

# **pH Probes – Lab vs. Process Care, Calibrations and Comparison**

**Presented by:  
Michael Blackburn  
Technical Sales Specialist  
at Hach Company**

# What Will We Cover Today?

- **Calibrations vs. Validation**
- **Detection Methods**
- **Lab vs. Process**
- **Example of Calibrations & Maintenance (pH)**
- **Your questions.**

# Calibration vs. Validation

- **Calibration – Documented altering of the calibration curve**
- **Validation – Checking of the current accuracy of the calibration curve**

# Detection Methods

- **ISE – Ion Selective Electrodes**
  - ◆ **Probes – pH, Conductivity**
    - ◆ Lab instrument – calibrate every time you use
    - ◆ Process instruments - quarterly
- **Colorimetric**
  - ◆ **Spectrophotometers, Colorimeters, (Hardness, Alkalinity, Chlorine)**
    - ◆ Annual calibration minimum!
- **Scatter Detection**
  - ◆ **Turbidity, Suspended Solids**
    - ◆ Lab and process – calibrate quarterly

# Lab vs. Process

- **Should I be calibrating with the same frequency (Lab vs. Process)?**
- **Which instrument should I trust?**
- **Some lab equipment doesn't require calibration.**
- **How do I know the calibration is accurate?**

# pH – Calibration and Maintenance

- What does pH stand for?
- How does it work?
- How often should I calibrate?
- What effects the calibration?
- Is it broken?

# So How Do These Things Work??



# Nernst Equation

$$E = E_0 - \frac{2.3RT}{nf} \log a_i$$

$$E = 59.16 \text{ mV per Decade}$$

@ 25°C

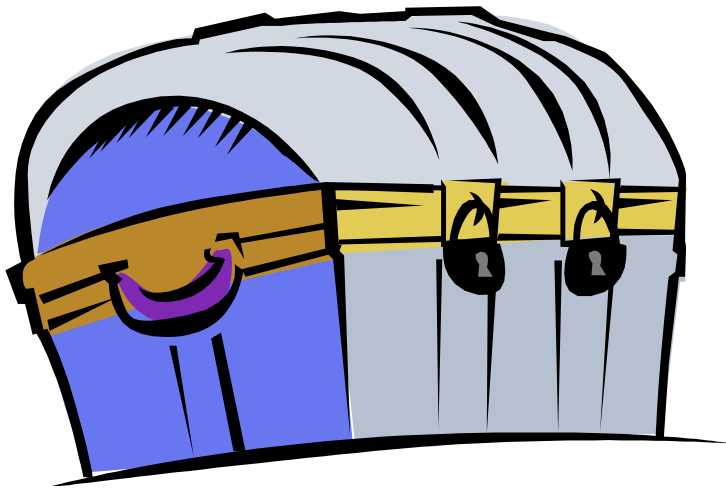


# pH Measuring Electrode Typical Problems

- pH membrane coating
- Slow response due to high impedance
- Abrasion and/or breakage
- Temperature shock

# Care of pH Electrodes

## Storage



- Store between 10 and 30 degrees C
- Use protective caps
- KCL or pH 4 buffer solution

# Care of pH Electrodes



- **Dehydration**
  - ◆ **Slow response**
  - ◆ **High glass resistance**

# Care of pH Electrodes

## Detrimental factors to electrode life



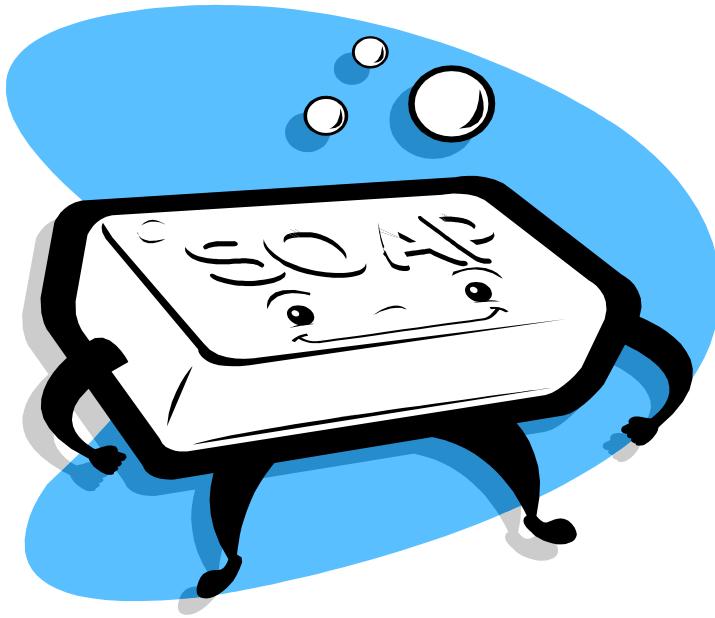
- Heat
- Cold
- Vibration

# Sensor Cleaning

Remove contaminate buildup



# Sensor Cleaning



## Hach

Recommends using:

4 pH buffer solution

*Or*

Liqui-Nox /Alconox

*Or*

Other mild acid

To clean the probe

# Sensor Cleaning



- **Clean electrode surface**
  1. Rinse with water
  2. Soak in 4 pH buffer
  3. Clean with soft toothbrush
  4. Rinse with water
  - ◆ Wipe probe dry with soft towel

# Sensor Cleaning



- Rinse and Calibrate



# pH Sensor Verification

- **Verification should be performed using buffer solutions**
  - ◆ Rinse with clean water and dry gently lint free lab cloth.
  - ◆ Place the sensor in 7pH buffer, rinse with clean water and dry gently lint free lab cloth, then place it in the 4pH buffer.
  - ◆ If the sensor is reading the buffers correctly you do not need to recalibrate.

# pH Sensor Calibration

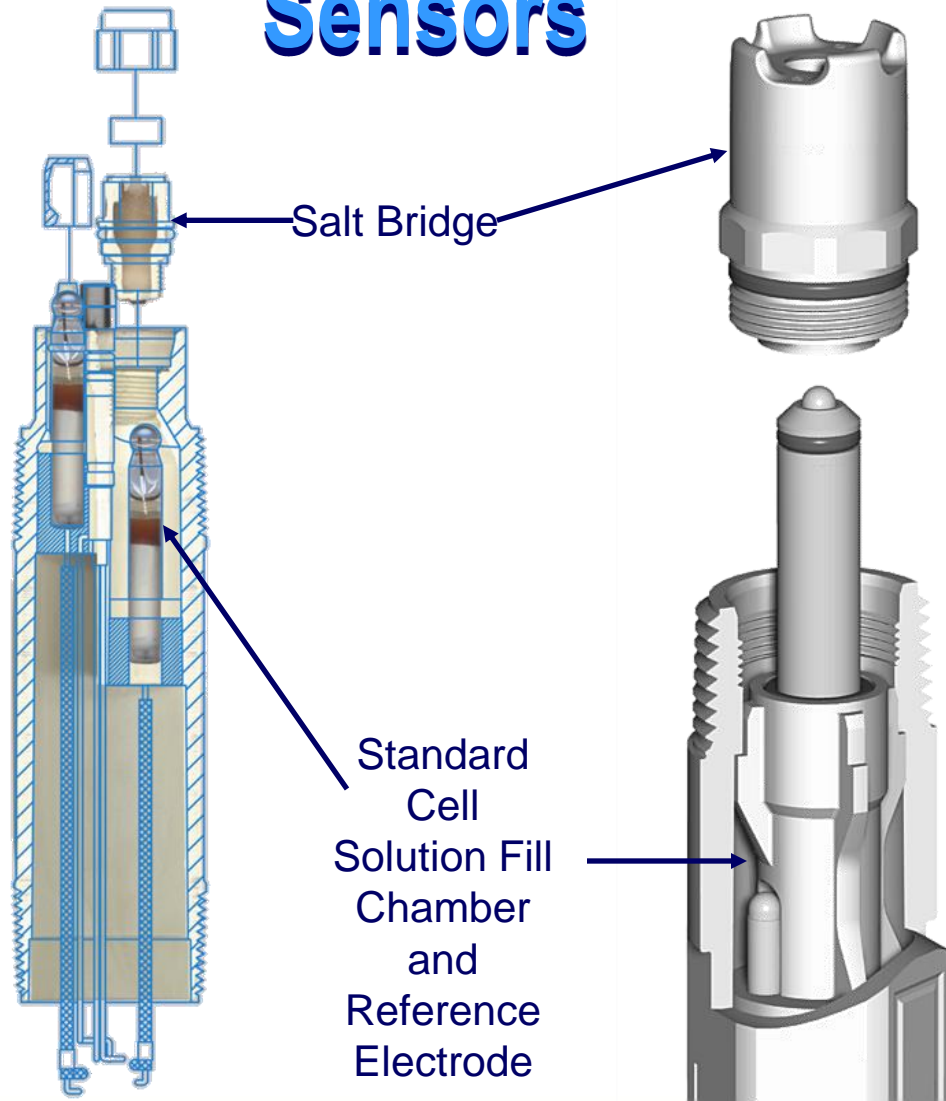
- **Clean the sensor**
- **Calibration keystrokes will depend on analyzer used**
- **A two point buffer calibration preferred**
- **7 and 4 pH calibration is ideal**

# pH Sensor Verification

- **If verifying using a hand-held or portable meter**
  - ◆ **Calibrate both the portable/handheld and the online system side by side in the same buffer solutions.**
  - ◆ **Verify that both units slope fall within manufacturer specifications**
  - ◆ **Be realistic with your expectations.**



# “Inside” Hach’s Differential pH Sensors



# Frequency of Salt-Bridge/Standard Cell Solution Maintenance

- *How often do I need to change the salt-bridge and reference solution on the pH/ORP sensors?*
  - ◆ This is process dependent, but generally at least twice a year.
- *What are the symptoms indicating the Saltbridge/standard cell solution need to be changed?*
  - ◆ System quickly goes out of calibration.
  - ◆ The offset is greater than +/-20 mV.

# Testing and Troubleshooting the Differential pH Sensor

- **Temperature compensator**
  - ◆ **Signal measured between yellow and black**
  - ◆ **300 ohm thermistor**
  - ◆ **Inversely proportional to temperature**
  - ◆ **300 ohms at 25 degrees C**
  - ◆ **Failures are normally an “open” or “short”**

# Testing and Troubleshooting a Differential pH Sensor

- **Theoretical pH signals in buffer**
  - ◆ Measure between Red and Green wire
  - ◆ 59.16 mV per pH
  - ◆ 7 pH is isopotential point, 0 mV
  - ◆ 4 pH is +177 mV
  - ◆ 10 pH is -177 mV
  - ◆ Offset is the mV signal in 7 pH buffer
  - ◆ Deviation is the mV signal in 4 or 10 pH buffer

# Testing and Troubleshooting a Differential pH Sensor

- **Acceptable Offset and Deviation Tolerances**
  - ◆ Signal measured between red and green wires
  - ◆ Offset should be 0 mV +/- 20 mV
  - ◆ Deviation should be 160 mV from offset



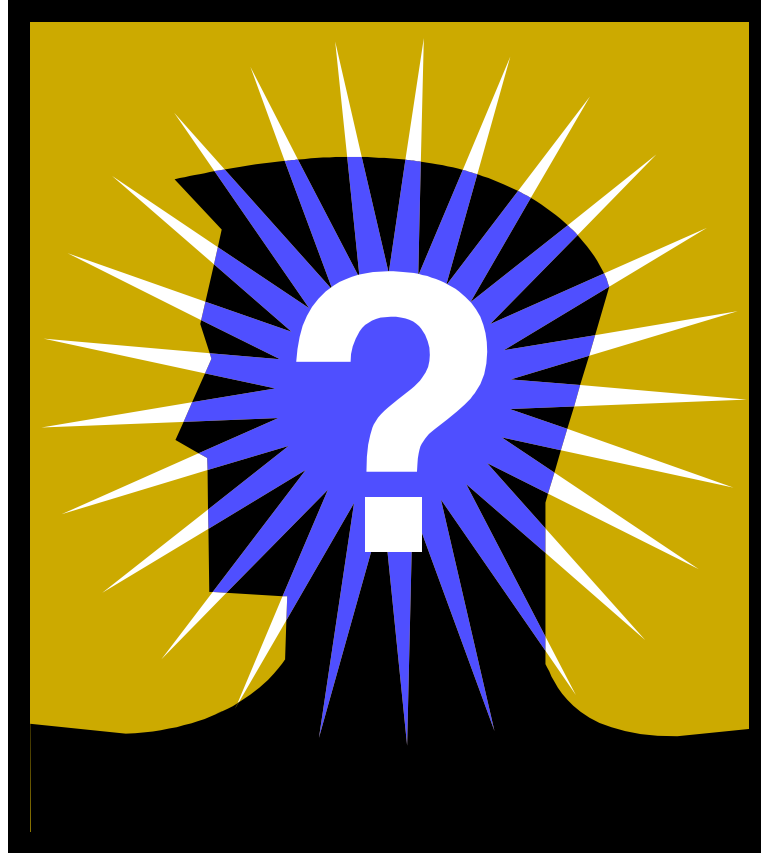
# Technical Support Contacts

- **Contact us by phone at:  
1-800-227-4224**
- **Or email us at  
techhelp@hach.com**

# Field Support Contacts

- **Mick Dollenmayer –  
Regional Sales Manager**
- **Steve Kasprzyk – Division  
Manger for Service**

# Questions???



# pH Sensor Preventative Maintenance and Troubleshooting

Please email any questions relating to this presentation to [mblackbu@hach.com](mailto:mblackbu@hach.com).

Include in the subject line:

*“Attn: pH maintenance presentation”*