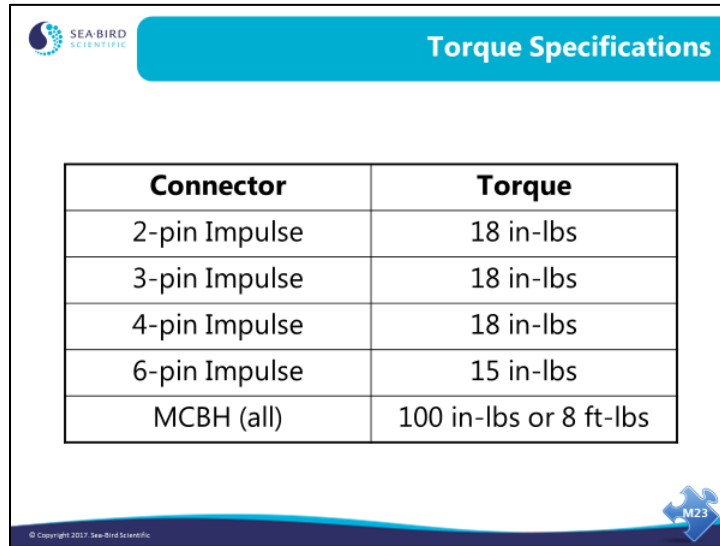


© Copyright 2017, Sea-Bird Scientific

M23

- 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 (*continued*)



The image shows a slide titled "Torque Specifications" from Sea-Bird Scientific. It contains a table with two columns: "Connector" and "Torque". The table lists torque values for various connector types: 2-pin Impulse (18 in-lbs), 3-pin Impulse (18 in-lbs), 4-pin Impulse (18 in-lbs), 6-pin Impulse (15 in-lbs), and MCBH (all) (100 in-lbs or 8 ft-lbs). The slide also features the Sea-Bird Scientific logo, a copyright notice for 2017, and a blue arrow icon labeled "M23".

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.

