Grab Sample Calibration

1. Grab sample calibration of a pH electrode is more valid when the electrode has been previously characterized to its pH meter via the two point pH buffer calibration procedure. The grab sample technique will evaulate the pH electrode's performance under actual operating conditions which differ from the pH buffer calibration conditions previously seen by the electrode.

2. For a proper grab sample technique, a known good laboratory pH electrode and pH meter that are in calibration with each are required equipment. The laboratory pH electrode should be exposed to the grab sample at the identical temperature that the onstream pH electrode sees in the service to prevent the introduction of an error introduced by the solution-temperature effects on the accurate pH measurements.

3. No two pH electrodes are identical. Therefore, exact pH readings are rarely achievable. The onstream pH electrode has been conditioned to the process environment and may be more correctly reporting the process pH than a laboratory pH electrode which has not yet totally acclimated to the process conditions.

4. The grab sample should be taken as physically close to the onstream pH electrode as possible to ensure that a representative sample is being taken. The pH readings should be compared immediately. If required, adjust the onstream pH meter to match the reading of the grab sample pH meter. Avoid any time lag between the grab sample pH reading and the calibration adjustment of the onstream pH meter.

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FermProbe® pH Electrodes

Designed with a Sealed Ag/AgCl and Dual Salt Bridge Reference Half-Cell

For use in all steam sterilizable and autoclavable pH measurement applications. T-pull handle and/or integrable styles are not autoclavable.

Electrode Specifications

pH Range:	0–14 pH
with least Na^+ Error:	0–13 pH
Bulb Glass:	HT-3 (steam sterilizable)
Temperature Range:	-5–135° C
Pressure (max.):	150 psig
Cable:	Low Noise Coax, Dual Shielded

Preparation for Use

1. Remove the electrode from the storage boot containing the storage soluction (3.8 M KCl) by unscrewing the bottle from the lid/electrode. Carefully slip the lid and sealing o-ring off the electrode body.

Note

Remove the electrode from the storage boot containing the storage solution (3.8 M KCl) by unscrewing the bottle from the lid/electrode. Carefully slip the lid and sealing o-ring off the electrode body.

2. Save the electrode's storage boot, cap, and sealing o-ring for future use as a storage container for the FermProbe when it is not in service. Be certain to use 3.8 M KCl (BJC P/N: AS-3210-C20-0500) as the storage solution.

3. **For first-time use after removing the FermProbe from its storage solution:** Inspect the electrode for any signs of breakage or shipping damage and commence its use in your application.

4. **For reuse of the Fermprobe, or after long-term storage in a solution other than the recommended 3.8 M KCl solution:** Immerse the lower 30 mm of the FermProbe in a 3.8 M KCl solution for 10–30 minutes. This treatment conditions the pH-sensitive bulb and prepares the ceramic liquid junction for contact with soutions to be tested.

Calibration Procedure

1. Rinse the FermProbe thoroughly with DI water to remove all traces of storage solution, process medium, or previous test solution and to prevent carryover contamination of the pH buffer test solutions. Thoroughly rinse the Fermprobe with DI water after each buffer test.

2. Insert the FermProbe in a 7.0 pH buffer solution and momentarily stir with the electrode to ensure proper contact. Allow a minimum of 30 seconds for the electrode to thermally equilibrate with the buffer solution before taking a pH reading. The pH reading should be 7.0 ± 0.33 pH (± 20 mV) at 25° C. Make necessary adjustments to the pH meter with the standardize or zero control for a pH indication equalling 7.0 pH.

3. Rinse the FermProbe with DI water and insert the electrode into a 4.01 pH buffer solution. Stir the solution with the electrode to ensure proper contact. Allow a minimum of 30 seconds for proper electrode-solution equilibration before taking a pH reading. Make any necessary adjustments to the pH meter with the slope or span control for a reading of 4.01 pH units.

Notes

• Always use new pH buffer solution for the best results.

• pH buffer solutions above 7.0 pH are less stable and have a limited lifespan. These high pH buffers will more readily absorb CO_2 from the atmosphere and will typically change to a lower pH value when left open.

• The older an electrode is, the slower the response time will be. An older electrode will also be less efficient in its ability to span several pH units with the same repeatability.

• pH electrodes are imperfect devices and require occasional recalibration in order to be properly characterized to its host pH meter.

Cleaning a FermProbe with Impaired Response

Used, intact pH electrodes can sometimes be restored to an improved level of performance. All pH electrodes have a maximum life span depending upon the conditions of use. One of the following cleaning procedures may be helpful in restoring a used pH electrode.

1. **Initial Cleaning:** Wash the electrode with a soution of liquid detergent or enzyme detergent and warm water, gently scrubbing with a soft toothbrush or soft tissue. Follow with a thorough rinse in DI or clean tap water.

2. **Inorganic Scale Deposits:** Dissolve the deposit by immersing the electrode's measurement tip in diluted hydrochloric acid for a few minutes. Repeat the initial cleaning procedure.

3. **Organic Oil or Grese Films:** Perform the initial cleaning procedure. If the film is known to be soluble in a particlar organic solvent that is not harmful to glass, wash with this solvent. Repeat the initial cleaning procedure. Depending on the extent of the oil or grease contamination, it is possible the ceramic liquid junction may be damaged beyond recovery. Soak in a 3.8 M KCl solution for a minimum of 30 minutes before recalibration and returning the electrode to service.

4. **Plugged or Dry Ceramic Liquid Junction:** Remove any observed contaminant with one of the above procedures, then soak in a 3.8 M KCl solution for a minimum of 30 minutes.

Notes

• Never permit the pH electrode to dehydrate or dry out. Always keep it in a wetted environment, especially when not in service.

• Cracked or broken electrodes are not repairable.

• Inspect the cable and its connector to ensure that the insulation integrity is intact and that there are no signs of corrosion or contaminants on the metal components.

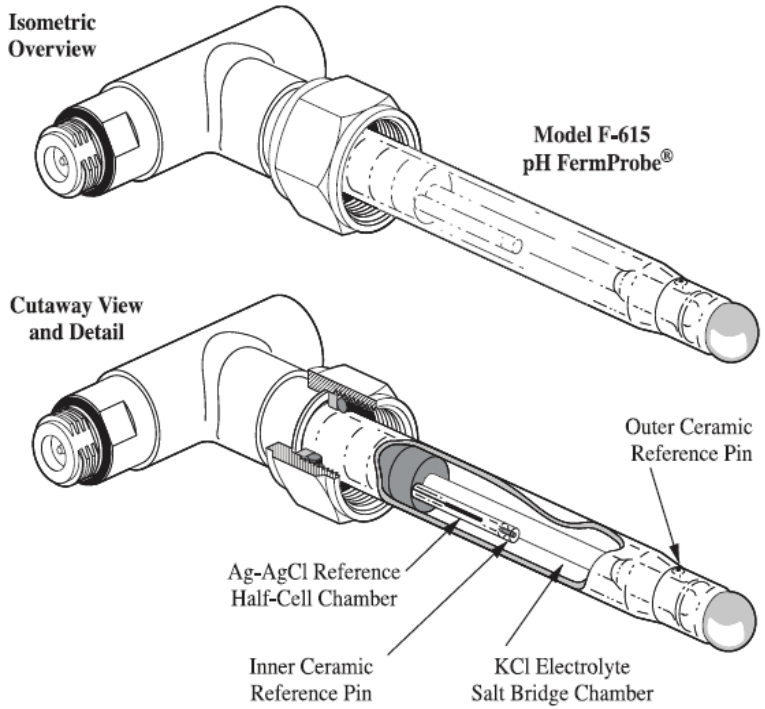
• T-pull handle and/or integral cable styles are not autoclavable.

Storage

1. **Short Term:** Immerse the electrode measurement tip and liquid junction surface areas in 3.8 M KCl. If this solution is not available, use 4.01 pH buffer, clean tap water, or a sample of the process being measured to keep the electrode hydrated.

2. **Long Term:** Fill the storage boot the electrode was originally shipped in with a freshly prepared 3.8 M KCl solution. Insert the electrode back into the filled storage boot. Make sure the storage boot's sealing o-ring and cap are securely in place. Tighten the cap by hand only. The electrode should be stored in an upright position.

Cutaway View of the pH FermProbe Double Junction Reference System



The FermProbe Double Junction Reference System

All FermProbes have two built-in electrolyte chambers that act to protect and isolate the sensitive inner AgCl reference half-cell. This double junction, dual chamber design effectively prevents two common failures of pH electrodes in biopharmeceutical applications:

1. Only the inner, smaller chamber has Ag ions in the electrolyte. The larger chamber is free of Ag ions. This design prevents Ag ions from coming in contact with proteins in the sample media. Reactions between the proteins and the Ag ions will cause the formation of substances that will clog the outer ceramic reference pin junction.

2. Sulfide ions are frequently found in sample medias. These ions are known to rapidly diffuse into both sealed electrodes and pressurized refillable electrodes. If sulfide ions come in contact with the inner AgCl half-cell, the electrode will fail. The FermProbe's dual chamber design effectively blocks the inward migration of sulfide ions and protects the inner AgCl half-cell.

All pH and redox FermProbes have this double juntion reference system as a standard feature to ensure maximum service life over the widest range of operating conditions.