BS ISO 17289:2014

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Water quality — Determination of dissolved oxygen — Optical sensor method

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National foreword

This British Standard is the UK implementation of ISO 17289:2014.

The UK participation in its preparation was entrusted to Technical Committee EH/3/2, Physical chemical and biochemical methods.

A list of organizations represented on this committee can be obtained on request to its secretary.

This publication does not purport to include all the necessary provisions of a contract. Users are responsible for its correct application.

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Water quality — Determination of dissolved oxygen — Optical sensor method

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Case postale 56 • CH-1211 Geneva 20
Tel. + 41 22 749 01 11
Fax + 41 22 749 09 47
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Foreword

ISO (the International Organization for Standardization) is a worldwide federation of national standards bodies (ISO member bodies). The work of preparing International Standards is normally carried out through ISO technical committees. Each member body interested in a subject for which a technical committee has been established has the right to be represented on that committee. International organizations, governmental and non-governmental, in liaison with ISO, also take part in the work. ISO collaborates closely with the International Electrotechnical Commission (IEC) on all matters of electrotechnical standardization.

The procedures used to develop this document and those intended for its further maintenance are described in the ISO/IEC Directives, Part 1. In particular the different approval criteria needed for the different types of ISO documents should be noted. This document was drafted in accordance with the editorial rules of the ISO/IEC Directives, Part 2 (see www.iso.org/directives).

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For an explanation on the meaning of ISO specific terms and expressions related to conformity assessment, as well as information about ISO's adherence to the WTO principles in the Technical Barriers to Trade (TBT) see the following URL: Foreword - Supplementary information

The committee responsible for this document is ISO/TC 147, *Water quality*, Subcommittee SC 2, *Physical, chemical and biochemical methods*.

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INTERNATIONAL STANDARD ISO 17289:2014(E)

Water quality — Determination of dissolved oxygen — Optical sensor method

WARNING — Persons using this International Standard should be familiar with normal laboratory practice. This International Standard does not purport to address all of the safety problems, if any, associated with its use. It is the responsibility of the user to establish appropriate safety and health practices and to ensure compliance with any national regulatory conditions.

IMPORTANT — It is absolutely essential that tests conducted in accordance with this International Standard be carried out by suitably trained staff.

1 Scope

This International Standard specifies an optical method for the determination of dissolved oxygen in water using a sensor working on the basis of fluorescence quenching.

Measurement can be made either as a concentration of oxygen in milligrams per litre, percentage saturation (% dissolved oxygen), or both. Depending on the instrument used, detection limits of 0,1 mg/l or 0,2 mg/l can be reached according to the manufacturer's manual. Most instruments permit measurement of values higher than 100 %, i.e. supersaturation.

NOTE Supersaturation is possible when the partial pressure of oxygen is higher than in air. Especially in case of strong algae growth, supersaturation up to 200 % and more is possible.

If waters with a saturation higher than 100 % are measured, it is essential to make arrangements to prevent the outgassing of oxygen during the handling and measurement of the sample. Similarly, it is important that the transport of oxygen into the sample is prevented if the saturation is below 100 %.

The method is suitable for measurements made in the field and for continuous monitoring of dissolved oxygen as well as measurements made in the laboratory. It is one of the preferred methods for highly coloured and turbid waters, and also for analysis of waters not suitable for the Winkler titration method because of iron- and iodine-fixing substances, which can interfere in the iodometric method specified in ISO 5813.

The method is suitable for drinking waters, natural waters, waste waters, and saline waters. If used for saline waters such as sea or estuarine waters, a correction for salinity is essential for concentration measurement of oxygen.

2 Normative references

The following documents, in whole or in part, are normatively referenced in this document and are indispensable for its application. For dated references, only the edition cited applies. For undated references, the latest edition of the referenced document (including any amendments) applies.

ISO 3696, *Water for analytical laboratory use — Specification and test methods*

3 Principle

Optical sensors that measure luminescence/fluorescence lifetime or luminescence/fluorescence phase shift are normally composed of a luminophore or fluorescent dye situated in a sensor cap, a light source [e.g. a light emitting diode (LED)], and a photodetector. The pulsed or modulated light from the source causes excitation of the luminophore, which is quenched in the presence of oxygen. The photodetector converts the resulting light emission into an electrical signal that can be sampled and processed to

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compute the phase shift or fluorescence or luminescence lifetime. This phase shift or excitation lifetime is used to quantify dissolved oxygen concentrations.

Temperature has two different influences. The first influence relates to the variation of the quenching process of the membrane with the temperature. So the primary signal of the probe has to be compensated with a built-in temperature sensor. State-of-the-art meters are able to do this automatically. The second influence is given by the sample and the temperature dependence of the solubility of oxygen in it. Also salinity can have a significant effect.

For calculating the percentage of saturation of samples being in contact with an atmosphere, it is necessary to take the atmospheric pressure into account. This can be performed manually or by implementing a pressure sensor for automatic compensation.

Most sensors have a second LED to be used as internal reference for compensation purposes.

4 Interferences

No interferences in waters as described in Clause 1.

5 Reagents

During analysis (i.e. for calibration), use only reagents of analytical grade.

5.1 Water, grade 2, as specified in ISO 3696.

5.2 Sodium sulfite, anhydrous, Na_2SO_3, or heptahydrate, $Na_2SO_3 \cdot 7H_2O$.

5.3 Cobalt(II) salt, for example cobalt(II) chloride hexahydrate, $CoCl_2 \cdot 6H_2O$.

5.4 Ascorbic acid.

5.5 Sodium hydroxide solution, NaOH, c = 1 mol/l.

5.6 Nitrogen gas, N_2, purity 99,995 % or better.

6 Apparatus

6.1 Measuring instrument, comprising the following components.

6.1.1 Measuring probe.

Probe designs vary in the wavelength of the excitation light and the luminophore or fluorescent dye.

6.1.2 Meter to show the mass concentrations of dissolved oxygen directly and/or percentage saturation with oxygen.

6.2 Thermometer, graduated to at least 0,5 °C.

NOTE Commonly, a temperature sensor is integrated into the instrument.

6.3 Barometer, graduated to 1 hPa.

NOTE Usually, the barometer is integrated into the instrument.

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