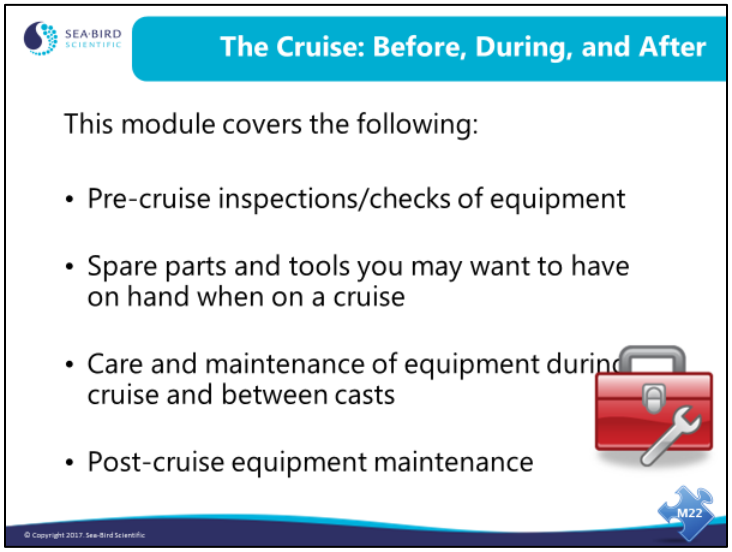
The Cruise: Before, During, and After

Sea-Bird Scientific University Module 22

Overview


SEA-BIRD SCIENTIFIC
The Cruise: Before, During, and After
This module covers the following:
• Pre-cruise inspections/checks of equipment
• Spare parts and tools you may want to have on hand when on a cruise
• Care and maintenance of equipment during cruise and between casts
• Post-cruise equipment maintenance
M22
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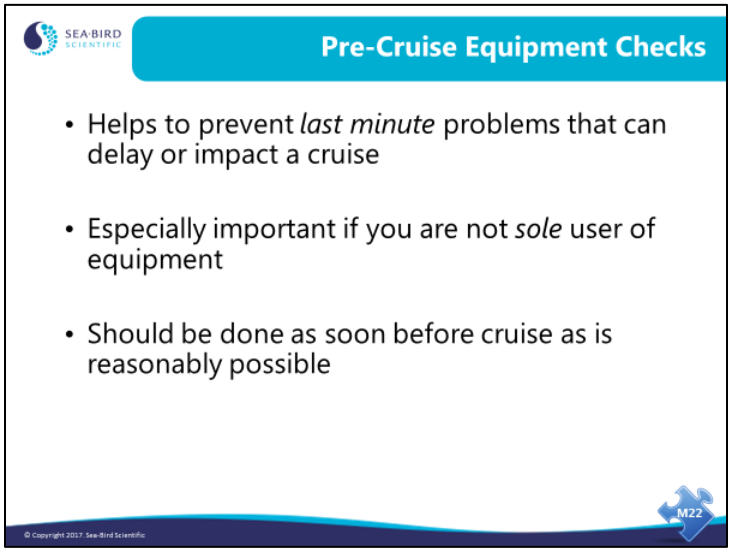
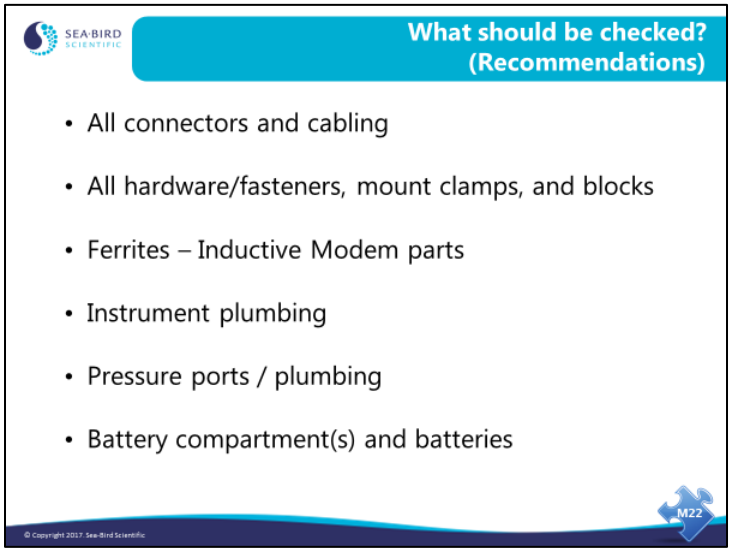
Pre-Cruise Equipment Checks



Pre-Cruise Equipment Checks

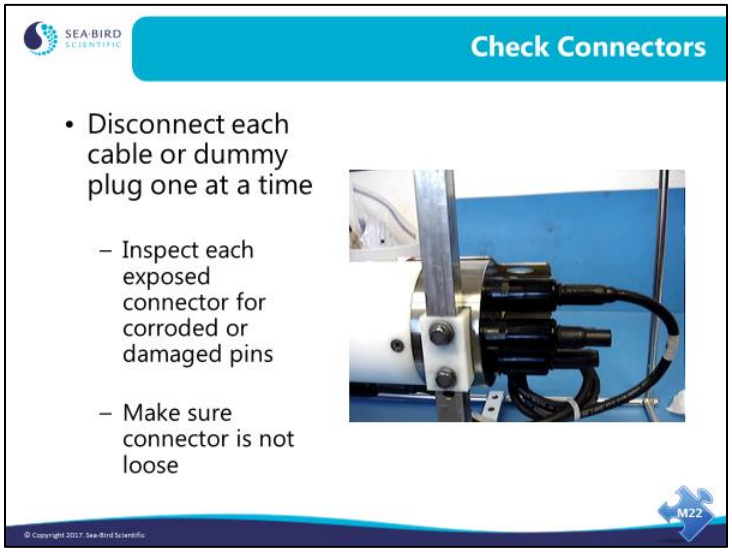


We'll discuss these in more detail in the next few slides.

These checks are directed mostly toward equipment that is typically only used a few times a year.

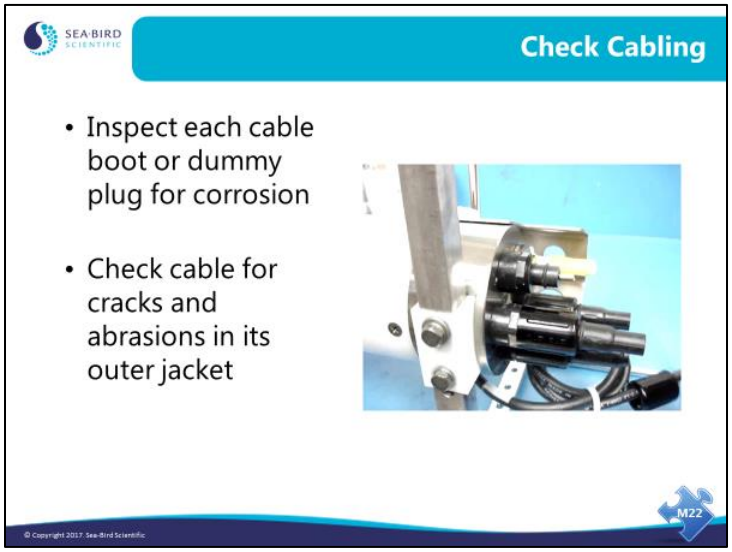
Equipment that is used in regular weekly/monthly sampling may not need to be checked as thoroughly before each use.

Pre-Cruise Equipment Checks -- Connectors



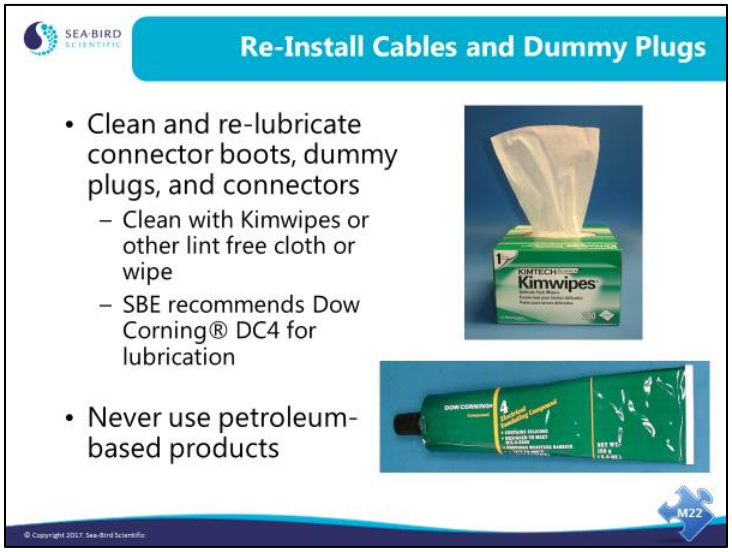
Application Note 57: Connector Care and Cable Installation on our website is a good resource for connector cleaning and installation, and also provides cold weather installation tips.

Pre-Cruise Equipment Checks – Cables and Dummy Plugs



Cables can be damaged by chaffing, extreme bends, or contact with the ship deck or hull (pinching).

Pre-Cruise Equipment Checks – Cables and Dummy Plugs *(continued)*

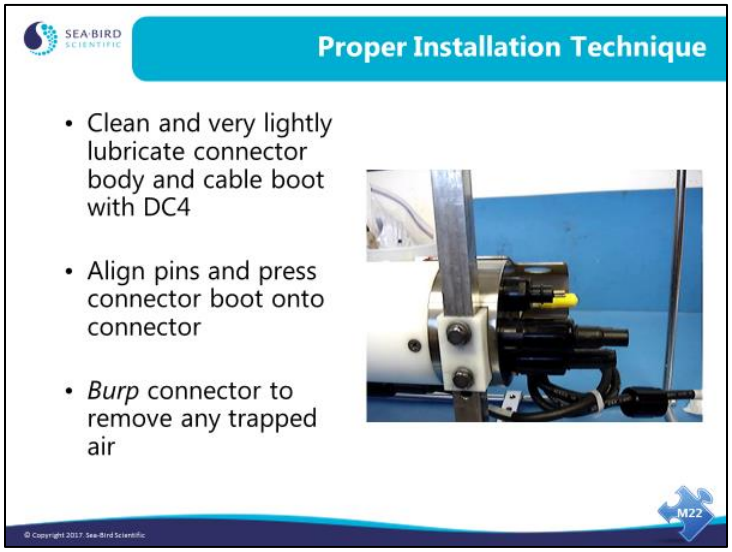


Do not use WD-40 or other petroleum-based lubricants; petroleum-based lubricants will damage connectors.

Dow Corning® DC-4 is a silicone-based electrical insulating compound.

Other lubricants may have a tendency to *ball* when cold.

Pre-Cruise Equipment Checks – Cables and Dummy Plugs *(continued)*



Align the dimple on the connector boot with the large pin on the connector.

Remember to *burp* the connector(s) after installation.

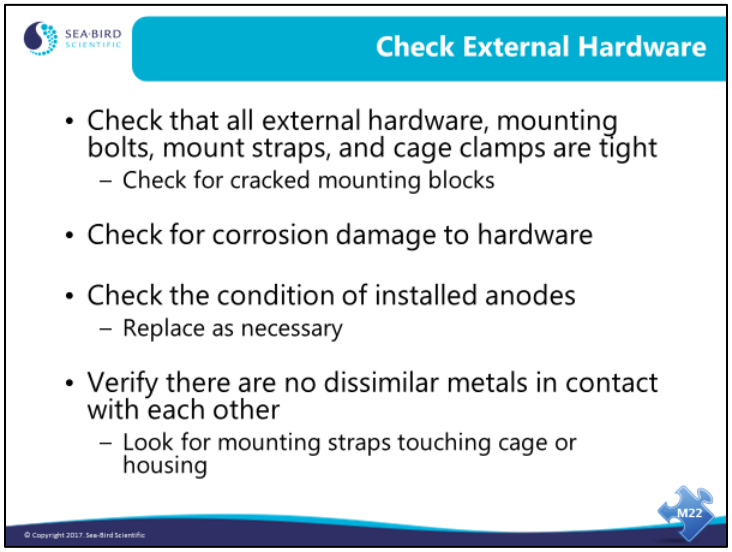
In cold weather, a connector may be hard to install and remove.

When possible, mate connectors in warm environments before the cruise and leave them connected. If not, warm the connector sufficiently so it is flexible.

To remove a frozen connector:

1. Wrap the connector with a washrag or other cloth.
2. Pour hot water on the cloth and let the connector sit for a minute or two. The connector should thaw and become flexible enough to be removed.

Pre-Cruise Equipment Checks – External Hardware

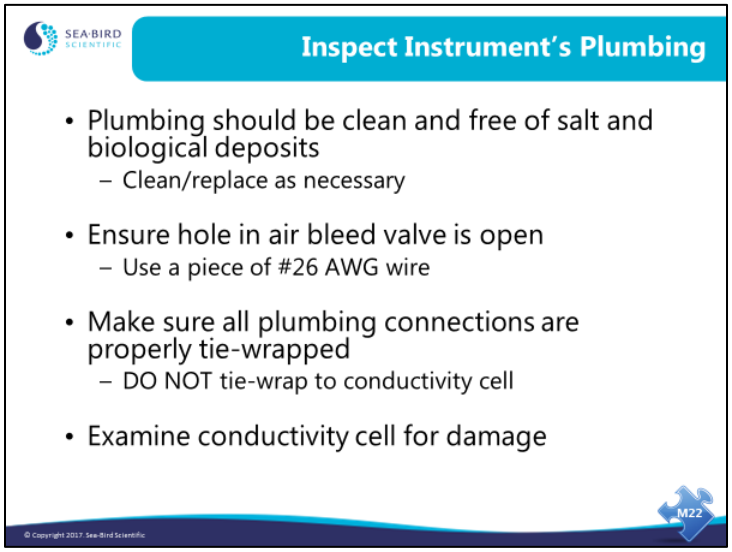


Excess corrosion on anodes can negate their effectiveness.

Rapid loss of anode material can be an indication of grounding problems.

Always install Teflon insulating tape on mounting straps. Pay particular attention to the buckle on the mounting strap.

Pre-Cruise Equipment Checks – Plumbing



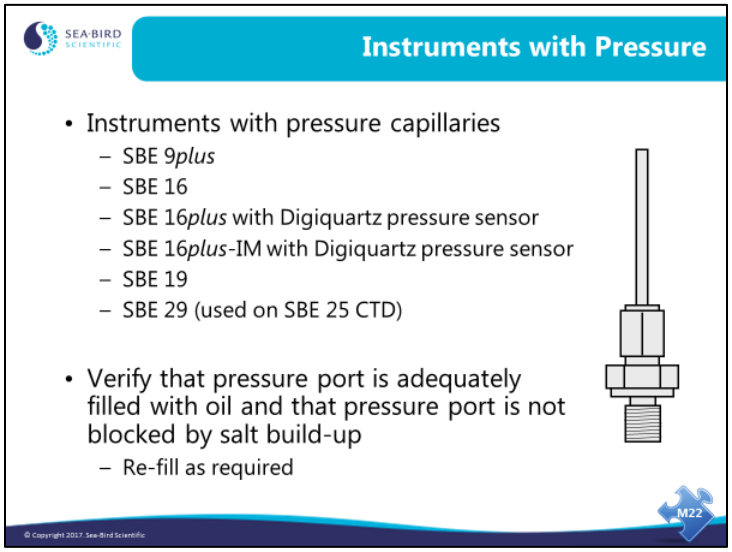
Contaminated plumbing may degrade the initial data.

New instruments include several pieces of wire for clearing the air bleed hole.

Conductivity cells are glass and can be damaged by impact or mishandling.

- Cells with chipped **ends** are usually OK to use.
- Larger cracks or breaks in the cell will cause bad data and may allow the instrument to flood.

Pre-Cruise Equipment Checks – Pressure Capillary

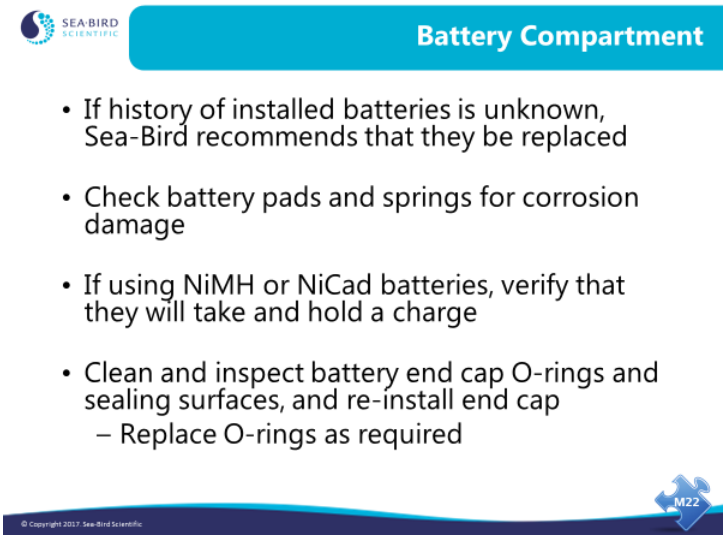


Sea-Bird can provide a pressure sensor oil refill kit, PN 50025, for these instruments. *Application Note 12-1: Pressure Port Oil Refill Procedure & Nylon Capillary Fitting Replacement* provides the details on use of the kit.

Note: Instruments with Druck strain gauge pressure use a pressure port plug instead of a pressure capillary; oil filling is not required. These instruments include: SBE 16*plus*, 16*plus*-IM, 16*plus* V2, 16*plus*-IM V2 with strain gauge pressure sensor; 19*plus* and 19*plus* V2, 25*plus*, 37, 39, 49, and 52-MP.

The SBE 26, 26*plus*, 53, and 54 have a pressure capillary connected to a bladder bag, which is filled with silicone oil at the factory. See the applicable user manual for details.

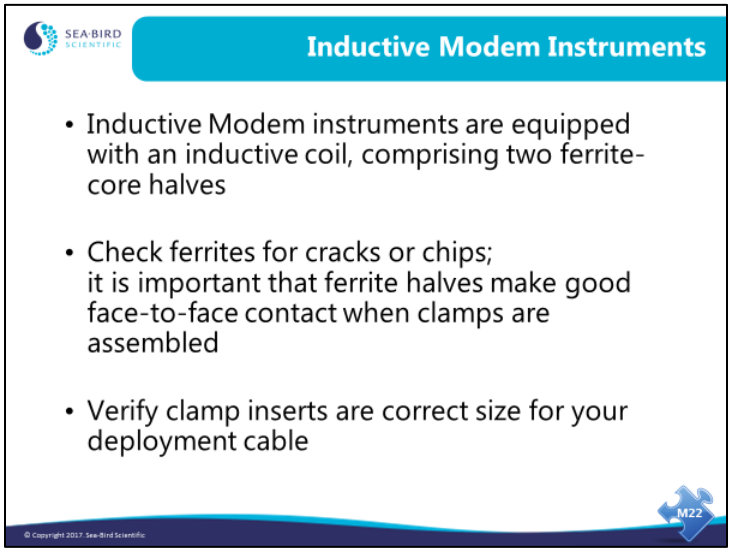
Pre-Cruise Equipment Checks – Batteries



Batteries may have a *good* voltage reading when not under load.

Always make sure that the battery end cap and the cage above the battery end cap are completely dry before opening the battery end cap. This will prevent water from dripping into the battery compartment.

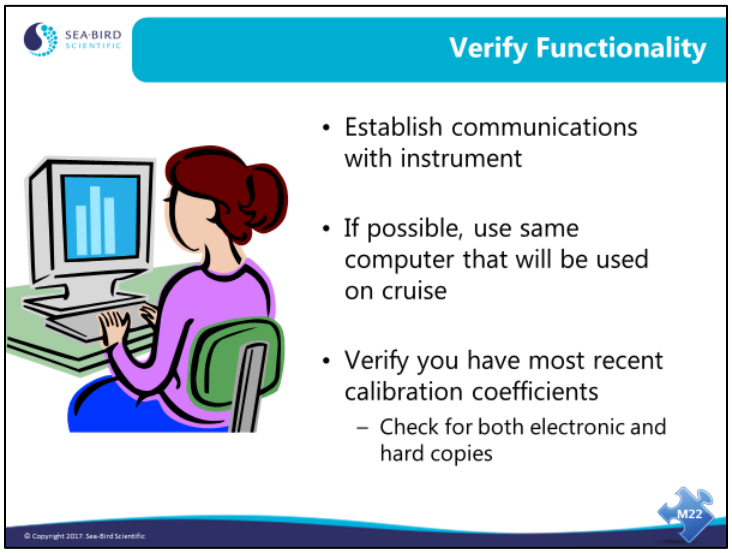
Pre-Cruise Equipment Checks – Inductive Instruments



Proper communications with an IM instrument requires that the ferrites are not damaged, and that the two modem halves mate closely (< 0.1 mm gap). Note that if the clamp inserts are too small for the cable, there will be a gap between the modem halves. An attempt to reduce the gap may damage the cable or modem if the bolts are over-tightened.

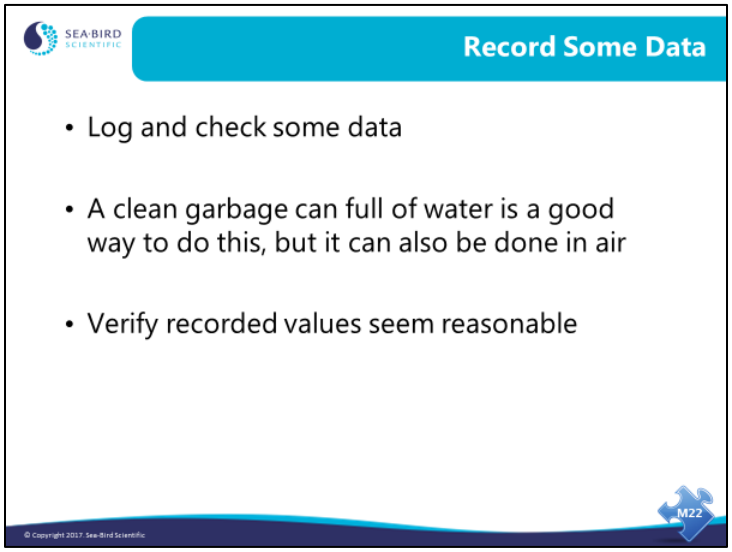
Application Note 85: Handling of Ferrite Core on Instruments with Inductive Modem Telemetry provides details.

Pre-Cruise Equipment Checks – Verify Functionality



As applicable, capture and save responses to status commands (**DS** – display status, **DC** – display calibration coefficients, etc.). This will help to verify the instrument setup if troubleshooting is required later.

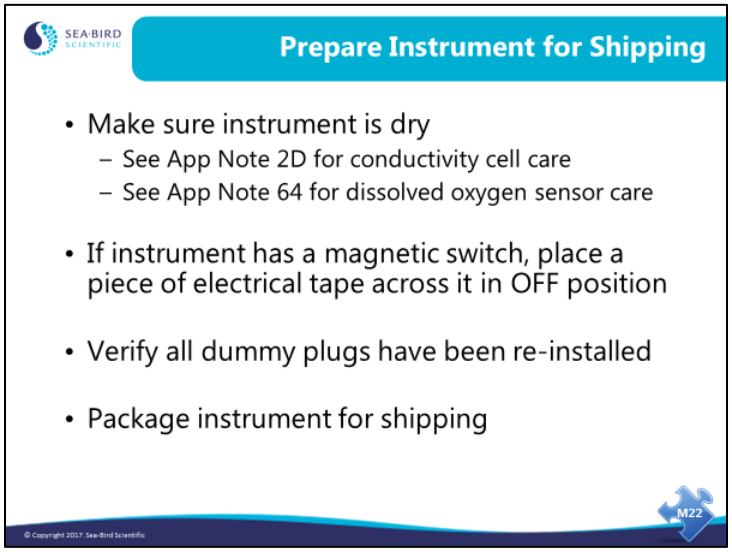
Pre-Cruise Equipment Checks – Verify Functionality *(continued)*



As mentioned on the last slide for the status commands, saving this data will help to verify the instrument was functioning properly before the deployment if troubleshooting is required later.

If the testing is performed in air, put a few drops of water in the pump head to lubricate the pump impeller.

Shipping Precautions



If shipping by air:

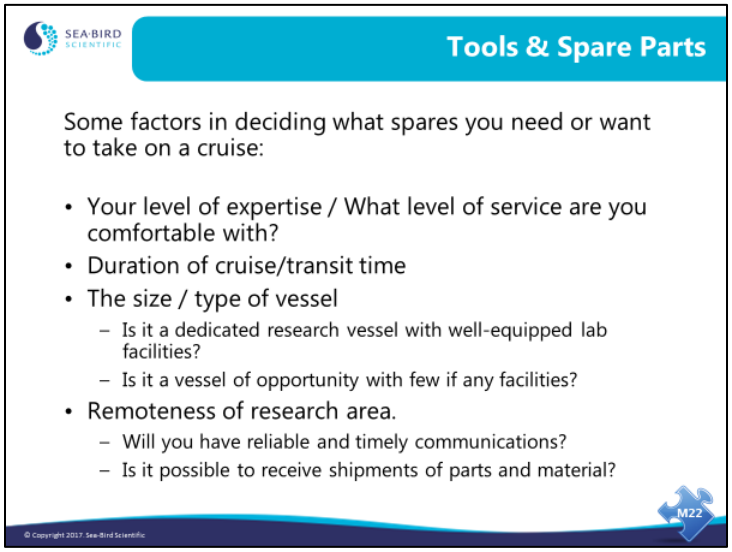
- Lithium batteries cannot be shipped installed in MicroCATs or SBE 44s.
- D-cell lithium batteries cannot be shipped installed in the instrument.
- NiMH battery packs cannot be shipping installed in the instrument.

We'll cover this in more detail in Module 18.

Taping the magnetic switch will prevent the instrument from being turned on accidentally during transit.

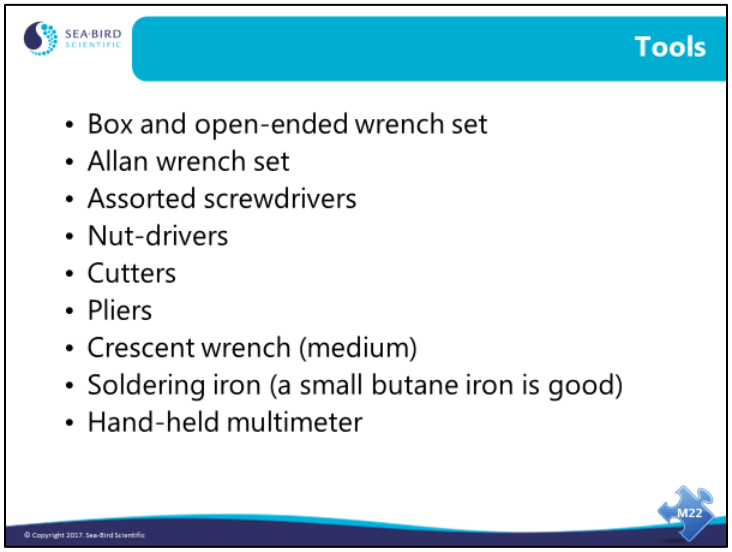
If spare parts are being shipped in the crate, make sure they are adequately secured.

Tools and Spare Parts



Some spares are not practical as their use requires recalibration of the instrument (for example, spare conductivity cells and spare temperature probes).

Tools and Spare Parts *(continued)*

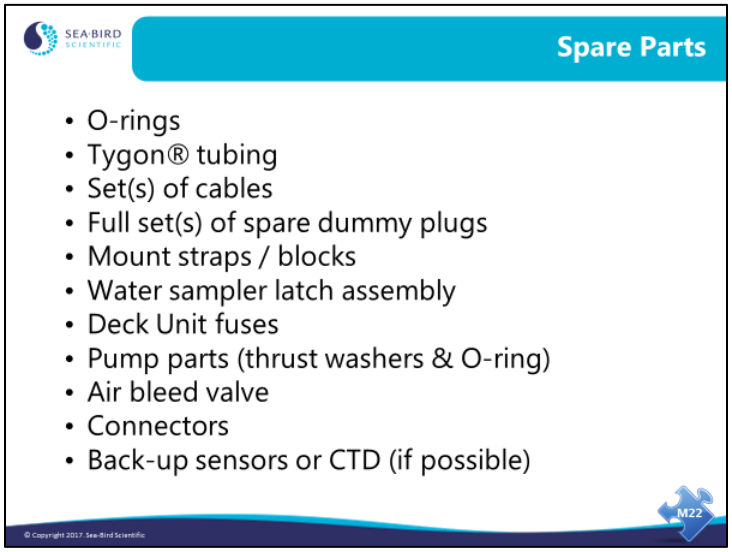


If weight is a factor, create a custom tool box with only tools that fit the hardware installed on your instrument.

A crescent wrench is useful for opening the battery end cap.

The Multimeter can be a valuable diagnostic tool.

Tools and Spare Parts *(continued)*

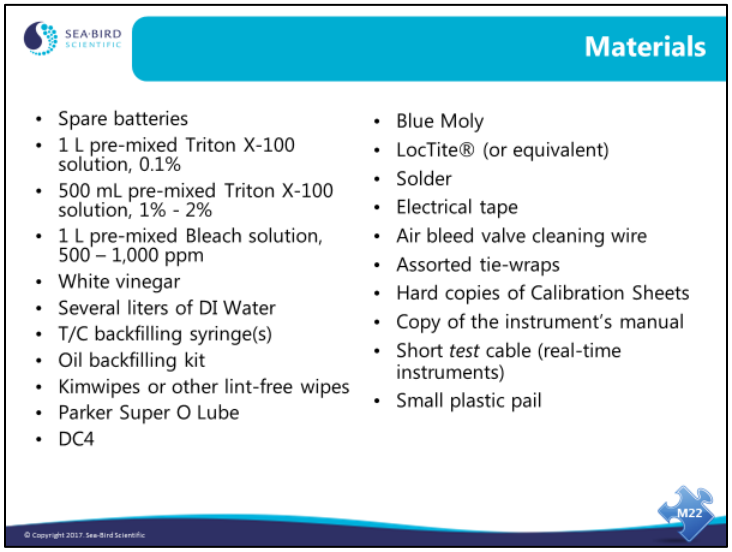


When it comes to spares, having more is usually better!

Work within your comfort zone when deciding what you need as spares.

The best *Spare* is a backup system.

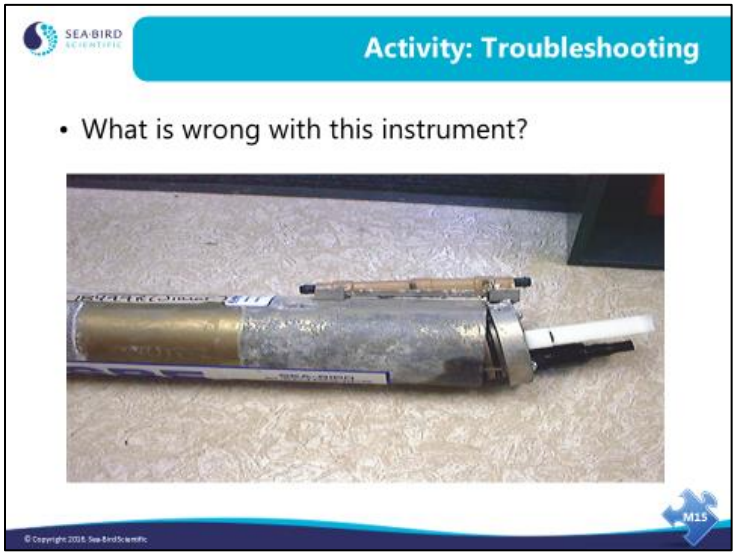
Tools and Spare Parts *(continued)*



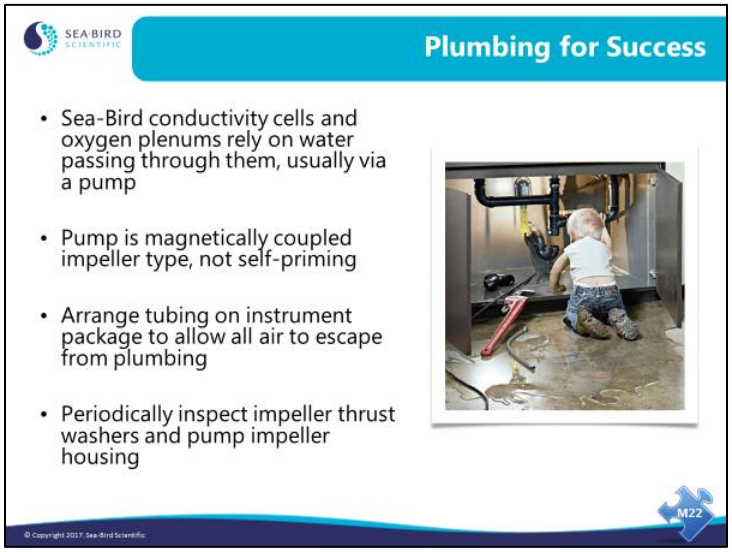
Having pre-mixed solutions is a timesaver.

Use bottled DI water for flushing cells and sensors. The ship's fresh water supplies may contain trace contaminants.

Activity: Troubleshooting



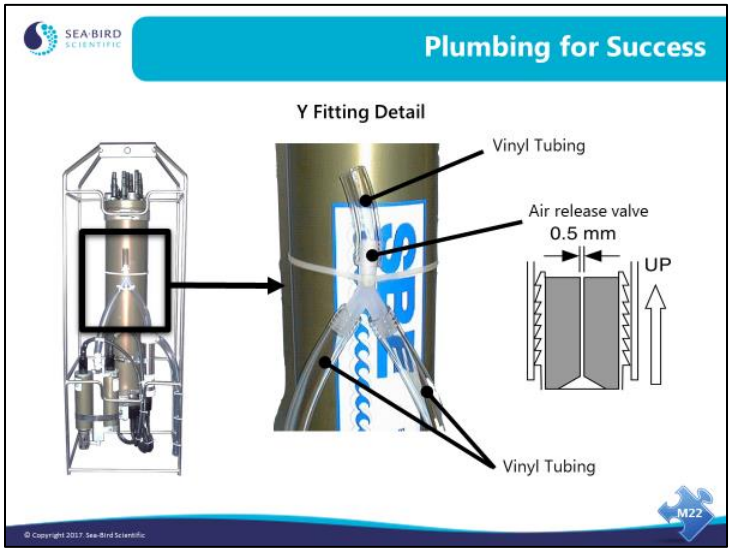
Deployment: Instrument Plumbing



Sea-Bird CTDs use a pump to maintain a constant flow of water through the conductivity cell and past the oxygen electrode. While this technique complicates the instrument package, it pays off in data quality. The tubing that connects the pump and the sensors must be arranged to allow all the air that is in the system while it is on deck to escape quickly when it is submerged. Failure to allow a path for the air to escape causes problems in the first 10 meters of data collection. Beyond 10 meters, the bubbles usually collapse sufficiently for the system to operate correctly. If bubbles collect in the pump, it will fail to prime. If bubbles are caught in the conductivity cell, the pump will fail to turn on. If bubbles are caught in the dissolved oxygen plenum, the dissolved oxygen signal will be in error.

Note: For additional information on self-priming vs non-self-priming pumps, see www.pumpstoreusa.com/knowledgebase/selfpriming

Deployment: Instrument Plumbing *(continued)*

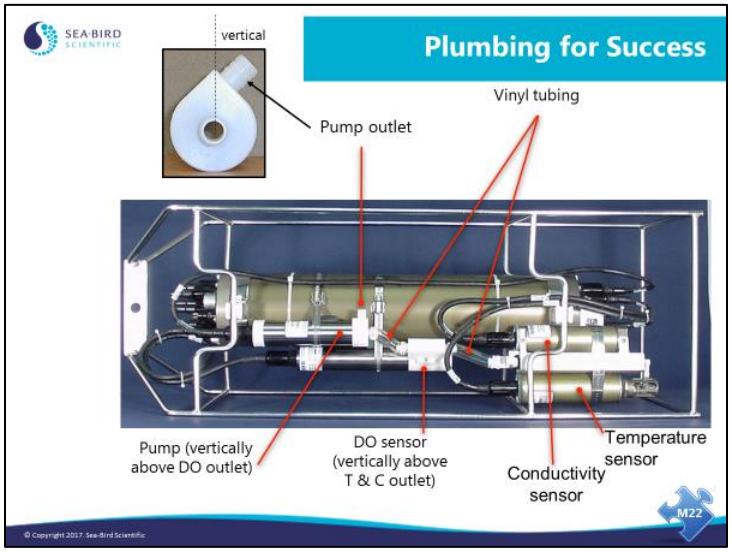


This slide shows the proper way to run the tubing for an instrument in a cage meant to be deployed vertically. Note the highest point in the plumbing is the top of the *Y*; there is a fitting with a small hole in the top of the *Y* that allows the air in the tubing to vent as the instrument goes into the water.

For the SBE 9*plus*, an exhaust tube runs from the pump outlet down the side of the cage, stopping at the same height as the T-C duct inlet. This equalizes pressure at the plumbing inlet and outlet, eliminating any acceleration / deceleration of water in the plumbing (which can cause small errors in the measurements). The exhaust tube is usually omitted for the SBE 19 and 25 families of instruments, due to the lower accuracy of those systems.

Periodically clean the air release valve with a 0.4 mm diameter wire (you can use #26 AWG wire), and blow through it to ensure it is open. A clogged air release valve can trap air, preventing the pump from functioning properly; this will affect the data quality.

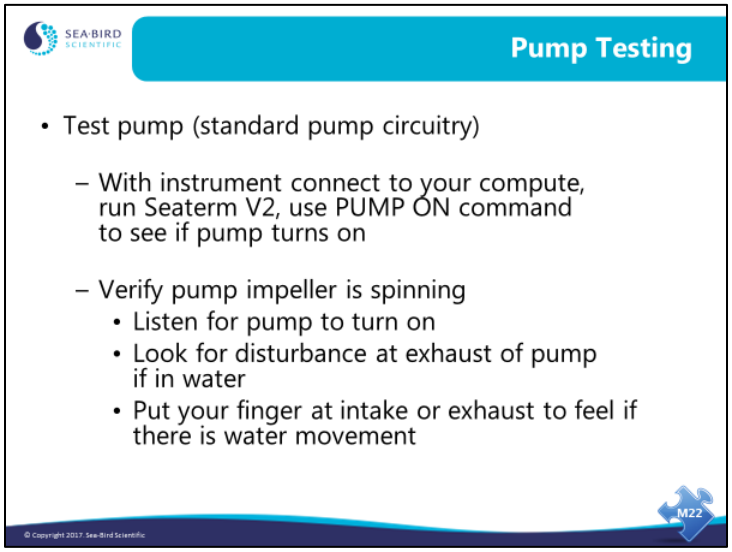
Deployment: Instrument Plumbing (*continued*)



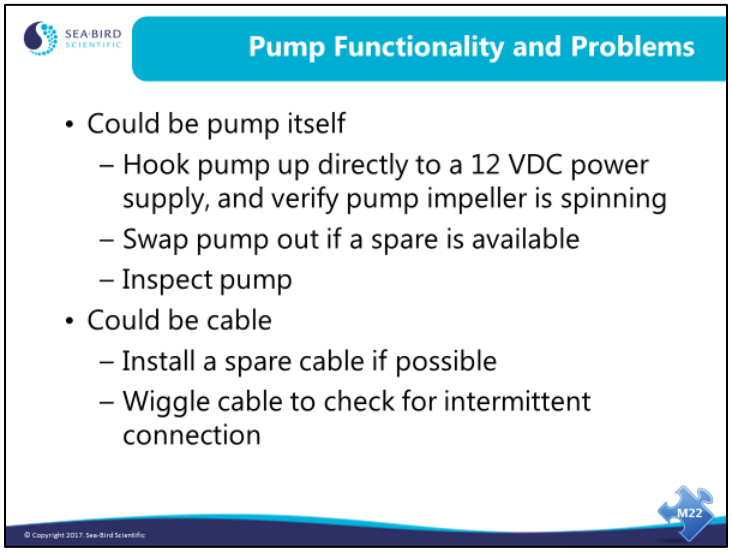
Instruments meant for horizontal deployment are easier to plumb. The pump is oriented so that the outlet is the highest point on the plumbing. Care must be taken to ensure there are no loops in the plumbing that would trap air. Because this system is meant to be deployed horizontally, there is no *sloshing* effect and no requirement for the SBE 9*plus* that the inlet and outlet be at the same height.

Application Note 64-1: Plumbing Installation – SBE 43 DO Sensor and Pump on a CTD on the website provides more details on both the vertical and horizontal plumbing schemes.

Deployment: Pump Operation

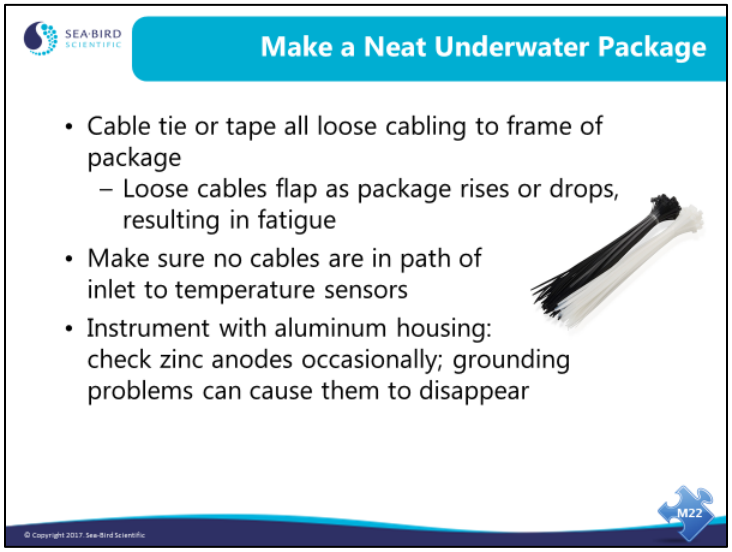


Deployment: Pump Operation *(continued)*



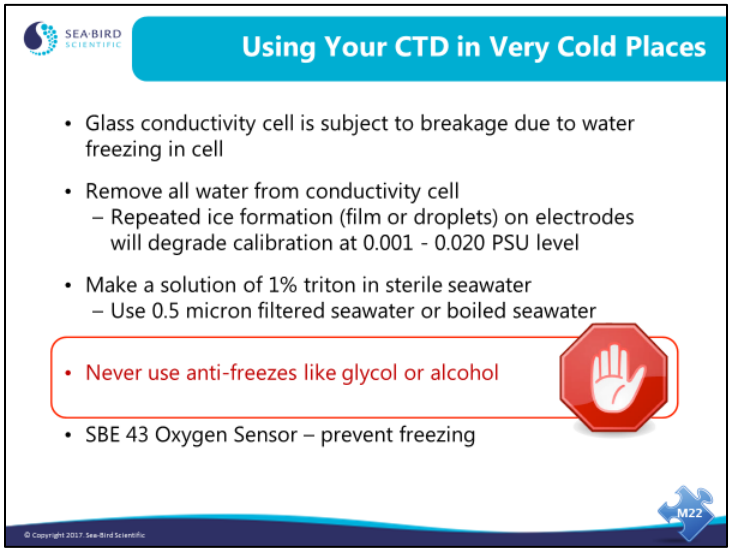
Neatness counts! Secure all your loose cables. When you lower your instrument package at 1 meter per second, any loose cabling will flap. This sort of repetitive motion will fatigue the cables and shorten their working life.

Deployment: Failed Underwater Connections…Be Neat!



Neatness counts! Secure all your loose cables. When you lower your instrument package at 1 meter per second, any loose cabling will flap. This sort of repetitive motion will fatigue the cables and shorten their working life.

Deployment: Using your CTD in Very Cold Places



Never store water in the conductivity cells or plumbing if there is a risk of freezing.

Another option in place of a Triton solution for the conductivity cell is the use of a brine solution (distilled seawater or homemade salt solution that is higher than 35 psu in salinity), as salty water depresses the freezing point. However, there is still a risk of forming ice inside the conductivity cell if deploying through frazil ice on the surface, if the freezing point of the salt water is the same as the water temperature.

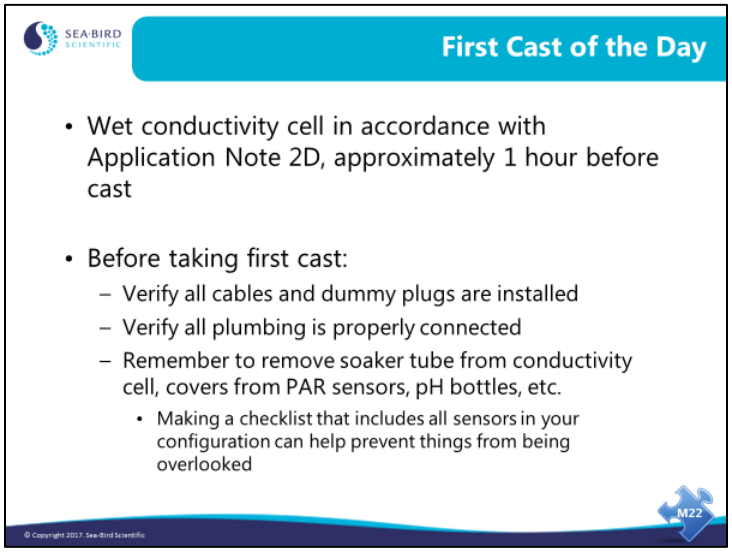
- If no surface frazil ice is present, rinse the conductivity cell in the 1% Triton solution or in a brine solution to prevent freezing during deployment. But this does not mean you can store the cell in this solution outside…it will freeze!
- If surface frazil ice is present, it is best to deploy the conductivity cell in a dry state.

Commercially available alcohol or glycol antifreezes contain trace amounts of oils that will coat the conductivity cell and the electrodes, causing a calibration shift, and consequently result in errors in the data. **Do not use alcohol or glycol in the conductivity cell!**

For the SBE 43 Dissolved Oxygen Sensor, avoid prolonged exposure to freezing temperatures, including during shipment. Do not store the SBE 43 with water, Triton

solution, alcohol, or glycol in the plenum. The best precaution is to keep the SBE 43 indoors or in some shelter out of the cold weather.

Deployment: Final Preparation

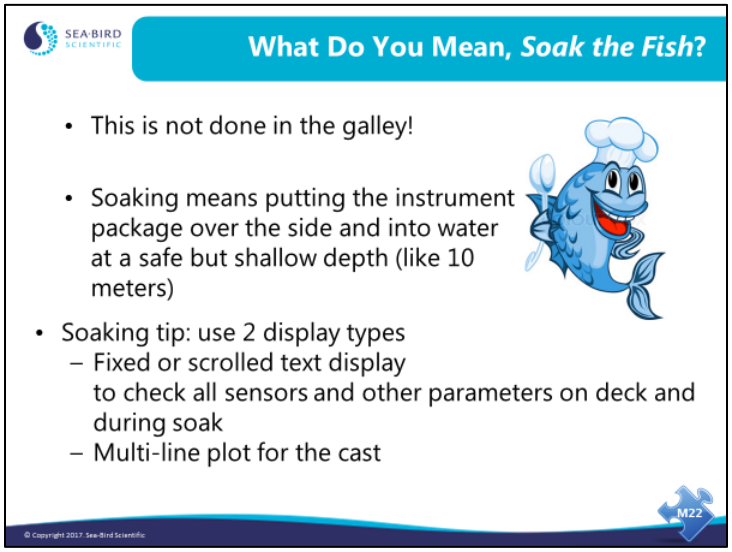


Use a 0.1% Triton X-100 solution to rewet the conductivity cell.

Soaker tubes and par covers inadvertently left in place can cause severe damage.

A check list is especially helpful if personnel unfamiliar with the system are assisting (Students, Grad Students, Ship's Tech, etc.).

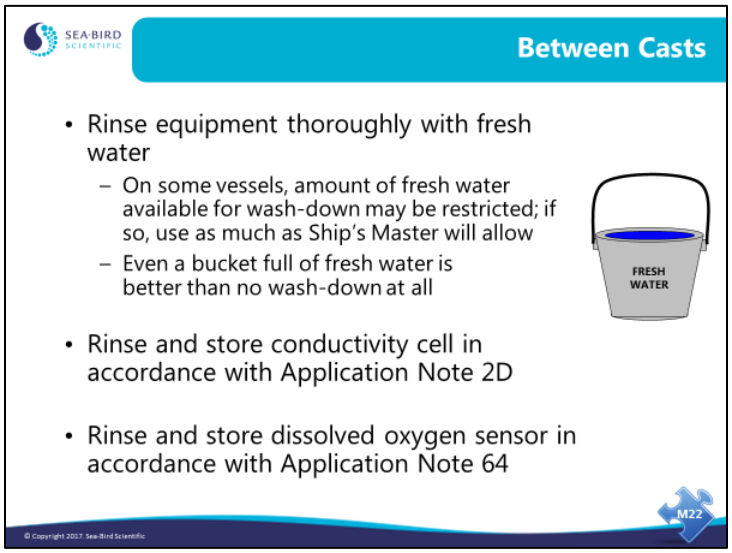
Deployment: Final Preparation *(continued)*



As you prepare to take a cast, it is considered good practice to place the instrument package in the water and allow it to equilibrate. This allows several good things to happen. The whole package comes to the surface temperature rather than the air temperature on deck, the conductivity cell wets with seawater, and the oxygen sensor comes to surface temperature (and in the case of older sensors, the oxygen sensor polarizes). Further, if you are working in real-time, you can quickly confirm the operation of the instrument and all the sensors. This is a great idea because nothing irritates the deck crew more than starting the cast only to bring the instrument package back aboard a few minutes later.

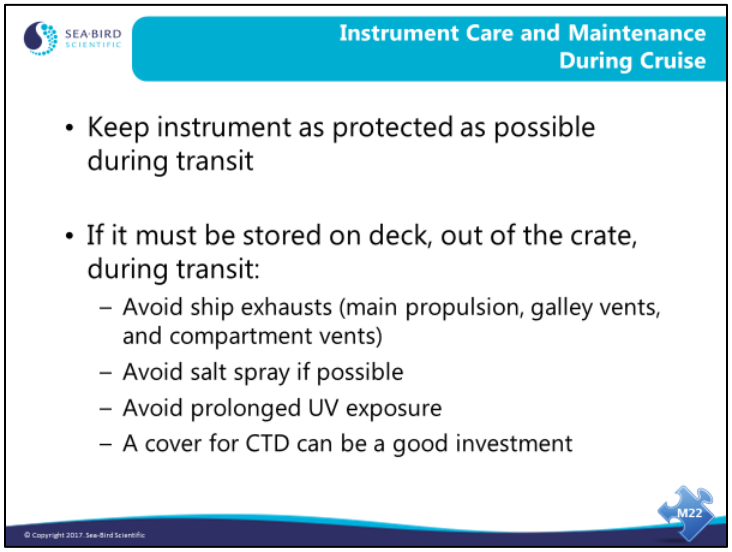
If you are using a real-time system, use 2 different display types in Seasave: a text display (fixed and/or scrolled) for deck and surface soak checkout, and a plot for the cast. The text display will tell you that the sensors are working and when the pump comes on.

Care and Maintenance during Cruise



Most ships have both freshwater and saltwater wash-down hose connections. Make sure you are using the freshwater.

Care and Maintenance during Cruise *(continued)*

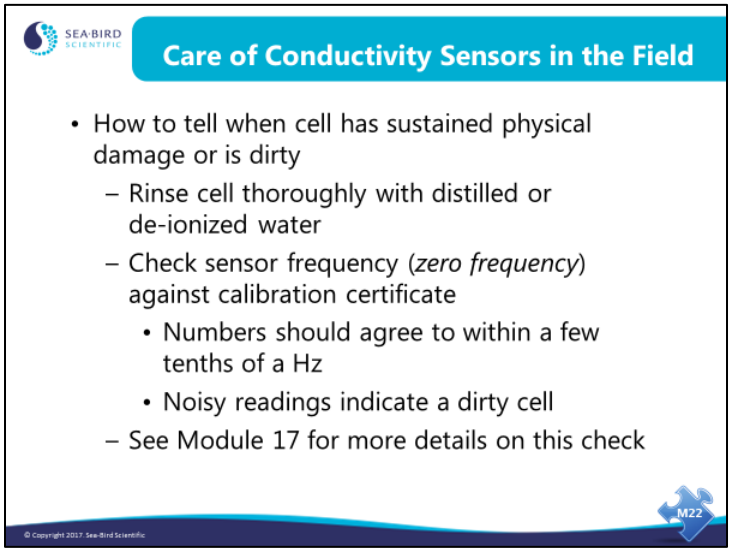


Rough weather can create hazards.

Exhausts may contain traces of oils and other contaminants.

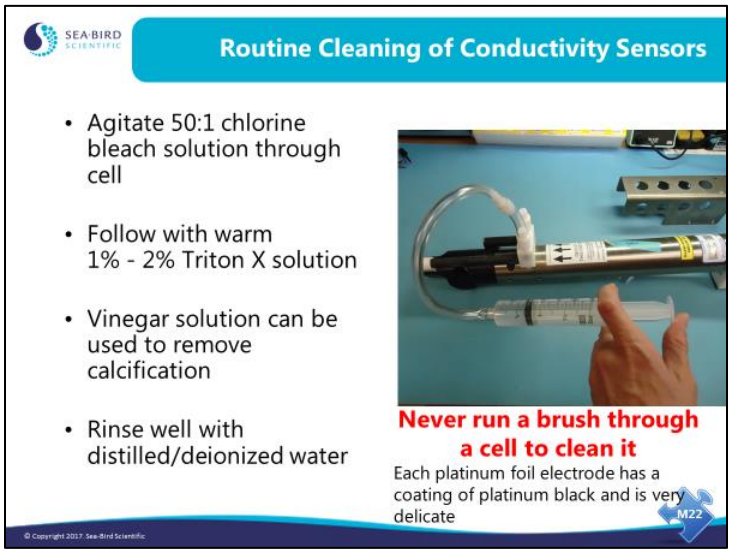
UV can shorten the life of plastics as well as promote growth of bio-fouling.

Care of Conductivity Sensors in the Field



Every conductivity calibration certificate has a frequency output for zero conductivity. This is obtained from a cell thoroughly rinsed in distilled or de-ionized water, with all the water shaken out. This means there are no electrical paths within the cell. A zero frequency that has changed by more than a few 10ths of a Hertz may indicate a cell that is damaged or considerably out of calibration. Noisy readings (± a few 10ths of a Hertz) indicate a dirty cell; we suggest a good rinse with dilute bleach and Triton-X.

Care of Conductivity Sensors in the Field *(continued)*



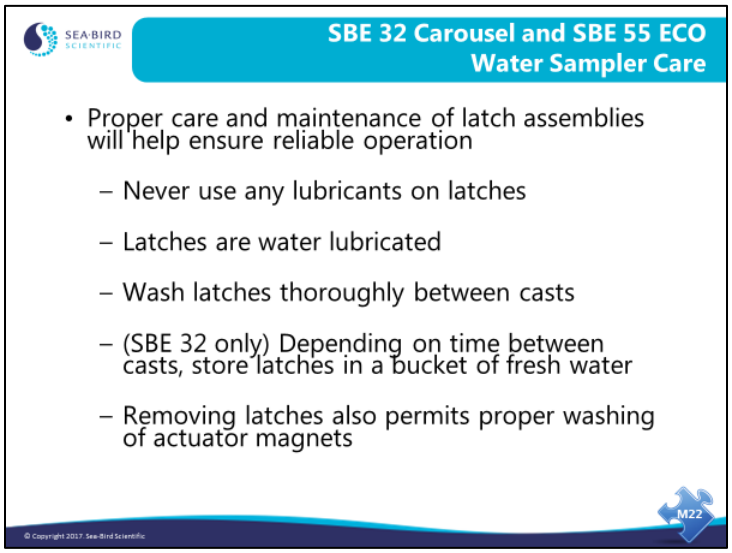
The cleaning with dilute bleach and Triton-X may be repeated several times for badly fouled sensors.

Sea lore has it that in some environments $CaCO_3$ or other inorganic coatings may accrete on the inside of the cell. This is more likely in a moored instrument. An HCl solution will dissolve these. Rather than doing this aggressive cleaning yourself, Sea-Bird recommends that the sensor be returned to the factory for cleaning and inspection.

- For the SBE 37-IMP, 37-IMP-IDO, 37-SMP, 37-SMP-IDO, 37-SIP, and 37-SIP-IDO MicroCAT; SBE 49 FastCAT; and any other instruments with an integral internal pump: **Do not perform acid cleaning**; it must be performed at the factory to avoid damage to the pump.

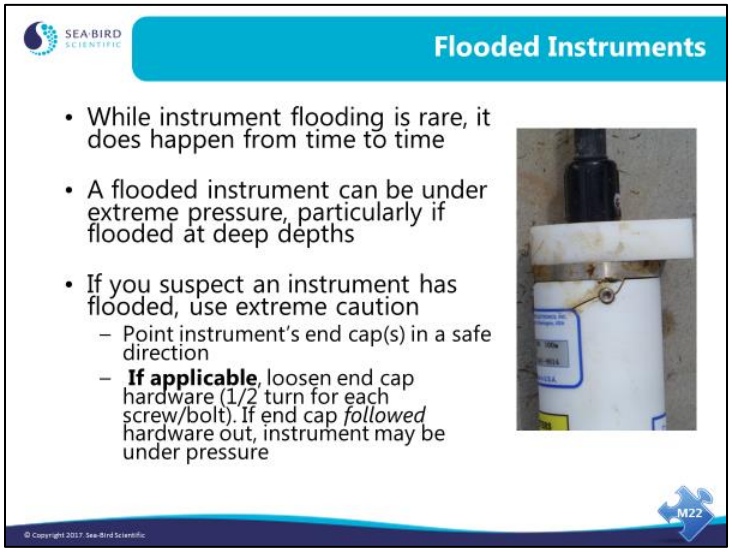
See **Application Note 2D** on our website for complete details on cleaning conductivity cells.

Care and Maintenance of Water Samplers



The titanium parts of the trigger are coated in Tiodizing (similar to anodizing aluminum).

Flooded Instruments

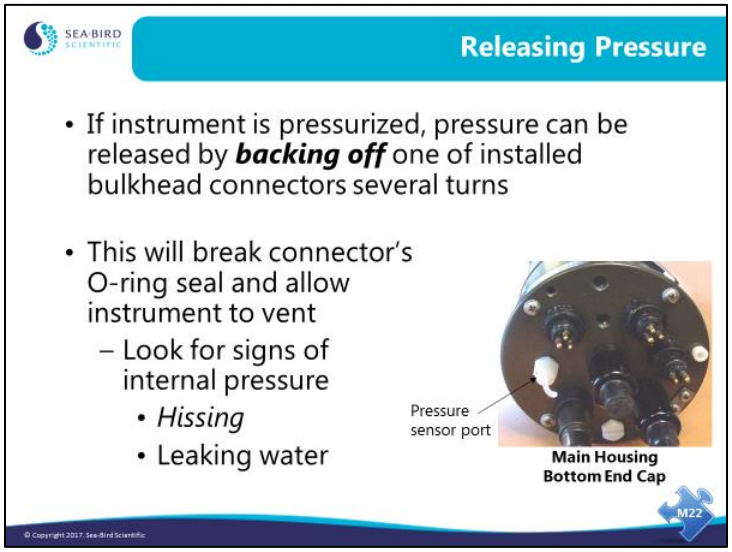


Loosening the end cap hardware to test if the instrument is under pressure is only applicable to instruments that attach to the housing through the **top** of the end cap (for example, SBE 9*plus*, 25, 17*plus*, 26, 26*plus*, 53, 54).

Loosening the end cap hardware to test if the instrument is under pressure is **not** applicable to instruments with end caps that attach to the housing through the **side** instead of the top of the end cap (for example, SBE 16*plus* and 16*plus* V2, 16*plus*-IM and 16*plus*-IM V2, 19*plus* and 19*plus* V2, 25*plus*, 37, 49).

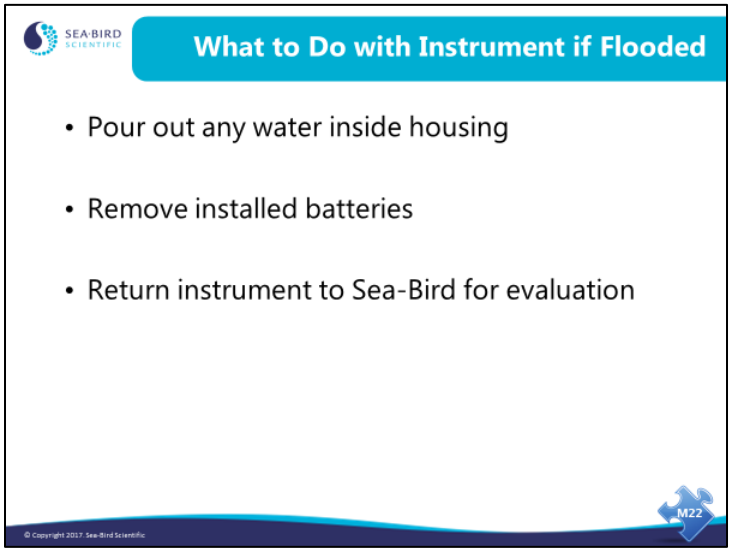
See your instrument manual for detailed instructions on handling flooded instruments.

Flooded Instruments *(continued)*



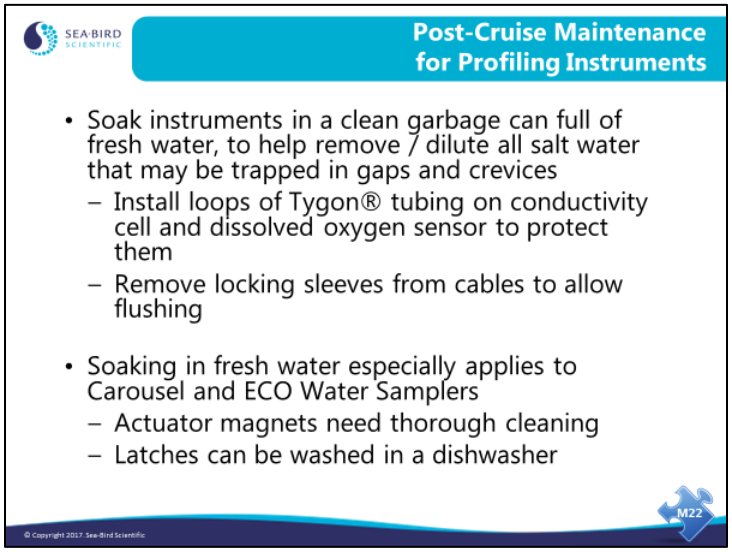
Some instruments do not have connectors Use extreme caution when handling these instruments.

Flooded Instruments *(continued)*



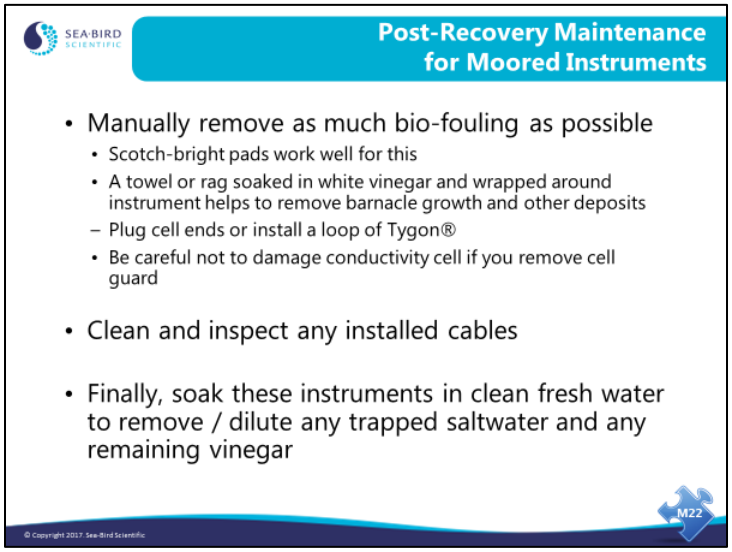
Any details that you can provide to Sea-Bird regarding a flooded instrument are appreciated, especially deployment depth or the depth that good data was lost (modular or real time sensors).

Care and Maintenance after Cruise



Post-cruise maintenance is very important to the longevity of the instrument. Trapped salt water will form crystals as it dries; these crystals can eventually cause damage to both housings and O-rings.

Care and Maintenance after Cruise *(continued)*

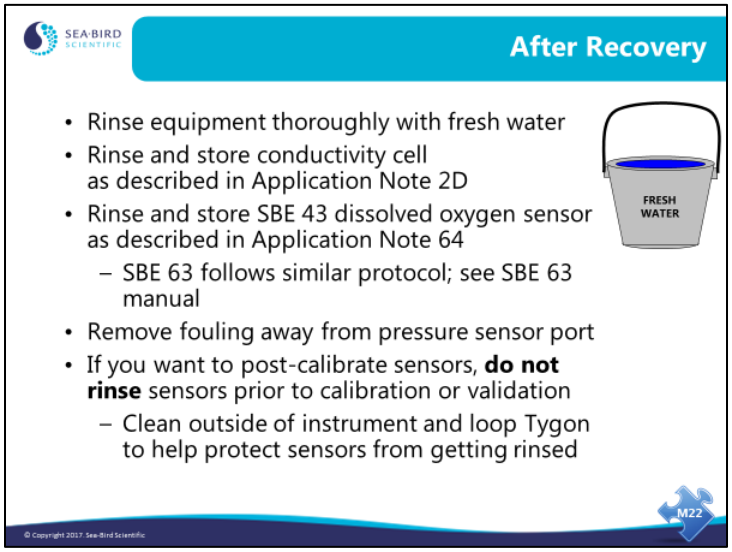


You need to remove as much biological material from the outside of the housing as possible. Sea-Bird cannot place an instrument with a large amount of biological material on the housing in our calibration bath. Plug the ends of the conductivity cell to prevent the cleaning solution from getting into the cell, and then soak the entire instrument in white vinegar for a few minutes. We recommend using a Heavy Duty Scotch-Brite pad (http://www.3m.com/us/home_leisure/scotchbrite/products/scrubbing_scouring.html) or similar scrubbing device.

When using vinegar on instruments with epoxy cast cells (SBE 4, 16, 19, and 21), avoid prolonged contact of the cell with the vinegar as it may damage the RTV on the cell.

If you painted the housing with anti-foul paint, you will need to remove this as well, using a Heavy Duty Scotch-Brite pad.

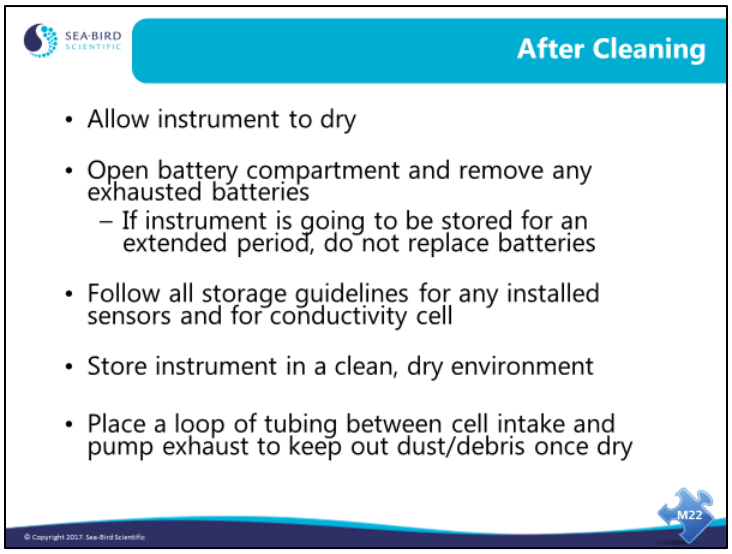
Care and Maintenance after Cruise *(continued)*



Application note 2D:
http://www.seabird.com/document/an02d-instructions-care-and-cleaning-conductivity-cells

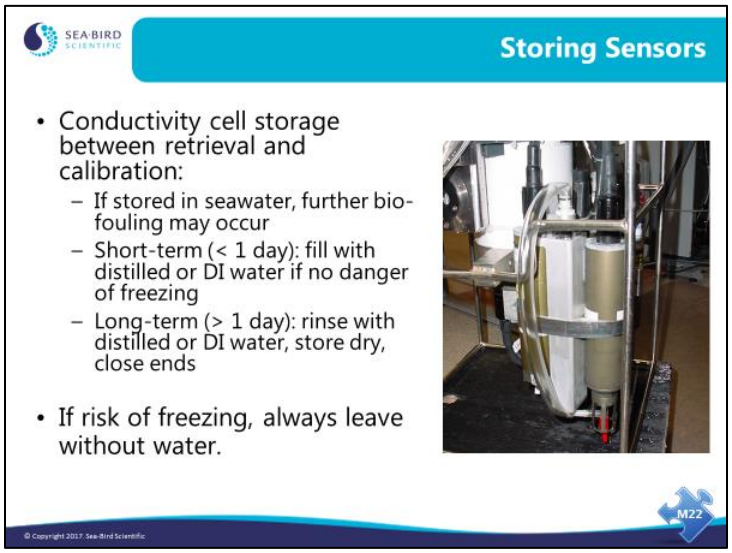
Application note 64:
http://www.seabird.com/document/an64-sbe-43-dissolved-oxygen-sensor-background-information-deployment-recommendations

Care and Maintenance after Cruise *(continued)*



If batteries leak in the battery compartment, battery bulkhead replacement needs to be performed at Sea-Bird.

Sensor Storage



Conductivity cell (See **Application Note 2D** for details.):

- Short-term storage: If there is no danger of freezing, store the conductivity cell with distilled or de-ionized water in Tygon tubing looped around the cell. If there is danger of freezing, store the conductivity cell dry, with Tygon tubing looped around the cell.
- Long-term storage: Since conditions of transport and long-term storage are not always under the control of the user, we recommend storing the conductivity cell dry, with Tygon tubing looped around the cell ends. Dry storage eliminates the possibility of damage due to unforeseen freezing, as well as the possibility of bio-organism growth inside the cell.