

USE OF DOUBLE JUNCTION GLASS pH ELECTRODES

This is an addendum to the Instrument Operating Procedures for Beckman pHI 240, pHI255, Thermo Scientific 3 Star, Orion Starr A221 meters, and the Accumet 15, AR 15, 15 XL, and XL150 models. Additional procedures and precautions for handheld pH meters and benchtop pH meters are found in IOP:007.xA, IOP:007.xB, IOP:007.xC, IOP007.xF, IOP:008.xA, and IOP008.xB.

PRECAUTIONS:

POTENTIAL INTERFERENCES

- Do not store electrodes in distilled or deionized (DI) water.
- Electrodes are stored in an upright, vertical position.
- Electrode filling hole remains open during calibration, calibration checks, and pH measurements.
- Moving or touching the electrode cable may result in unstable readings.
- Do not pull electrode directly out of the storage bottle before loosening the cap.
- Do not expose electrode to extreme temperatures.
- Do not handle or roughly wipe electrode sensing bulb.

SAFETY

No special safety precautions

PROCEDURES:

- I. Conditioning and Preparation of New and Spare Electrodes (Probes).
 - A. To help optimize and re-establish the thin hydration layer on the sensing bulb critical to pH measurement, pH electrodes must be conditioned before first use. Spares must be conditioned once a month.
 - B. Examine electrode filling chamber. If the electrolyte is lower than $\frac{1}{4}$ inch below the cap, add Electrolyte Filling Solution. If electrolyte levels are adequate, proceed to C.
 1. To add Electrolyte Filling Solution, the fill hole should be in the open position. Replace the cap on electrolyte bottle with the spout cap. Extend the spout from the cap of the electrolyte bottle and firmly press it into the fill hole to make an airtight seal. While maintaining the seal, gently squeeze the electrolyte bottle.
 - C. Remove plastic storage bottle from the electrode by unscrewing lid completely and then separating from the bottle. Rinse the end of the probe with DI water to remove salt deposits.
 - D. Shake down the electrode to remove air bubbles and soak the electrode in pH Electrode Storage Solution for 1-2 hours.
 - E. Fill plastic storage bottle with fresh pH Electrode Storage Solution. If the electrode is being put into service, connect the electrode to the pH meter and proceed with calibration and calibration checks.
- or* If the electrode is a spare and will be stored indefinitely, replace solution in plastic storage bottle with fresh pH Electrode Storage Solution. Place the probe back in plastic storage bottle and store in an upright position. Repeat *monthly* for stored electrodes.

II. Regular Maintenance

A. Disinfection and Cleaning

1. To reduce chances of clogged interference from buildup, electrodes should be disinfected once a month (every other trip) or when an individual probe is having performance issues. The following two disinfection solutions are acceptable. Proceed to Step 2 after preparing a or b.
 - a. 1:10 Bleach Solution
 - i. Mix 1 ml of bleach for every 10 ml of DI water.
 - b. 0.1 M Hydrochloric Acid Solution
 - i. Mix 1 ml 1N HCl for every 9 ml of DI water. Add acid to water first to prevent acid splashing.
 2. Soak electrodes in disinfection solution for 10 minutes, leaving fill hole closed. Plastic storage bottles, caps, o-rings, and buffer bottles may also be soaked to eliminate any algal or bacterial growth.
 3. Flush electrodes and any bottles or caps well. Initial rinses may consist of tap water if available, followed by a triple rinse with DI water. Place fresh pH Electrode Storage Solution in plastic storage bottles.
 4. Gently blot off any excess DI water from probes with laboratory wipe and insert into plastic storage bottles. Set aside buffer bottles and miscellaneous components to air-dry as needed.
- or* If an individual electrode is being cleaned due to performance issues, proceed with calibration and calibration checks to ensure proper function. If cleaning does not improve probe performance, reference junction may be clogged. Proceed to B.

B. Troubleshooting Electrode Performance

1. If an individual probe is having performance issues that are not solved by disinfection procedure, or if sample enters the probe through the fill hole, the Electrolyte Filling Solution may be exchanged with fresh electrolyte.
 - a. "Flush and Fill" - Use syringe or pipette to slowly withdraw Electrolyte Filling Solution from open fill hole. Once drained, flush filling chamber with a small amount of fresh Electrolyte Filling Solution and drain again.
 - b. Add new Electrolyte Filling Solution. Shake probe downward to eliminate air bubbles.
 - c. Proceed with calibration and calibration checks. Repeat exchange of Electrolyte Filling Solution as needed. There are no limitations on how many times filling solution can be exchanged in a probe.

If exchange of Electrolyte Filling solution does not solve issue, reference junction may be clogged by KCl crystallization inside the electrode. Electrode may be soaked in KCl storage

solution heated to 60-80 °C for up to an hour. Allow electrode to cool for an additional hour in room temperature KCl storage solution. Proceed with calibration and calibration checks.

III. Electrode Storage

A. Short-term Storage: During Field Season

1. Close the electrode filling hole, insert electrode into plastic storage bottle and store vertically.
2. For subsequent use, open the electrode fill hole, rinse salt from the electrode with DI water, and immerse in buffer to begin calibration.
3. During a shift between pH sample measurements, electrode may be placed back into plastic storage bottle containing pH Electrode Storage Solution, buffer 4, or kept in stream water.

B. Long-term Storage: Winterization

1. The filling solution chamber should be filled appropriately with Electrolyte Filling Solution. Seal fill hole with paraffin film.
2. Fill the plastic storage bottle with fresh pH Electrode Storage Solution and insert the electrode. Wrap with paraffin film. Detach from pH meter. Store electrode upright.
3. Replace solution in plastic storage bottle with fresh pH Electrode Storage Solution once a month. Place electrode back in storage bottle and store in an upright position. Re wrap with paraffin film.
4. For subsequent use prepare the electrode as a new electrode. Refer to Section I.