



# SLOVENSKI STANDARD SIST EN ISO 15586:2003

01-december-2003

Water quality - Determination of trace elements using atomic absorption spectrometry with graphite furnace (ISO 15586:2003)

Wasserbeschaffenheit - Bestimmung von Spurenelementen mittels Atomabsorptionsspektrometrie mit dem Graphitrohr-Verfahren (ISO 15586:2003)

Qualité de l'eau - Dosage des oligo-éléments par spectrométrie d'absorption atomique en four graphite (ISO 15586:2003)

Ta slovenski standard je istoveten z: EN ISO 15586:2003

<https://standards.iteh.ai/catalog/standards/sist/b7ee6b02-6197-4ccd-8d68-e3f10f72c6fb/sist-en-iso-15586-2003>

### ICS:

13.060.50 Examination of water for chemical substances

SIST EN ISO 15586:2003

en

**iTeh STANDARD PREVIEW**  
**(standards.iteh.ai)**

SIST EN ISO 15586:2003

<https://standards.iteh.ai/catalog/standards/sist/b7ee6b02-6197-4ccd-8d68-e3f10f72c6fb/sist-en-iso-15586-2003>

ICS 13.060.50

English version

Water quality - Determination of trace elements using atomic  
absorption spectrometry with graphite furnace (ISO 15586:2003)

Qualité de l'eau - Dosage des oligo-éléments par  
spectrométrie d'absorption atomique en four graphite (ISO  
15586:2003)

Wasserbeschaffenheit - Bestimmung von  
Spurenelementen mittels Atomabsorptionsspektrometrie  
mit dem Graphitrohr-Verfahren (ISO 15586:2003)

This European Standard was approved by CEN on 1 September 2003.

CEN members are bound to comply with the CEN/CENELEC Internal Regulations which stipulate the conditions for giving this European Standard the status of a national standard without any alteration. Up-to-date lists and bibliographical references concerning such national standards may be obtained on application to the Management Centre or to any CEN member.

This European Standard exists in three official versions (English, French, German). A version in any other language made by translation under the responsibility of a CEN member into its own language and notified to the Management Centre has the same status as the official versions.

CEN members are the national standards bodies of Austria, Belgium, Czech Republic, Denmark, Finland, France, Germany, Greece, Hungary, Iceland, Ireland, Italy, Luxembourg, Malta, Netherlands, Norway, Portugal, Slovakia, Spain, Sweden, Switzerland and United Kingdom.

[SIST EN ISO 15586:2003](https://standards.iteh.ai/catalog/standards/sist/b7ee6b02-6197-4ccd-8d68-e3f10f72c6fb/sist-en-iso-15586-2003)

<https://standards.iteh.ai/catalog/standards/sist/b7ee6b02-6197-4ccd-8d68-e3f10f72c6fb/sist-en-iso-15586-2003>



EUROPEAN COMMITTEE FOR STANDARDIZATION  
COMITÉ EUROPÉEN DE NORMALISATION  
EUROPÄISCHES KOMITEE FÜR NORMUNG

Management Centre: rue de Stassart, 36 B-1050 Brussels

**CORRECTED 2003-12-03**

## Foreword

This document (EN ISO 15586:2003) has been prepared by Technical Committee ISO/TC 147 "Water quality" in collaboration with 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 April 2004, and conflicting national standards shall be withdrawn at the latest by April 2004.

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, Hungary, Iceland, Ireland, Italy, Luxembourg, Malta, Netherlands, Norway, Portugal, Slovakia, Spain, Sweden, Switzerland and the United Kingdom.

## Endorsement notice

The text of ISO 15586:2003 has been approved by CEN as EN ISO 15586:2003 without any modifications.

**(standards.iteh.ai)**

NOTE: Normative references to International Standards are listed in annex ZA (normative).

[SIST EN ISO 15586:2003](https://standards.iteh.ai/catalog/standards/sist/b7ee6b02-6197-4ccd-8d68-e3f10f72c6fb/sist-en-iso-15586-2003)

<https://standards.iteh.ai/catalog/standards/sist/b7ee6b02-6197-4ccd-8d68-e3f10f72c6fb/sist-en-iso-15586-2003>

## Annex ZA (normative)

### Normative references to international publications with their relevant European publications

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 (including amendments).

NOTE Where an International Publication has been modified by common modifications, indicated by (mod.), the relevant EN/HD applies.

Publication	Year	Title	EN	Year
ISO 3696	1987	Water for analytical and laboratory use — Specification and test methods	EN ISO 3696	1995
ISO 5667-1	1980	Water quality — Sampling — Part 1: Guidance on the design of sampling programs	EN 25667-1	1993
ISO 5667-2	1991	Water quality — Sampling — Part 2: Guidance on sampling techniques	EN 25667-2	1993
ISO 5667-3	1994	Water quality — Sampling — Part 3: Guidance on the preservation and handling of samples	EN ISO 5667-3	1995
ISO 15587-1	2002	Water quality - Digestion for the determination of selected elements in water - Part 1: Aqua regia digestion	EN ISO 15587-1	2002
ISO 15587-2	2002	Water quality - Digestion for the determination of selected elements in water - Part 2: Nitric acid digestion	EN ISO 15587-2	2002

**iTeh STANDARD PREVIEW**  
**(standards.iteh.ai)**

SIST EN ISO 15586:2003

<https://standards.iteh.ai/catalog/standards/sist/b7ee6b02-6197-4ccd-8d68-e3f10f72c6fb/sist-en-iso-15586-2003>

---

---

**Water quality — Determination of trace  
elements using atomic absorption  
spectrometry with graphite furnace**

*Qualité de l'eau — Dosage des éléments traces par spectrométrie  
d'absorption atomique en four graphite*

**iTeh STANDARD PREVIEW**  
**(standards.iteh.ai)**

[SIST EN ISO 15586:2003](https://standards.iteh.ai/catalog/standards/sist/b7ee6b02-6197-4ccd-8d68-e3f10f72c6fb/sist-en-iso-15586-2003)

[https://standards.iteh.ai/catalog/standards/sist/b7ee6b02-6197-4ccd-8d68-  
e3f10f72c6fb/sist-en-iso-15586-2003](https://standards.iteh.ai/catalog/standards/sist/b7ee6b02-6197-4ccd-8d68-e3f10f72c6fb/sist-en-iso-15586-2003)



**PDF disclaimer**

This PDF file may contain embedded typefaces. In accordance with Adobe's licensing policy, this file may be printed or viewed but shall not be edited unless the typefaces which are embedded are licensed to and installed on the computer performing the editing. In downloading this file, parties accept therein the responsibility of not infringing Adobe's licensing policy. The ISO Central Secretariat accepts no liability in this area.

Adobe is a trademark of Adobe Systems Incorporated.

Details of the software products used to create this PDF file can be found in the General Info relative to the file; the PDF-creation parameters were optimized for printing. Every care has been taken to ensure that the file is suitable for use by ISO member bodies. In the unlikely event that a problem relating to it is found, please inform the Central Secretariat at the address given below.

**iTeh STANDARD PREVIEW**  
**(standards.iteh.ai)**

[SIST EN ISO 15586:2003](https://standards.iteh.ai/catalog/standards/sist/b7ee6b02-6197-4ccd-8d68-e3f10f72c6fb/sist-en-iso-15586-2003)

<https://standards.iteh.ai/catalog/standards/sist/b7ee6b02-6197-4ccd-8d68-e3f10f72c6fb/sist-en-iso-15586-2003>

© ISO 2003

All rights reserved. Unless otherwise specified, no part of this publication may be reproduced or utilized in any form or by any means, electronic or mechanical, including photocopying and microfilm, without permission in writing from either ISO at the address below or ISO's member body in the country of the requester.

ISO copyright office  
Case postale 56 • CH-1211 Geneva 20  
Tel. + 41 22 749 01 11  
Fax + 41 22 749 09 47  
E-mail [copyright@iso.org](mailto:copyright@iso.org)  
Web [www.iso.org](http://www.iso.org)

Published in Switzerland



## Contents

Page

Foreword .....	iv
1 Scope .....	1
2 Normative references .....	1
3 Principle .....	2
4 Interferences .....	3
5 Reagents .....	3
6 Apparatus .....	5
7 Sampling and pre-treatment .....	6
8 Chemical modification .....	8
9 Determination .....	10
10 Calibration .....	10
11 Calculation .....	11
12 Precision .....	12
13 Test report .....	17
Annex A (informative) Preparation of stock solutions, 1 000 mg/l .....	18
Annex B (normative) Digestion of sediment samples .....	20
Annex C (informative) Examples of instrumental parameter settings .....	22
Bibliography .....	23

## 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.

International Standards are drafted in accordance with the rules given in the ISO/IEC Directives, Part 2.

The main task of technical committees is to prepare International Standards. Draft International Standards adopted by the technical committees are circulated to the member bodies for voting. Publication as an International Standard requires approval by at least 75 % of the member bodies casting a vote.

Attention is drawn to the possibility that some of the elements of this document may be the subject of patent rights. ISO shall not be held responsible for identifying any or all such patent rights.

ISO 15586 was prepared by Technical Committee ISO/TC 147, *Water quality*, Subcommittee SC 2, *Physical, chemical and biochemical methods*.

## iTeh STANDARD PREVIEW (standards.iteh.ai)

[SIST EN ISO 15586:2003](https://standards.iteh.ai/catalog/standards/sist/b7ee6b02-6197-4ccd-8d68-e3f10f72c6fb/sist-en-iso-15586-2003)

<https://standards.iteh.ai/catalog/standards/sist/b7ee6b02-6197-4ccd-8d68-e3f10f72c6fb/sist-en-iso-15586-2003>

# Water quality — Determination of trace elements using atomic absorption spectrometry with graphite furnace

**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.

## 1 Scope

This International Standard includes principles and procedures for the determination of trace levels of: Ag, Al, As, Cd, Co, Cr, Cu, Fe, Mn, Mo, Ni, Pb, Sb, Se, Tl, V, and Zn in surface water, ground water, drinking water, wastewater and sediments, using atomic absorption spectrometry with electrothermal atomization in a graphite furnace. The method is applicable to the determination of low concentrations of elements.

The detection limit of the method for each element depends on the sample matrix as well as of the instrument, the type of atomizer and the use of chemical modifiers. For water samples with a simple matrix (i.e. low concentration of dissolved solids and particles), the method detection limits will be close to instrument detection limits. The minimum acceptable detection limit values for a 20- $\mu$ l sample volume are given in Table 1.

## 2 Normative references

SIST EN ISO 15586:2003

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

ISO 3696:1987, *Water for analytical laboratory use — Specification and test methods*

ISO 5667-1, *Water quality — Sampling — Part 1: Guidance on the design of sampling programmes*

ISO 5667-2, *Water quality — Sampling — Part 2: Guidance on sampling techniques*

ISO 5667-3, *Water quality — Sampling — Part 3: Guidance on the preservation and handling of water samples*

ISO 5667-4, *Water quality — Sampling — Part 4: Guidance on sampling from lakes, natural and man-made*

ISO 5667-5, *Water quality — Sampling — Part 5: Guidance on sampling of drinking water and water used for food and beverage processing*

ISO 5667-6, *Water quality — Sampling — Part 6: Guidance on sampling of rivers and streams*

ISO 5667-10, *Water quality — Sampling — Part 10: Guidance on sampling of waste waters*

ISO 5667-11, *Water quality — Sampling — Part 11: Guidance on sampling of groundwaters*

ISO 5667-15, *Water quality — Sampling — Part 15: Guidance on preservation and handling of sludge and sediment samples*

ISO 15587-1, *Water quality — Digestion for the determination of elements in water — Part 1: Aqua regia digestion*

ISO 15587-2, *Water quality — Digestion for the determination of elements in water — Part 2: Nitric acid digestion*

**Table 1 — Approximate characteristic masses, instrument detection limits and optimum working ranges for water samples using a 20 µl sample volume**

Element	Characteristic mass	Detection limit <sup>b</sup>	Optimum working range <sup>c</sup>
	$m_0^a$ µg	µg/l	µg/l
Ag	1,5	0,2	1 to 10
Al	10	1	6 to 60
As	15	1	10 to 100
Cd	0,7	0,1	0,4 to 4
Co	10	1	6 to 60
Cr	3	0,5	2 to 20
Cu	5 <sup>d</sup>	0,5	3 to 30
Fe	5	1	3 to 30
Mn	2,5	0,5	1,5 to 15
Mo	10	1	6 to 60
Ni	13	1	7 to 70
Pb	15	1	10 to 100
Sb	20	1	10 to 100
Se	25	2	15 to 150
Tl	10 <sup>d</sup>	1	6 to 60
V	35	2	20 to 200
Zn	0,8	0,5	0,5 to 5

<sup>a</sup> The characteristic mass ( $m_0$ ) of an element is the mass in picograms, corresponding to a signal of 0,004 4 s, using the integrated absorbance (peak area) for evaluation.

<sup>b</sup> The detection limits are calculated as three times (3 ×) the standard deviation of repeated measurements of a blank solution.

<sup>c</sup> The optimum working range is defined as the concentration range that corresponds to integrated absorbance readings between 0,05 s and 0,5 s.

<sup>d</sup> If Zeeman effect background correction is used, the  $m_0$ -value will be higher.

### 3 Principle

Water samples are preserved by acid treatment, filtered and preserved by addition of acid, or digested. Sediment samples are digested. A small sub-sample of sample solution is injected into a graphite furnace of an atomic absorption spectrometer. The furnace is electrically heated. By increasing the temperature stepwise, the sample is dried, pyrolyzed and atomized. Atomic absorption spectrometry is based on the ability of free atoms to absorb light. A light source emits light specific for a certain element (or elements). When the light beam passes through the atom cloud in the heated graphite furnace, the light is selectively absorbed by atoms of the chosen element(s). The decrease in light intensity is measured with a detector at a specific wavelength. The concentration of an element in a sample is determined by comparing the absorbance of the sample with the absorbance of calibration solutions. If necessary, interferences may be overcome by adding a matrix modifier to the samples before analysis, or by performing the calibration with the standard addition technique.

The results are given as the mass of analyte (micrograms, µg, or milligrams, mg) per litre of water, or per kilogram of dried material in sediments.