

QA BULLETIN
CALIBRATION OF DISSOLVED OXYGEN METERS

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NEW ENGLAND
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**FINAL QA BULLETIN
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ISSUE: Dissolved oxygen (DO) measurements at low oxygen levels may be inaccurate when DO membrane electrode meters are calibrated only at 100 percent saturated air.

BACKGROUND: As stated in *Standard Methods for the Examination of Water and Wastewater*, 20th ed., 4500-O G, the electrode method for measuring dissolved oxygen is extremely useful for *in situ* measurements for a variety of waters. One of the problems with the method includes unknowingly altering the characteristics of the DO probe's membrane. The probe's oxygen-permeable plastic membrane can be compromised by being punctured or by a coating adhering to it which may not be visible upon inspection. It is EPA NE's experience that these situations result in high DO measurements when the probe is placed in waters with low DO levels. This problem cannot be detected when the DO meter is calibrated only at the 100 percent saturated air level (approximately 10 mg/L at 15° C, 760 mm Hg).

RECOMMENDATION: If DO is a critical parameter for an investigation, EPA NE recommends a two point calibration using 100 percent saturated air and a zero DO solution. These two points define the measurement range.

Standard Methods for the Examination of Water and Wastewater, 20th ed., 4500-O G states that the DO meter should be calibrated following the manufacturer's instructions. Four common manufacturer* manuals, YSI, Hydrolab, In-Situ and Horiba, instruct users to calibrate the DO meter at 100 percent saturated air. In-situ and Horiba also instruct users to calibrate using a zero DO solution. The zero DO solution consists of a saturated solution of sodium sulfite with a trace of cobalt chloride. EPA NE has found that cobalt chloride can be omitted from the zero DO solution; however, the reaction time is slower. This solution should have a measured DO of less than 0.5 mg/L. If DO is a critical analytical parameter, EPA NE recommends calibration at 100 percent saturated air or using a known dissolved oxygen concentration (determined by the iodometric method) for the upper limit and with a zero DO solution (even if it is not explicitly stated in a particular manufacturer's manual) for the lower limit. If the DO meter does not allow for a second calibration point, the zero DO solution can be used as a check standard when the DO meter is set to the measurement mode. The DO meter should read less than 0.5 mg/L (or to the accuracy of the DO meter). If the DO meter does not read less than 0.5 mg/L, then there may be a problem with the DO membrane.

If it is determined that the DO membrane needs to be replaced, consult the manufacturer's manual on conditioning the new membrane before use. It is also possible that other maintenance may need to be performed on the DO meter or the zero DO solution may need to be replaced. Other factors that affect the accuracy of DO measurements include: improper calibration, not verifying calibration after use, not correcting for ambient barometric pressure/altitude, and instrument drift.

SUMMARY: If DO is a critical parameter, EPA New England (EPA NE) recommends a second calibration point using the zero DO solution or a check of low DO accuracy with a zero DO solution.

* The use of specific manufacturers' names does not constitute endorsement, recommendation, or approval of any manufacturer's equipment by EPA NE.