

SLOVENSKI STANDARD

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Nadomešča:
SIST ISO 17733:2005

Zrak na delovnem mestu - Določevanje živega srebra in anorganskih spojin živega srebra - Metoda atomske absorpcijske spektrometrije s hladnimi parami ali z atomsko fluorescenčno spektrometrijo

Workplace air - Determination of mercury and inorganic mercury compounds - Method by cold-vapour atomic absorption spectrometry or atomic fluorescence spectrometry

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Air des lieux de travail - Détermination du mercure et des composés inorganiques de mercure - Méthode par spectrométrie d'absorption atomique ou spectrométrie de fluorescence atomique de la vapeur froide

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INTERNATIONAL STANDARD

**ISO
17733**

Second edition
2015-12-15

Workplace air — Determination of mercury and inorganic mercury compounds — Method by cold-vapour atomic absorption spectrometry or atomic fluorescence spectrometry

*Air des lieux de travail — Détermination du mercure et des
composés inorganiques de mercure — Méthode par spectrométrie
d'absorption atomique ou spectrométrie de fluorescence atomique
de la vapeur froide*

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Contents

	Page
Foreword.....	vi
Introduction.....	vii
1 Scope.....	1
2 Normative references.....	1
3 Terms and definitions.....	2
3.1 General definitions.....	2
3.2 Particle size fraction definitions.....	3
3.3 Sampling definitions.....	3
3.4 Analytical definitions.....	4
3.5 Statistical terms.....	6
4 Principle.....	7
5 Interferences.....	7
6 Requirement.....	8
7 Reagents.....	8
8 Apparatus.....	10
8.1 Sampling equipment for diffusive sampling.....	10
8.2 Sampling equipment for pumped sampling.....	11
8.3 Laboratory apparatus.....	14
8.4 Analytical instrumentation.....	16
9 Occupational exposure assessment.....	21
9.1 General.....	21
9.2 Personal sampling.....	21
9.3 Static (area) sampling.....	21
9.4 Selection of measurement conditions and measurement pattern.....	22
9.4.1 General.....	22
9.4.2 Screening measurements of variation of concentration in time and/or space.....	22
9.4.3 Screening measurements of time-weighted average concentration and worst case measurements.....	22
9.4.4 Measurements near an emission source.....	22
9.4.5 Measurements for comparison with limit values and periodic measurements.....	22
10 Sampling.....	23
10.1 Selection of sampling method.....	23
10.1.1 Measurement of mercury vapour.....	23
10.1.2 Measurement of particulate inorganic mercury compounds.....	23
10.1.3 Measurement of mercury vapour and particulate inorganic mercury compounds.....	23
10.2 Consideration of temperature and pressure effects.....	24
10.2.1 Effect of temperature and pressure on the uptake rate of diffusive badges.....	24
10.2.2 Effect of temperature and pressure on volumetric flow rate in the pumped sampling method.....	24
10.2.3 Expression of results.....	24
10.3 Diffusive sampling.....	24
10.3.1 Selection and use of diffusive badges.....	24
10.3.2 Preparation for sampling.....	25
10.3.3 Sampling position.....	26
10.3.4 Sample collection.....	26
10.3.5 Transportation of samples.....	26
10.4 Pumped sampling.....	27
10.4.1 Preliminary considerations.....	27
10.4.2 Preparation for sampling.....	28

ISO 17733:2015(E)

10.4.3	Sampling position	29
10.4.4	Collection of samples	30
10.4.5	Transportation of samples	30
11	Analysis	31
11.1	General	31
11.2	Cleaning of glassware and plasticsware	31
11.3	Preparation of blank, sample and calibration solutions for analysis of diffusive badges	31
11.3.1	Preparation of blank and sample solutions	31
11.3.2	Preparation of calibration solutions	32
11.4	Preparation of blank, sample and calibration solutions for analysis of pumped samples	33
11.4.1	Preparation of blank and sample solutions	33
11.4.2	Preparation of calibration solutions	34
11.5	Instrumental analysis	35
11.5.1	Setting up the instrument	35
11.5.2	Introduction of solutions into the mercury cold-vapour generation system	36
11.5.3	Conditioning the mercury cold-vapour generation system	36
11.5.4	Check for contamination of the reagents and/or system	37
11.5.5	Calibration	37
11.5.6	Determination	38
11.6	Estimation of detection and quantification limits	39
11.6.1	Estimation of the instrumental detection limit	39
11.6.2	Estimation of the method detection limit and the quantification limit	39
11.7	Quality control	40
11.7.1	Reagent blanks and laboratory blanks	40
11.7.2	Quality control solutions	40
11.7.3	Certified reference materials (CRMs)	40
11.7.4	External quality assessment	40
11.8	Measurement uncertainty	40
12	Expression of results	41
12.1	Calculation of the volume of air samples	41
12.1.1	Diffusive sampling	41
12.1.2	Pumped sampling	41
12.2	Calculation of mercury in air concentrations	41
13	Method performance	42
13.1	General	42
13.2	Detection and quantification limits	42
13.2.1	Sampling with diffusive badges and analysis by cold-vapour atomic absorption spectrometry	42
13.2.2	Sampling with pumped sorbent tubes and analysis by cold-vapour atomic absorption spectrometry	42
13.2.3	Sampling with pumped sorbent tubes and analysis by cold-vapour atomic fluorescence spectrometry	42
13.2.4	Sampling with inhalable samplers and analysis by cold-vapour atomic absorption spectrometry	42
13.3	Upper limits of the analytical range	43
13.4	Blank values	43
13.5	Bias and precision	43
13.5.1	Analytical bias	43
13.5.2	Analytical precision	43
13.5.3	Overall bias of sampling and analysis methods	44
13.5.4	Overall precision of sampling and analysis methods	44
13.6	Overall uncertainty of sampling and analysis methods	44
13.7	Effects on sampler performance	45
13.7.1	Effect of exposure concentration and time on sampler performance	45
13.7.2	Effect of atmospheric temperature, pressure and humidity on sampler performance	45
13.7.3	Effect of air velocity on performance of diffusive badges	45

13.8	Sample uptake rate and sampling capacity of diffusive badges	46
13.9	Collection efficiency, breakthrough volume and sampling capacity of sorbent tubes	46
13.10	Storage stability	46
13.11	Mechanical strength	46
13.12	Interferences	46
14	Test report	47
14.1	Test record	47
14.2	Laboratory report	48
Annex A	(informative) Guidance on selection of a sampling method for mercury vapour	49
Annex B	(informative) Temperature and pressure corrections	50
Bibliography	52

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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).

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. Details of any patent rights identified during the development of the document will be in the Introduction and/or on the ISO list of patent declarations received (see www.iso.org/patents).

Any trade name used in this document is information given for the convenience of users and does not constitute an endorsement.

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 146, *Air quality*, Subcommittee SC 2, *Workplace atmospheres*.

This second edition cancels and replaces the first edition (ISO 17733:2004), of which it constitutes a minor revision. This edition corrects a typographical error in the title of 7.10.

Introduction

The health of workers in many industries is at risk through exposure by inhalation of mercury and inorganic mercury compounds. Industrial hygienists and other public health professionals need to determine the effectiveness of measures taken to control workers' exposure, and this is generally achieved by making workplace air measurements. This International Standard presents a method for making valid exposure measurements for mercury and inorganic mercury compounds in use in industry. It will be of benefit to: agencies concerned with health and safety at work; industrial hygienists and other public health professionals; analytical laboratories; industrial users of mercury and inorganic mercury compounds and their workers, etc.

The procedure described in this International Standard is based upon a method published by the United Kingdom Health and Safety Executive^[1], which was developed after a thorough review of sampling and analysis techniques available for determination of mercury and inorganic mercury compounds in air^[2]. This procedure has been fully validated and the resulting back-up data are freely available^[3, 4]. Similar methods have been published by the United States Occupational Safety and Health Administration (OSHA)^[5, 6] and the United States National Institute of Occupational Safety and Health (NIOSH)^[7].

It has been assumed in the drafting of this International Standard that the execution of its provisions and the interpretation of the results obtained are entrusted to appropriately qualified and experienced people.

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Workplace air — Determination of mercury and inorganic mercury compounds — Method by cold-vapour atomic absorption spectrometry or atomic fluorescence spectrometry

1 Scope

This International Standard specifies a procedure for determination of the time-weighted average mass concentration of mercury vapour and inorganic mercury compounds in workplace air. Mercury vapour is collected on a solid sorbent using either a diffusive badge or a pumped sorbent tube. Particulate inorganic mercury compounds, if present, are collected on a quartz fibre filter. Samples are analysed using either cold vapour atomic absorption spectrometry (CVAAS) or cold vapour atomic fluorescence spectrometry (CVAFS) after acid dissolution of the mercury collected.

This International Standard is applicable to the assessment of personal exposure to mercury vapour and/or particulate inorganic mercury compounds in air for comparison with long-term or short-term exposure limits for mercury and inorganic mercury compounds and for static (area) sampling.

The lower limit of the working range of the procedure is the quantification limit. This is determined by the sampling and analysis methods selected by the user, but it is typically in the range 0,01 µg to 0,04 µg of mercury (see [13.1](#)). The upper limit of the working range of the procedure is determined by the capacity of the diffusive badge, sorbent tube or filter used for sample collection, but it is at least 30 µg of mercury (see [13.2](#)). The concentration range of mercury in air for which this International Standard is applicable is determined in part by the sampling method selected by the user, but it is also dependent on the air sample volume.

The diffusive badge method is not applicable to measurements of mercury vapour when chlorine is present in the atmosphere, e.g. in chloralkali works, but chlorine does not interfere with the pumped sorbent tube method (see [13.12.1](#)). Gaseous organomercury compounds could cause a positive interference in the measurement of mercury vapour (see [13.12.2](#)). Similarly, particulate organomercury compounds and gaseous organomercury compounds adsorbed onto airborne particles could cause a positive interference in the measurement of particulate inorganic mercury compounds (see [13.12.3](#)).

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 648, *Laboratory glassware — Single-volume pipettes*

ISO 1042, *Laboratory glassware — One-mark volumetric flasks*

ISO 3585, *Borosilicate glass 3.3 — Properties*

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

ISO 7708:1995, *Air quality — Particle size fraction definitions for health-related sampling*

ISO 8655-1, *Piston-operated volumetric apparatus — Part 1: Terminology, general requirements and user recommendations*

ISO 8655-2, *Piston-operated volumetric apparatus — Part 2: Piston pipettes*

ISO 17733:2015(E)

ISO 8655-5, *Piston-operated volumetric apparatus — Part 5: Dispensers*

ISO 8655-6, *Piston-operated volumetric apparatus — Part 6: Gravimetric methods for the determination of measurement error*

EN 13205:2002, *Workplace atmospheres — Assessment of performance of instruments for measurement of airborne particle concentrations*

3 Terms and definitions

For the purposes of this document, the following terms and definitions apply.

3.1 General definitions

3.1.1

chemical agent

any chemical element or compound, on its own or admixed as it occurs in the natural state or as produced by any work activity, whether or not produced intentionally and whether or not placed on the market

Note 1 to entry: This definition is taken from the “Council Directive 98/24/EC of 7 April 1998 on the protection of the health and safety of workers from the risks related to chemical agents at work”.

[SOURCE: EN 1540^[8]]

3.1.2

breathing zone

<general> space around the worker's face from where he or she takes his or her breath

3.1.3

breathing zone

<technical> hemisphere (generally accepted to be 0,3 m in radius) extending in front of the human face, centred on the midpoint of a line joining the ears, whose base is a plane through this line, the top of the head and the larynx

Note 1 to entry: This definition is not applicable when respiratory protective equipment is used.

[SOURCE: Adapted from EN 1540^[8]]

3.1.4

exposure

<by inhalation> situation in which a chemical agent is present in air which is inhaled by a person

3.1.5

measuring procedure

procedure for sampling and analysing one or more chemical agents in the air, including storage and transportation of the sample

3.1.6

operating time

<of a sampling pump> period during which a sampling pump can be operated at specified flow rate and back-pressure without recharging or replacing the battery

[SOURCE: EN 1232^[9]]

3.1.7

time-weighted average concentration

TWA concentration

concentration of a chemical agent in the atmosphere, averaged over the reference period

Note 1 to entry: A more detailed discussion of TWA concentrations has been published by the American Conference of Government Industrial Hygienists (ACGIH)^[10].

3.1.8**limit value**

reference figure for concentration of a chemical agent in air

3.1.9**reference period**

specified period of time stated for the limit value of a specific chemical agent

Note 1 to entry: Examples of limit values for different reference periods are short-term and long-term exposure limits, such as those established by the ACGIH^[10].

3.1.10**workplace**

defined area or areas in which work activities are carried out

[SOURCE: EN 1540^[8]]

3.2 Particle size fraction definitions**3.2.1****inhalable convention**

target specification for sampling instruments when the inhalable fraction is of interest

[SOURCE: ISO 7708:1995, 2.4]

3.2.2**inhalable fraction**

mass fraction of total airborne particles which is inhaled through the nose and mouth

Note 1 to entry: The inhalable fraction depends on the speed and direction of air movement, on breathing rate and other factors.

[SOURCE: ISO 7708:1995, 2.3] <https://standards.iteh.ai/catalog/standards/sist/89b19d9d-05e7-478f-9571-0ef23e1a0ab4/sist-iso-17733-2018>

3.2.3**total airborne particles**

all particles surrounded by air in a given volume of air

Note 1 to entry: Because all measuring instruments are size-selective to some extent, it is often impossible to measure the concentration of total airborne particles.

[SOURCE: ISO 7708:1995, 2.13]

3.3 Sampling definitions**3.3.1****diffusive badge****dosimeter****badge-type diffusive sampler****passive badge**

diffusive sampler in which the gas or vapour passes to the sorbent by permeation through a thin solid membrane or diffusion across a porous membrane

Note 1 to entry: The cross-sectional area of a diffusive badge is large in relation to the internal air gap.

3.3.2**diffusive sampler****passive sampler**

device which is capable of taking samples of gases or vapours from the atmosphere at a rate controlled by a physical process such as gaseous diffusion through a static air layer or permeation through a membrane, but which does not involve the active movement of air through the sampler

ISO 17733:2015(E)

[SOURCE: EN 838^[11]]

3.3.3**personal sampler**

device attached to a person that samples air in the breathing zone

[SOURCE: EN 1540^[8]]

3.3.4**personal sampling**

process of sampling carried out using a personal sampler

[SOURCE: EN 1540^[8]]

3.3.5**sampler**

device for collecting airborne particles

Note 1 to entry: Instruments used to collect airborne particles are frequently referred to by a number of other terms, e.g. sampling heads, filter holders, filter cassettes, etc.

3.3.6**pumped sorbent tube**

tube, usually made of metal or glass, containing an active sorbent or reagent-impregnated support, through which sampled atmosphere is passed at a rate controlled by an air sampling pump

[SOURCE: EN 1076^[12]]

3.3.7**static sampler****area sampler**

device, not attached to a person, that samples air in a particular location

3.3.8**static sampling****area sampling**

process of air sampling carried out using a static sampler

3.4 Analytical definitions**3.4.1****blank solution**

solution prepared by taking a reagent blank, laboratory blank or field blank through the same procedure used for sample preparation

3.4.2**calibration blank solution**

calibration solution prepared without the addition of any working standard solution

Note 1 to entry: The concentration of mercury in the calibration blank solution is taken to be zero.

3.4.3**calibration solution**

solution prepared by dilution of the working standard solution, containing mercury at a concentration that is suitable for use in calibration of the analytical instrument

Note 1 to entry: The technique of matrix-matching is normally used when preparing calibration solutions.

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3.4.4**field blank**

sorbent capsule, filter or sorbent tube that is taken through the same handling procedure as a sample, except that it is not used for sampling

Note 1 to entry: For the purposes of this International Standard, the field blank is loaded into a diffusive badge, sampler or sorbent tube holder, transported to the sampling site and then returned to the laboratory for analysis.

3.4.5**laboratory blank**

unused sorbent capsule, filter or sorbent tube, taken from the same batch used for sampling, that does not leave the laboratory

3.4.6**linear dynamic range**

range of concentrations over which the calibration curve for mercury is linear

Note 1 to entry: The linear dynamic range extends from the detection limit to the onset of calibration curvature.

3.4.7**matrix interference****matrix effect****non-spectral interference**

interference of a non-spectral nature caused by a difference between the matrices of the calibration and test solutions

3.4.8**matrix-matching**

technique used to minimize the effect of matrix interferences on analytical results, involving the preparation of calibration solutions in which the concentrations of acids and other major solutes are matched with those in the test solutions

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3.4.9**reagent blank**

combination of all reagents used in sample dissolution, in the same quantities used for preparation of laboratory blank, field blank and sample solutions

3.4.10**sample dissolution**

process of obtaining a solution containing mercury from a sample, which might or might not involve complete dissolution of the sample

3.4.11**sample preparation**

all operations carried out on a sample, after transportation and storage, to prepare it for analysis, including transformation of the sample into a measurable state, where necessary

3.4.12**sample solution**

solution prepared from a sample by the process of sample dissolution

Note 1 to entry: A sample solution might need to be subjected to further operations, e.g. dilution, in order to produce a test solution that is ready for analysis.

3.4.13**stock standard solution**

solution, used for preparation of the calibration solutions, containing mercury at a certified concentration that is traceable to national standards