

**Vee kvaliteet - Biokeemilise hapnikutarbe  
(BHT<sub>n</sub>) määramine n päeva pärast - Osa 1:  
Meetod, kus kasutatakse lahjendamist ja  
idukristalli sisseviimist koos allüütiokarbamiidi  
lisamisega**

Water quality - Determination of biochemical  
oxygen demand after n days (BOD<sub>n</sub>) -  
Part 1: Dilution and seeding method with  
allylthiourea addition  
(ISO 5815:1989, modified)

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ICS 13.060.50

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**English version**

**Water quality**

Determination of biochemical oxygen demand after  $n$  days ( $BOD_n$ )  
Part 1: Dilution and seeding method with allylthiourea addition  
(ISO 5815 : 1989, modified)

Qualité de l'eau – Détermination de la demande biochimique en oxygène après  $n$  jours ( $DOB_n$ ) – Partie 1: Méthode par dilution et ensemencement avec apport d'allyl thio-urée (ISO 5815 : 1989, modifiée)

Wasserbeschaffenheit – Bestimmung des Biochemischen Sauerstoffbedarfs nach  $n$  Tagen ( $BSB_n$ ) – Teil 1: Verdünnungs- und Impfverfahren nach Zugabe von Allylthioharnstoff (ISO 5815 : 1989, modifiziert)

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**CEN**

European Committee for Standardization  
Comité Européen de Normalisation  
Europäisches Komitee für Normung

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## Foreword

This European Standard has been prepared by Technical Committee CEN/TC 230 "Water analysis", the secretariat of which is held by DIN.

This European Standard shall be given the status of a national standard, either by publication of an identical text or by endorsement, at the latest by September 1998, and conflicting national standards shall be withdrawn at the latest by September 1998.

According to the CEN/CENELEC Internal Regulations, the national standards organizations of the following countries are bound to implement this European Standard: Austria, Belgium, Czech Republic, Denmark, Finland, France, Germany, Greece, Iceland, Ireland, Italy, Luxembourg, Netherlands, Norway, Portugal, Spain, Sweden, Switzerland and the United Kingdom.

This draft European Standard consists of the following parts:

- EN 1899-1 Water quality – Determination of biochemical oxygen demand after n days ( $BOD_n$ ) – Part 1: Dilution and seeding method with allylthiourea addition
- EN 1899-2 Water quality – Determination of biochemical oxygen demand after n days ( $BOD_n$ ) – Part 2: Method for undiluted samples

Annex A, which is normative, concerns alternative incubation periods.

Annex B, which is informative, concerns multitesting, which may be used to obtain enhanced precision, or if the presence of substances toxic to microorganisms is suspected.

### Endorsement notice

The text of the International Standard ISO 5815:1989 was approved by CEN as a European Standard with agreed common modifications as given below:

- Change in setup (splitting into two parts)
- Addition of annexes.

## Introduction

This European Standard EN 1899-1 is a modified version of ISO 5815:1989, "Water Quality - Determination of biochemical oxygen demand after 5 days (BOD<sub>5</sub>) - Dilution and seeding method".

The times of incubation specified in the proposal are 5 days - as in ISO 5815 and as has been applied in many European countries - or 7 days as has been applied in several Nordic countries through the past many years. The 7 day incubation will typically give higher BOD results than 5 days incubation time.

With an incubation time of 5 days weekend work can only be avoided, if samples are collected Wednesdays, Thursdays to Fridays. With an incubation time of 7 days, samples collected on the first five weekdays can be analysed without implying weekend work. For this reason a 7 day incubation can be considered more convenient than the conventional 5 day incubation.

A new, modified 7 day incubation is described in a normative annex. The first investigations indicate that BOD results obtained by this modified method are identical to results obtained by the 5 day method described in the proposed standard. It is hoped that more comparative data on these two incubation methods will be obtained during the coming years, so that the modified 7 day incubation method can be included fully at the time of review and revision of this standard.

## 1 Scope

This European Standard specifies a determination of the biochemical oxygen demand of waters by dilution and seeding with suppression of nitrification.

This standard is applicable to all waters having biochemical oxygen demands greater than or equal to the limit of determination 3 mg/l of oxygen and not exceeding 6000 mg/l of oxygen. For biochemical oxygen demands greater than 6 000 mg of oxygen/l, the method is still applicable, but the errors caused by the necessary dilutions can influence the analytical quality of the test method and the results are to be interpreted with circumspection. In this standard the limit of detection,  $D_L$ , is defined as

$$D_L = t_{0,95(f)} \cdot 2 \cdot s_B \cdot \sqrt{1 + \frac{1}{n}} \quad (1)$$

where  $s_B$  is the within series standard deviation,  $t_{0,95(f)}$  is the student t-value, with  $f$  is the degrees of freedom for the determination of  $s_B$  and  $n$  is the number of analysis for determination of the blank in an analytical series.  $s_B$  is calculated from determinations of real samples with a BOD content near the estimated  $D_L$ .

In cases where the analytical method does not require any blank correction the term

$$\sqrt{1 + \frac{1}{n}} \quad (2)$$

is omitted.

The results obtained are the product of a combination of biochemical and chemical reactions. They do not have the rigorous and unambiguous character of those resulting from, for example, a single, well-defined, chemical process. Nevertheless, they provide an indication from which the quality of waters can be estimated.

The test can be influenced by the presence of various substances. Those which are toxic to microorganisms, for example bactericides, toxic metals or free chlorine, will inhibit biochemical oxidation. The presence of algae or nitrifying microorganisms can produce artificially high results.

It is absolutely essential that tests conducted according to this standard are carried out by suitably qualified staff.

Annex A describes alternative incubation periods.

Annex B describes multitesting, which can be used to obtain enhanced precision or to demonstrate the presence of substances toxic to microorganisms.

## 2 Normative references

This European Standard incorporates by dated or undated reference provisions from other publications. These normative references are cited at the appropriate places in the text and the publications are listed hereafter. For dated references, subsequent amendments to or revisions of any of these publications apply to this European Standard only when incorporated in it by amendment or revision. For undated references the latest edition of the publication referred to applies.

EN ISO 3696	Water for analytical laboratory use – Specification and test methods (ISO 3696:1987)
EN 25813	Water quality – Determination of dissolved oxygen – Iodometric method (ISO 5813:1983)
EN 25814	Water quality – Determination of dissolved oxygen – Electrochemical probe method (ISO 5814:1990)
EN ISO 8467	Water Quality – Determination of permanganate index (ISO 8467:1993)
ISO 6060:1989	Water quality – Determination of chemical oxygen demand
ISO 6107-2:1997	Water quality – Vocabulary – Part 2
ISO 7393-1:1985	Water quality – Determination of free chlorine and total chlorine – Part 1 : Titrimetric method using N,N-diethyl-1,4-phenylenediamine
ISO 7393-2:1985	Water quality – Determination of free chlorine and total chlorine – Part 2 : Colorimetric method using N,N-diethyl-1,4-phenylenediamine, for routine control purposes.
ISO 8245:1987	Water Quality – Guidelines for the determination of total organic carbon (TOC).

## 3 Definition

For the purposes of this European Standard, the following definition applies:

**Biochemical oxygen demand after n days (BOD<sub>n</sub>):** The mass concentration of dissolved oxygen consumed under specified conditions by the biochemical oxidation of organic and/or inorganic matter in water. n is the incubation time; it is equal to 5 or 7.

NOTE: This definition is similar to the definition of ISO 6107-2. For the purpose of this European Standard, "biochemical oxidation" is taken to mean "biological oxidation".

## 4 Principle

Pre-treatment of the sample of water to be analyzed and dilution with varying amounts of a dilution water rich in dissolved oxygen and containing a seed of aerobic microorganisms, with suppression of nitrification.

Incubation at 20 °C for a defined period, 5 or 7 days, in the dark, in a completely filled and stoppered bottle. Determination of the dissolved oxygen concentration before and after incubation. Calculation of the mass of oxygen consumed per litre of sample.

## 5 Reagents

### 5.1 General

Throughout the text, use only reagents of recognized analytical quality.

### 5.2 Water

Use only grade 3 water (in accordance with EN ISO 3696). However, the water shall not contain more than 0,01 mg/l of copper, nor chlorine or chloramines.

### 5.3 Seeding water

If the test sample does not contain, by itself, sufficient adapted microorganisms, seeding water, obtained in one of the following ways, shall be used:

- Urban waste water of maximum COD (chemical oxygen demand measured in accordance with ISO 6060) 300 mg/l or TOC (total organic carbon measured in accordance with ISO 8245) 100 mg/l, collected from a main sewer or from a sewer of a residential zone free from significant industrial contamination. Decant or filter the water through a coarse filter;
- River or lake water containing urban waste water;
- Settled effluent from a waste water treatment plant;