Calibration and Use of Fisherbrand FE 150 pH Benchtop Meter

1. SCOPE AND APPLICATION

1.1. This procedure is based on the *Fisherbrand FE150 pH Benchtop Meter User Manual.* It is used to calibrate the meter prior to measuring pH in aqueous solutions.

2. SUMMARY OF METHOD

2.1. The pH benchtop meter is set up and calibrated. After the initial set-up, daily calibration checks are performed and recorded in the LIMS logbook. A three-point calibration is used in the morning, and a one-point calibration in the afternoon. To perform the calibrations, the meter is turned on and the desired "MODE" is selected. The probe is placed in the aqueous standard solution and swirled briefly before allowing to stabilize. The probe is rinsed with DI water between each reading. End-of-day measurements are made and recorded to ensure the probe readings have not drifted.

2.2. Calibration checks are performed each day prior to the first use of the meter and after last use of the meter for parameters that are being measured. If more than two hours pass after calibration, in which the meter has not been used, standards are rechecked.

2.3. Interferences: Temperature, probe not rinsed thoroughly, not waiting for meter to stabilize, contaminated standards.

2.4. Definitions:

2.4.1. ATC: Automatic temperature compensation

3. EQUIPMENT AND SUPPLIES

3.1. Fisherbrand FE150 pH Benchtop Meter

3.2. pH electrode

3.3. ATC probe

3.4. 30 mL disposable plastic cups

3.5. Thermometer calibrated per SOP TA-06.13 (Can be electronic or liquid filled. Mercury-filled thermometers are not used in this lab.)

3.6. Rinse water cup

3.7. Kimwipes®

3.8. Computer with access to the Laboratory Information Management System (LIMS)

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4. REAGENTS AND STANDARDS

4.1. Deionized (DI) Water with 500 mL wash bottle

4.2. Standard buffer solutions, pH 4 or 5, 7, 9 or 10, and 13 (Fisher Scientific certified pH calibration solutions)

4.3. Second-source buffer, pH 7 (Orion® pH 7.0 buffer solution, or another brand just not the Fisher brand.)

5. INITIAL SETUP AND CALIBRATION

5.1. Initial Setup

5.1.1. Unbox the FE 150 pH benchtop meter, sensor electrode, the ATC Temperature Probe, and the AC adapter. Connect the Sensor electrode to the back of the meter in the socket marked “INPUT”.

5.1.1.1. The meter accepts a standard pH electrode.

5.1.2. Insert the temperature probe into the connector marked “ATC” to connect the ATC Temperature probe.

5.1.3. Slide the jack of the AC adapter into the input marked “DC” until it is secured.

5.1.4. To connect the optional electrode holder, use a Philips screwdriver to remove the screw under the meter holding the electrode holder. Slide the metal bar until the second screw slot lines up with the original screw hole. Use the screw removed earlier to secure the electrode holder into position. Mount the electrode arm into the metal rod on the side bar, align the slot with the metal rod and base of the electrode arm. Push it downwards until it fully sits into position.

5.2. Meter Calibration

5.2.1. Selecting pH Buffer Standard Program

5.2.1.1. With the meter powered OFF, press and hold the “MODE” key and press and release the ON/OFF key. The display will show the “SETUP” indicator.

5.2.1.2. Press the UP (↑) or down (↓) arrow key to scroll through the programs until “bUF” is shown on the display and “P3.0” is shown on the lower display.

5.2.1.3. Press the “ENTER” key to access the program P3.0. The lower display will show either “USA” or “nST”.

5.2.1.4. Press the UP (↑) or down (↓) arrow key to select the “USA” buffer set.

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5.2.1.5. Press the “ENTER” key to confirm the selected buffer set.

5.2.1.6. Press the UP (↑) or down (↓) arrow key to select three calibration points and press the “ENTER” key. The display will flash, and the display will return to P3.0.

5.2.2. Temperature Calibration

5.2.2.1. To perform the temperature calibration procedure, the temperature probe must be attached to the meter and “ATC” icon must be shown on the display. The meter must be in pH measurement mode as well.

5.2.2.2. Immerse the temperature probe into a solution of known temperature until the temperature probe stabilizes.

5.2.2.3. Press the “CAL/MEAS” key to enter the pH calibration mode.

5.2.2.4. Press the “MODE” key to switch to the temperature calibration mode.

5.2.2.5. Press the UP (↑) or down (↓) arrow key to scroll to the correct temperature value corresponding to the known solution temperature.

5.2.2.5.1. The meter allows a limit of ±5°C variation with a 0.1°C resolution of the input temperature reading.

5.2.2.6. Once the correct temperature is set, press the “ENTER” key to confirm. The meter will automatically proceed to the pH measurement mode.

5.2.3. pH Calibration

5.2.3.1. Power the Meter on and use the “MODE” key to select the pH measurement mode (the display will indicate “pH” for the pH measurement mode). The meter is usually already in pH mode when first turned on. Wait 15 minutes for the meter to warm up before calibrations.

5.2.3.2. Pour the pH 4 buffer solution into a 30-mL plastic vial.

5.2.3.3. Immerse the pH electrode and temperature probe into the pH 4 buffer solution.

5.2.3.3.1. The tip of the pH electrode must be completely immersed in the buffer. Swirl the buffer gently to create a homogenous solution.

5.2.3.4. Press the CAL/MEAS key to enter the calibration mode.

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5.2.3.4.1. The “CAL” icon will be shown on top of the display to indicate the meter is in pH calibration mode.

5.2.3.4.2. The upper display will show the measured reading and lower display will indicate the pH buffer standard value, based on the selected buffer set.

5.2.3.5. Wait for the measured pH value to stabilize and the “READY” icon to be shown on the display.

5.2.3.6. Press the “ENTER” key to confirm the calibration point.

5.2.3.6.1. The upper display will flash the calibration value briefly before storing the calibration point in the meter.

5.2.3.6.2. The lower display will toggle between the next calibration buffer values, based on the selected buffer set.

5.2.3.7. Rinse the pH electrode and thermometer with deionized water or rinse solution.

5.2.3.8. Select and pour the pH 7 buffer into a clean container.

5.2.3.8.1. The meter will automatically recognize the buffers in the buffer set selected in the Setup mode (USA).

5.2.3.9. Immerse the pH electrode and temperature probe into the pH 7 buffer.

5.2.3.9.1. The lower display will update the pH buffer standard value, based on the selected buffer set.

5.2.3.10. Wait for the measured pH value to stabilize and the “READY” icon to be shown on the display.

5.2.3.11. Press the “ENTER” key to confirm the calibration point.

5.2.3.11.1. The upper display will flash the calibration value briefly before storing the calibration point in the meter.

5.2.3.11.2. The lower display will switch to the next calibration buffer value, based on the selected buffer set.

5.2.3.12. Save the calibration point and rinse the pH electrode and thermometer.

5.2.3.13. Pour the pH 10 buffer solution into a clean 30 mL plastic vial.

5.2.3.14. Immerse the pH electrode and temperature probe into the pH 10 solution.

5.2.3.15. Wait for the measured pH value to stabilize and the “READY” icon to be shown on the display.

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5.2.3.16. Press the "ENTER" key to confirm the calibration.

5.2.3.16.1. The meter will automatically proceed to the measurement mode after the calibration is completed.

5.2.3.17. After calibration, be sure the meter is in pH measurement mode and immerse the pH electrode in the pH 7 buffer solution to check the calibration.

5.2.3.18. Record the meter reading in the LIMS/Laboratory/Technical/Laboratory Logbook/TOX_pH_METER . If the PH is >0.1 units from the nominal value of the buffer solution:

5.2.3.18.1. Repeat the calibration procedure, or

5.2.3.18.2. Use new buffers and recalibrate, or

5.2.3.18.3. Replace the pH electrode and recalibration.

5.2.3.18.4. In case of emergency, contact the toxicology coordinator.

5.2.3.19. Remove the probe from the solution and rinse with DI water. Blot the electrode with a Kimwipe® if necessary. Do not rub.

5.2.3.20. Morning pH calibrations are coupled with a brief temperature calibration check. Immerse the temperature probe in the DI rinse cup along with a certified thermometer. Record the pH meter and thermometer readings in LIMS/TOX_THERMOMETER. ±0.2°C of variation is allowed between the two readings.

5.2.4. Afternoon Calibration

5.2.4.1. If it has been >2 hours since the meters were calibrated, an afternoon calibration check is performed. Only the pH 7 Orion buffer needs to be rechecked for this. Follow steps 5.2.3.17-18.

5.2.5. End of Day Calibration

5.2.5.1. After the final pH measurement has been made each day the pH electrode is immersed in a second-source pH buffer 7 solution. The reading is recorded in LIMS/TOX_pH_METER.

5.2.5.1.1. The End-of-day reading should be within ±0.1 units of the nominal value of the buffer solution.

6. SAMPLE MEASUREMENT

6.1. Measuring pH

6.1.1. After calibration, be sure the meter is in pH measurement mode.

6.1.2. Immerse the pH electrode and temperature probe into the sample and stir.

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6.1.2.1. Be sure that the glass bulb of the pH electrode is completely immersed in the sample.

6.1.3. Wait for the reading to stabilize. When the reading stabilizes, the "READY" icon will be shown.

6.1.3.1. The "READY" icon is shown when the pH readings are stable within a range of ±0.01 pH.

6.1.4. Record the measurements in LIMS/TOX_pH_METER.

7. DATA ARCHIVAL

7.1. Use a black, waterproof pen for all bench sheets and logbooks.

7.2. To correct raw data entries, place a single line through the incorrect or illegible entry, write the corrected entry near the error, date and initial the correction. Do not overwrite entries.

7.2.1. The corrected entry is written as near as possible to the error or in the comment box on the appropriate bench sheet.

7.2.2. If the correction requires an explanation, write a comment and reference the error with a letter. Initial and date the explanation. Do not attempt to put all information (correction and comments) into a small space.

7.2.3. Use sequential alphabetical annotation to identify errors and corresponding comments (use A for first error and use A for corresponding explanatory comment; use B for second error, etc.).

7.3. FDEP Laboratory Information Management System (LIMS)

8. QUALITY CONTROL

8.1. A three-point calibration is performed on the meter. The low and high buffer solutions bracket the expected pH values of the received samples.

8.1.1. If a measured sample pH is outside of the bracketed range, the meter should be recalibrated to include the measured pH.

8.2. The second-source pH buffer should read <±0.1 pH units of the exact pH value at the measured temperature. If the reading is outside of this range, repeat the calibration procedure. If the analyst believes the problem is with the buffers, new buffers can be poured and used. If the probe is the cause, the probe can be changed and the meter recalibrated. In case of an emergency, a note should be made, and the pH of the solutions recorded.

8.3. A pH 7 buffer is used to perform an end-of-day calibration check to show that the meter did not fall out of calibration and that there was no drift. It is done after the

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last measurement of the day and before the meter is shut-down. The measurement should be <±0.1 pH units of the exact pH value at the measured temperature.

8.4. For each lot number of pH buffer solution, a certificate of analysis must be obtained. They are saved in the "pH certificate of analysis" folder located in a binder next to the telephone in B-246 (Tox lab). They are also saved in X:\Labs\Lab5\Biology\BenchCommon\ToxCommon\Certificates of Analysis. The certificate of analysis label can be removed from the side of the container or obtained from the www.Fishersci.com website.

8.5. The pH electrode should be stabilized (at thermal equilibrium) before a measurement is recorded. Swirling helps hasten probe acclimation. It can require up to 2 minutes for the probe to stabilize; however, buffers are kept at room temperature (~25˚C), and most samples are warmed to ~25˚C, so thermal equilibrium usually occurs within seconds.

8.6. The electrode is blotted with a Kimwipe® between measurements. It is never rubbed. An electrical charge could form and cause interference with measurements.

9. SAFETY/HAZARDOUS WASTE MANAGEMENT

9.1. Proper laboratory protection, including lab hood or ventilation system, lab coat, gloves and safety glasses, is required when working with chemicals and unprocessed samples.

9.2. Refer to the Laboratory Quality Manual for sample disposal.

9.3. Refer to the Laboratory Health and Safety Manual and Hazardous Waste Management.

9.4. Read MSDS information for reagent handling and disposal.

10. REFERENCES

10.1. Fisherbrand FE150 pH Benchtop Meter User's Manual

10.2. Fisher Scientific Website, www.Fishersci.com

10.3. Laboratory Quality Manual https://floridadep.gov/dear/florida-dep-laboratory/content/dep-laboratory-quality-assurance-manual-and-sops

10.4. Laboratory Health and Safety Manual Health and Safety Manual

10.5. DEP SOP TA-06.13, Thermometer Accuracy Check and Use

10.6. MSDS Information Sheets.

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APPENDIX OF CHANGES

11/27/2018	Removed “Accumet model” and replaced with “Fisherbrand FE 150 pH Benchtop Meter
11/12/2020	Included summary of methods. Changed all logbook references to LIMS. Updated data archival section with universal language. Added temperature and afternoon calibration checks. Updated equipment and supplies section.

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