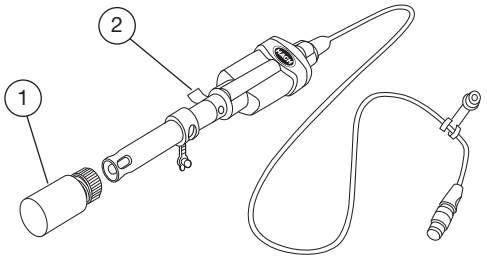
pH ELECTRODE CLEANING & MAINTENANCE GUIDE

Throughout the life of your pH electrode, you want to make sure you are getting the best performance and most accurate results possible. However minor items like air bubbles, crystallization, low electrolyte solution, KCl leakage and minor contamination can cause issues. Issues which can result in a lower confidence in the results being provided and additional purchases of replacement electrodes. This guide will provide tips to help you maintain and keep your pH electrodes clean, extending your electrode's life, while allowing you to maintain a high level of confidence in your readings.

1. First Use & Conditioning



pH electrodes are typically shipped with a storage cap to protect and hydrate the glass bulb (1). Refillable pH electrodes are additionally shipped with the refill hole sealed to prevent electrolyte leakage during shipment. This is often a piece of tape which must be removed before first use (2). During shipment, the electrolyte can move or shift, sometimes allowing air bubbles into the glass bulb, or drying of the reference element.

Air in the pH Glass Bulb

Because of this, it is recommended that the pH electrode be conditioned before first use. After unpacking, check for sufficient electrolyte inside the electrode and refill if necessary (for refillable electrodes). Then check that the glass bulb is completely filled with electrolyte and that there are no visible air bubbles. If there are, shake the electrode in a downward motion to force air bubbles out of the glass bulb.

The pH electrode will then need to be conditioned per the electrode's user manual (typically this requires soaking the electrode for several minutes in the sample or pH buffers). The response time for a new, conditioned pH electrode in pH buffers at 25°C is typically less than 30 seconds.

2. Closing & Opening the KCl Refill Hole

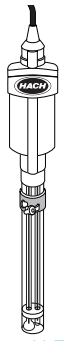
Refillable pH electrodes have a refill hole where electrolyte can be added. The level or height of the inner liquid is important for a refillable pH electrode junction.

Electrode Refill Hole Stopper

If sufficient electrolyte solution is inside the electrode, the hydrostatic pressure of the liquid column will allow electrolyte to flow out of the electrode at a faster flow rate, and additionally will prevent sample solution from going inside the electrode.

Typically, the faster the electrolyte flow rate, the faster the pH stabilization time. However this is dependent on the junction type used. Infiltration of the sample solution can contaminate the reference element and cause unstable or unreliable measurements.

Open the refill hole plug during use and close it when not in use.



Refillable pH Electrode with Stopper

3. Regular Maintenance

There are some key signs that will help the electrode user understand when to clean.

- Slow stabilization times
- Erroneous or erratic readings
- Difficulty in calibrating

Proper maintenance will ensure faster measurements, improve pH accuracy and extend the lifetime of the electrode.

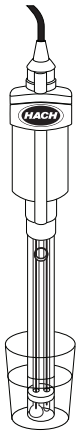
Regular pH electrode maintenance requires that a pH electrode be stored in the recommended pH storage solution between measurements, and that the electrolyte filling solution be refilled as necessary. For best electrode performance, do not let the reference junction dry out.

The pH electrode will need to be cleaned regularly, depending on the nature of the sample. The most suitable cleaning solution is one which interacts in a more selective way with the contamination. Typically fats, oils and grease (FOG) contaminations should be cleaned with a non-ionic surfactant solution or methanol, proteins such as food stuff should be cleaned with an acidic pepsin cleaning solution and mineral deposits should be cleaned with an acidic cleaning solution. Refer to your user manual for your electrode's specific guidelines; however, typical cleaning/maintenance guidelines are as follows:

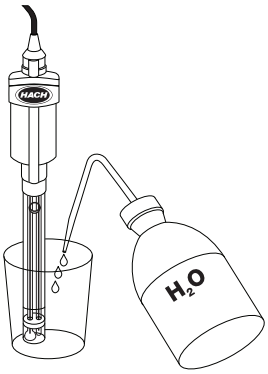
Proteins: Cleaned with an acidic pepsin cleaning solution.

Fats, oils: Cleaned with a non-ionic surfactant solution or methanol.

Afterward, rinse the electrode with deionized water, then store in the recommended pH storage solution.



Electrode in Beaker



Rinse Electrode

Hach Electrode Cleaning Solution

hach.com/HQdGuide-pH

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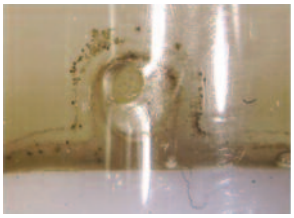
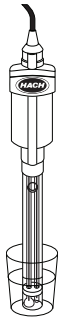
4. Regular Cleaning of the Glass Bulb and Reference Junction

For optimal response time, it may be necessary to clean the pH electrode's glass bulb and reference junction of contaminants and precipitations. The pH electrode will need to be cleaned regularly following the steps outlined in the pH electrode manual. Typically, it is recommended to soak the electrode for a few minutes in warm deionized water, or in a cleaning solution (Hach Electrode Cleaning Solution) to maintain the reference junction.

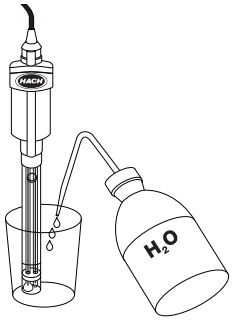
Correctly Functioning Ceramic Junction Outflow of Electrolyte (Red Dye)



Contaminated Reference Junction



Electrode in Beaker

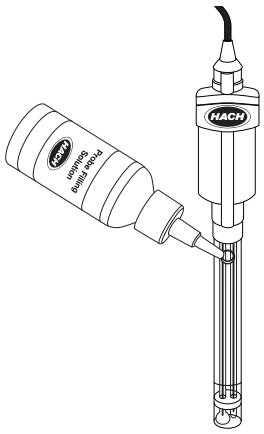


Rinse Electrode

Hach Electrode Cleaning Solution

5. Refilling pH Electrode Electrolyte

Refer to the specific pH electrode manual to determine the correct electrode filling solution to use. Remove the filling hole plug, and fill the pH electrode with electrolyte to just below the refill hole. Leave a small amount of space below the refill hole to help minimize electrolyte leakage and build up of KCl crystallization at the filling hole. Replace the filling hole plug (or leave open if next step is to take a measurement).



Refill with KCl

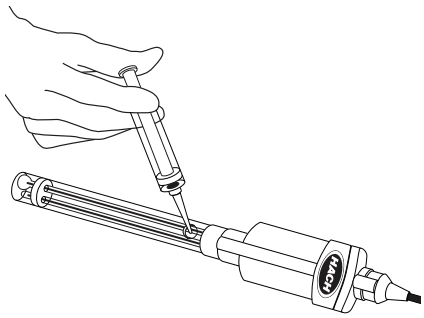
KCl

KCl w/Ag

Sat. KCl

6. Exchange of Electrolyte Filling Solution

If the electrolyte filling solution is contaminated, or if a different electrolyte is needed, use a syringe with needle to empty the entire fluid contents of the electrode. Withdraw the filling solution slowly and carefully to ensure that the pH electrode is not damaged during this process. Refer to the pH electrode manual to determine the correct replacement filling solution to use to refill the electrode.

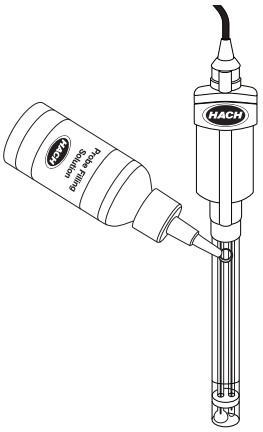


Remove Fluid Contents of Electrode

KCl

KCl w/Ag

Sat. KCl

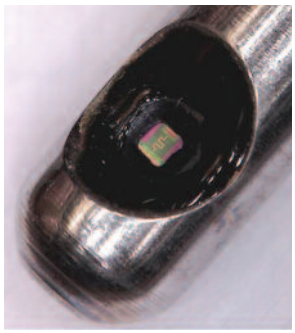


Refill with KCl

7. Cleaning ISFET pH Sensors

Using Toothbrush to Clean an ISFET pH Sensor

ISFET pH sensors are robust and can be cleaned with a toothbrush, even on the ISFET surface. Do NOT use sharp tools, abrasive materials, or cleaning powder. A mild soap or detergent can be used to help remove oil or fat. Pepsin cleaning solution should routinely be used for samples that contain proteins. After cleaning, rinse completely with deionized water.



Clean ISFET pH Sensor

Don't forget to clean the reference junction as well. Since ISFET electrodes are stored dry and are commonly exposed to food stuff, they commonly get KCl crystallization (see Tip 13) and dirty reference junction (see Tip 4).

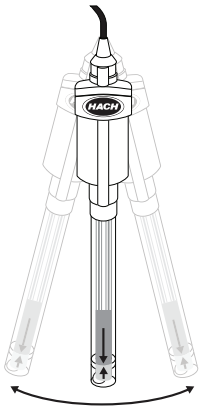
Make sure that the electrode cap is always placed on the electrode tip when not in use. This will create a humid environment to prevent the reference junction from drying out and clogging.

8. Air Bubble in Glass Bulb

The electrolyte inside a pH electrode can shift during shipment, during horizontal storage, and from general use. This movement can allow air bubbles into the glass bulb causing erratic readings or calibration errors. Before each use, it is recommended to inspect that the glass bulb is completely filled with electrolyte and that there are no visible air bubbles.

If the pH electrode has visible air bubbles, shake the electrode in a downward motion like a thermometer. This will force air bubbles out of the glass bulb.

Air in the pH Glass Bulb



Shaking the Electrode

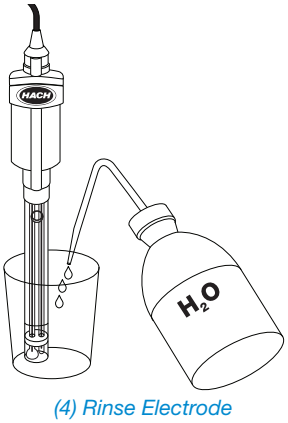
9. KCl Leakage & Salt Build-Up

Salt crystals can accumulate when water in a salt solution evaporates during contact with air (1) (2). As a result, liquid junctions of the pH electrode can occasionally become clogged (3) if not stored properly. The salt crystallization is not harmful to the electrode, nor does it inhibit the electrode's performance if treated properly. These salt crystals can be removed by rinsing the area with warm water (4). Salt crystals can also be minimized by properly covering the reference junction(s) with storage solution when the electrode is not in use, along with maintaining the electrolyte level in refillable electrode (5).

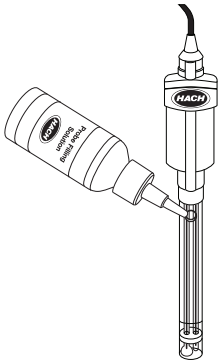
(1) KCl salt crystallization

(2) KCl salt crystallization

(3) KCl salt crystallization



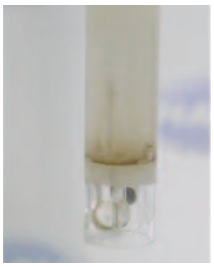
(4) Rinse Electrode



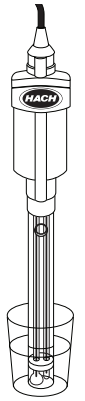
(5) Refill Electrode with KCl

10. Contamination Inside the Electrode

Some samples can cause unintended biological growth inside the pH electrode. This contamination affects the performance of the pH electrode. Thiourea solution (example: Hach KS410 Solution) can remove this type of organic growth. Allow the electrode to soak for a few hours in thiourea, followed by a thorough rinsing with deionized water.



Dirty Gel Electrolyte in Hach IntelliCAL PHC101 pH Electrode



Electrode in Beaker

Hach KS410 Solution

Clean Gel Electrolyte in Hach IntelliCAL PHC101 pH Electrode

11. Dirty Glass Bulb

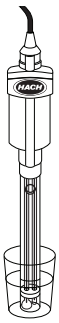
Dirty samples or samples that remain on the glass surface can result in incorrect pH readings. Refer to your user manual for specific guidelines for the most suitable cleaning solution for the specific contamination you have; however, a typical cleaning procedure for a dirty glass bulb is as follows:

General contaminants: Soak the glass bulb for up to 16 hours in Hach Electrode Cleaning Solution. Rinse in deionized water. Soak the electrode in pH 4 buffer for up to 20 minutes, then rinse with deionized water.

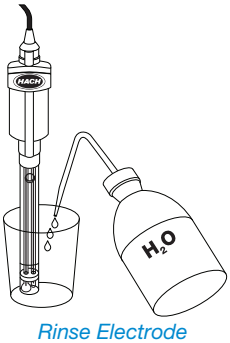
Dirty Glass pH Bulb

Dirty Glass pH Bulb

Dirty Glass pH Bulb



Electrode in Beaker



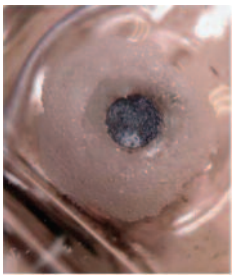
Rinse Electrode

Hach Electrode Cleaning Solution

12. Sulfide Precipitation

Sulfide and silver ions can react to form a dark precipitation inside of refillable pH electrodes. This precipitate can block the reference junction. Soak the pH electrode in thiourea solution (example: Hach KS410 Solution) for a few minutes to remove the blockage.

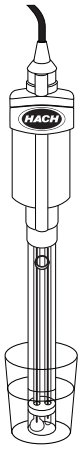
Ceramic Pin Junction Blocked by Sulfide Precipitation



Ceramic Pin Junction Blocked by Sulfide Precipitation

Ceramic Pin Junction Cleared of Sulfide Precipitation by Hach KS410 Solution

Ceramic Pin Junction Cleared of Sulfide Precipitation by Hach KS410 Solution



Electrode in Beaker

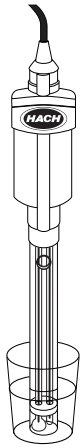
Hach KS410 Solution

13. KCl Crystallization Inside the Electrode

The most common electrolyte in Hach pH electrodes is 3 molar KCl. In some instances, such as low temperature, the KCl may crystallize inside the electrode. If the KCl crystals block the ion exchange with the reference element the electrode may read incorrect pH values.

Soak the electrode in a warm (45°C) KCl filling solution or buffer. Allow the electrode to cool down to room temperature. This should cause the KCl crystals to dissolve.

KCl Crystals Blocking Reference Junction



Electrode in Beaker

Hach Solutions for Your pH Electrodes

2965249 Electrode Cleaning Solution (500 mL)

2964449 Electrode Rinse Solution, Non-Ionic Surfactant (500 mL)

2975149 Acid Electrode Cleaning Solution (500 mL)

2756549 Fill or Storage Solution, 3M KCl (500 mL)

2841700 Fill Solution, 3M KCl Saturated w/ AgCl (30 mL)

2965026 Fill Solution, 2.44M Viscous KCl (59 mL)

For more information on Hach's pH electrodes, please visit us at: hach.com/HQdGuide-pH

To order any needed pH electrode solutions, please call Hach at: 800-227-4224

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