



Standard Test Method for On-Line Measurement of Low-Level Dissolved Oxygen in Water¹

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1. Scope

1.1 This test method covers the on-line determination of dissolved oxygen (DO) in water samples primarily in ranges from 0 to 500 $\mu\text{g/L}$ (ppb), although higher ranges may be used for calibration. On-line instrumentation is used for continuous measurements of DO in samples that are brought through sample lines and conditioned from high-temperature and high-pressure sources when necessary.

1.2 The values stated in SI units are to be regarded as standard. No other units of measurement are included in this standard.

1.3 *This standard does not purport to address all of the safety concerns, if any, associated with its use. It is the responsibility of the user of this standard to establish appropriate safety and health practices and determine the applicability of regulatory limitations prior to use.* For specific hazards statements, see 6.5.

2. Referenced Documents

2.1 ASTM Standards:²

D1066 Practice for Sampling Steam

D1129 Terminology Relating to Water

D1193 Specification for Reagent Water

D2777 Practice for Determination of Precision and Bias of Applicable Test Methods of Committee D19 on Water

D3370 Practices for Sampling Water from Closed Conduits

D3864 Guide for On-Line Monitoring Systems for Water Analysis

3. Terminology

3.1 *Definitions*—For definitions of terms used in this test method, refer to Terminology D1129.

¹ This test method is under the jurisdiction of ASTM Committee D19 on Water and is the direct responsibility of Subcommittee D19.03 on Sampling Water and Water-Formed Deposits, Analysis of Water for Power Generation and Process Use, On-Line Water Analysis, and Surveillance of Water.

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² For referenced ASTM standards, visit the ASTM website, www.astm.org, or contact ASTM Customer Service at service@astm.org. For *Annual Book of ASTM Standards* volume information, refer to the standard's Document Summary page on the ASTM website.

3.2 Definitions of Terms Specific to This Standard:

3.2.1 *diffusion-type probes, n*—galvanic or polarographic sensors that depend on the continuous influx of oxygen through the membrane to develop the electrical signal.

3.2.2 *equilibrium-type probes, n*—modified polarographic sensing probes that have a negligible influx of oxygen through the membrane except during changes of sample DO concentration.

3.2.2.1 *Discussion*—Oxygen consumption and regeneration balance each other within the probes under stable conditions, and the net flux through the membrane is insignificant.

3.2.3 *galvanic systems, n*—sensing probes and measuring instruments that develop an electrical current from two electrodes inside the probe from which the final measurement is derived.

3.2.4 *partial pressure (of oxygen), n*—the volume fraction of oxygen multiplied by the total pressure.

3.2.4.1 *Discussion*—The partial pressure of oxygen is the actual parameter detected by DO probes, whether in air or dissolved in water.

3.2.5 *polarographic systems, n*—sensing probes and measuring instruments that include circuitry to control the operating voltage of the system, usually using a third (reference) electrode in the probe.

4. Summary of Test Method

4.1 Dissolved oxygen is measured by means of an electrochemical cell separated from the sample by a gas-permeable membrane. Behind the membrane and inside the probe, electrodes immersed in an electrolyte develop an electrical current proportional to the oxygen partial pressure of the sample.

4.2 The partial pressure signal is temperature compensated automatically to account for variations with temperature of the following: oxygen solubility in water; electrochemical cell output; and, when necessary, diffusion rate of oxygen through the membrane. This yields a direct readout in concentration of $\mu\text{g/L}$ (ppb) or mg/L (ppm).

4.3 Diffusion-type probes rely on a continuous diffusion of oxygen through the membrane. Immediately inside the membrane, oxygen is reduced at the noble metal cathode, usually platinum or gold. An electrical current is developed