



# SLOVENSKI STANDARD SIST ISO 16000-23:2019

01-september-2019

Nadomešča:  
SIST ISO 16000-23:2013

---

**Notranji zrak - 23. del: Preskus lastnosti vpojnih gradbenih materialov, ki znižujejo koncentracije formaldehida in drugih karbonilnih spojin**

Indoor air - Part 23: Performance test for evaluating the reduction of formaldehyde and other carbonyl compounds concentrations by sorptive building materials

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

Air intérieur - Partie 23: Essai de performance pour l'évaluation de la réduction des concentrations en formaldéhyde par des matériaux de construction sorptifs

<https://standards.iteh.ai/catalog/standards/sist/45c2702b-742f-4fe5-a011-87192a02d6be/sist-iso-16000-23-2019>

**Ta slovenski standard je istoveten z: ISO 16000-23:2018**

---

**ICS:**

13.040.20	Kakovost okoljskega zraka	Ambient atmospheres
91.100.01	Gradbeni materiali na splošno	Construction materials in general

**SIST ISO 16000-23:2019**

**en**

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

SIST ISO 16000-23:2019

<https://standards.iteh.ai/catalog/standards/sist/45c2702b-742f-4fe5-a011-87192a02d6be/sist-iso-16000-23-2019>

INTERNATIONAL  
STANDARD

ISO  
16000-23

Second edition  
2018-12

---

---

**Indoor air —**

Part 23:

**Performance test for evaluating the  
reduction of formaldehyde and other  
carbonyl compounds concentrations  
by sorptive building materials**

iTeh STANDARD PREVIEW

(standards.iteh.ai)

*Air intérieur —*

*Partie 23: Essai de performance pour l'évaluation de la réduction des  
concentrations en formaldéhyde et autres composés carbonylés par  
des matériaux de construction sorptifs*

<https://standards.iteh.ai/catalog/standards/sist/45c2702b-742f-40c9-a011-87192a02d6be/sist-iso-16000-23-2019>



Reference number  
ISO 16000-23:2018(E)

© ISO 2018

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

SIST ISO 16000-23:2019

<https://standards.iteh.ai/catalog/standards/sist/45c2702b-742f-4fe5-a011-87192a02d6be/sist-iso-16000-23-2019>



### **COPYRIGHT PROTECTED DOCUMENT**

© ISO 2018

All rights reserved. Unless otherwise specified, or required in the context of its implementation, no part of this publication may be reproduced or utilized otherwise in any form or by any means, electronic or mechanical, including photocopying, or posting on the internet or an intranet, without prior written permission. Permission can be requested from either ISO at the address below or ISO's member body in the country of the requester.

ISO copyright office  
CP 401 • Ch. de Blandonnet 8  
CH-1214 Vernier, Geneva  
Phone: +41 22 749 01 11  
Fax: +41 22 749 09 47  
Email: [copyright@iso.org](mailto:copyright@iso.org)  
Website: [www.iso.org](http://www.iso.org)

Published in Switzerland

# Contents

Page

<b>Foreword</b> .....	<b>v</b>
<b>Introduction</b> .....	<b>vi</b>
<b>1 Scope</b> .....	<b>1</b>
<b>2 Normative references</b> .....	<b>1</b>
<b>3 Terms and definitions</b> .....	<b>1</b>
<b>4 Symbols</b> .....	<b>4</b>
<b>5 Principle</b> .....	<b>4</b>
<b>6 Apparatus and materials</b> .....	<b>5</b>
<b>7 Test conditions</b> .....	<b>6</b>
7.1 General.....	6
7.2 Test conditions to determine concentration reduction performance.....	6
7.2.1 Temperature and relative humidity.....	6
7.2.2 Supply air quality and background concentration.....	6
7.2.3 Mass transfer coefficient.....	7
7.2.4 Air change rate.....	7
7.2.5 Supply air concentration.....	7
7.3 Factors affecting the concentration reduction performance.....	7
7.3.1 General.....	7
7.3.2 Temperature and humidity.....	7
7.3.3 Concentration of target compound(s) in supply air.....	7
7.3.4 Interfering gases.....	8
<b>8 Verification of test conditions</b> .....	<b>8</b>
8.1 Monitoring of test conditions.....	8
8.2 Airtightness of test chamber.....	8
8.3 Air change rate in test chamber.....	8
8.4 Efficiency of the internal test chamber air mixing.....	8
8.5 Recovery.....	8
<b>9 Preparation of test chamber</b> .....	<b>9</b>
<b>10 Preparation of test specimens</b> .....	<b>9</b>
<b>11 Test method</b> .....	<b>9</b>
11.1 Background concentration and spiked supply air.....	9
11.2 Placing the test specimen in the test chamber.....	9
11.3 Time intervals for measurement of test chamber concentration.....	9
11.3.1 Test for target compound concentration reduction.....	9
11.3.2 Test for long-term reduction performance.....	10
11.3.3 Factors affecting the reduction performance.....	10
11.4 Air sampling.....	10
<b>12 Determination of target compound(s)</b> .....	<b>10</b>
<b>13 Expression of results</b> .....	<b>10</b>
13.1 Calculation of area-specific reduction rate.....	10
13.2 Calculation of equivalent ventilation rate per area.....	11
13.3 Calculation of total mass per area of sorption and saturation mass per area.....	11
<b>14 Test report</b> .....	<b>11</b>
<b>Annex A (normative) Sample tube test for long-term reduction performance</b> .....	<b>13</b>
<b>Annex B (normative) System for quality assurance and quality control</b> .....	<b>17</b>
<b>Annex C (informative) Example measurements of construction materials</b> .....	<b>19</b>

**ISO 16000-23:2018(E)**

<b>Annex D (informative) Example procedure for long-term reduction performance</b> .....	<b>24</b>
<b>Bibliography</b> .....	<b>27</b>

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

[SIST ISO 16000-23:2019](https://standards.iteh.ai/catalog/standards/sist/45c2702b-742f-4fe5-a011-87192a02d6be/sist-iso-16000-23-2019)

<https://standards.iteh.ai/catalog/standards/sist/45c2702b-742f-4fe5-a011-87192a02d6be/sist-iso-16000-23-2019>

## 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](http://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](http://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 voluntary nature of standards, the meaning of ISO specific terms and expressions related to conformity assessment, as well as information about ISO's adherence to the World Trade Organization (WTO) principles in the Technical Barriers to Trade (TBT) see the following URL: [www.iso.org/iso/foreword.html](http://www.iso.org/iso/foreword.html).

This document was prepared by Technical Committee ISO/TC 146, *Air quality*, Subcommittee SC 6, *Indoor air*.

Any feedback or questions on this document should be directed to the user's national standards body. A complete listing of these bodies can be found at [www.iso.org/members.html](http://www.iso.org/members.html).

This second edition cancels and replaces the first edition (ISO 16000-23:2009), which has been technically revised. The main changes compared to the previous edition are as follows.

- The target chemical compounds subject to this document have been changed from formaldehyde only to formaldehyde and other carbonyl compounds.

A list of all parts in the ISO 16000 series can be found on the ISO website.

## ISO 16000-23:2018(E)

### Introduction

Sorptive building materials have been marketed in the form of sheet and board products for removing airborne pollutants via physical sorption or chemical reaction.

Harmonized test methods for evaluating sorptive effects are important for quantitative performance assessment of sorptive building materials that are used for reducing levels of indoor air contaminants.

This document specifies procedures for evaluating the performance of sorptive building materials in reducing indoor air formaldehyde and other carbonyl compounds concentrations over time.

The performance of sorptive building materials is evaluated by measuring the area-specific reduction rate and the saturation mass per area. The former directly indicates material performance with respect to formaldehyde and other carbonyl compounds concentration reduction at a point in time; the latter relates to the ability of a product to maintain such a performance. This is affected by a number of factors and the performance test in conjunction with the standardized sampling, storage of samples and preparation of test specimens has objectives to provide manufacturers, builders, and end users with comparative performance data of sorptive building materials useful for the evaluation of the impact on the indoor air quality, and to promote the development of improved products. Specific test conditions are therefore defined in this document.

This document can be applied to most sorptive building materials used indoors and to formaldehyde and other carbonyl compounds used as an indoor air contaminant. This method does not apply to materials capable of decomposing target compound(s) by catalytic reaction in the presence of ultraviolet and visible rays.

This document is based on the test chamber method as specified in ISO 16000-9.

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

[SIST ISO 16000-23:2019  
https://standards.iteh.ai/catalog/standards/sist/45c2702b-742f-4fe5-a011-87192a02d6be/sist-iso-16000-23-2019](https://standards.iteh.ai/catalog/standards/sist/45c2702b-742f-4fe5-a011-87192a02d6be/sist-iso-16000-23-2019)



# Indoor air —

## Part 23:

# Performance test for evaluating the reduction of formaldehyde and other carbonyl compounds concentrations by sorptive building materials

## 1 Scope

This document specifies a general laboratory test method for evaluating the reduction of formaldehyde and other carbonyl compounds (aldehydes and ketones) concentrations by sorptive building materials. This method applies to boards, wallpapers, carpets, paint products, and other building materials. The sorption of those target compounds, i.e. formaldehyde and other carbonyl compounds, can be brought about by adsorption, absorption and chemisorption.

The method specified in this document employs formaldehyde and other carbonyl compound spiked supply air to determine the performance of building materials in reducing formaldehyde and other carbonyl compounds concentrations.

This document is based on the test chamber method specified in ISO 16000-9. Sampling, transport and storage of materials to be tested and preparation of test specimens are specified in ISO 16000-11. Air sampling and analytical methods for the determination of formaldehyde and other carbonyl compounds are specified in ISO 16000-3, which is part of the complete procedure.

This document applies to the determination of formaldehyde and other carbonyl compounds, such as formaldehyde, acetaldehyde, acetone, benzaldehyde, butyraldehyde, valeraldehyde, 2,5-dimethylbenzaldehyde, capronaldehyde, isovaleraldehyde, propionaldehyde, o-tolualdehyde, m-tolualdehyde, p-tolualdehyde.

## 2 Normative references

The following documents are referred to in the text in such a way that some or all of their content constitutes requirements 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 16000-3, *Indoor air — Part 3: Determination of formaldehyde and other carbonyl compounds in indoor air and test chamber air — Active sampling method*

ISO 16000-6, *Indoor air — Part 6: Determination of volatile organic compounds in indoor and test chamber air by active sampling on Tenax TA sorbent, thermal desorption and gas chromatography using MS or MS-FID*

ISO 16000-9, *Indoor air — Part 9: Determination of the emission of volatile organic compounds from building products and furnishing — Emission test chamber method*

ISO 16000-11, *Indoor air — Part 11: Determination of the emission of volatile organic compounds from building products and furnishing — Sampling, storage of samples and preparation of test specimens*

## 3 Terms and definitions

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

**ISO 16000-23:2018(E)**

ISO and IEC maintain terminological databases for use in standardization at the following addresses:

- ISO Online browsing platform: available at <https://www.iso.org/obp>
- IEC Electropedia: available at <https://www.electropedia.org/>

**3.1**  
**area-specific reduction rate**  
 $q_{\text{ads}}$   
mass of *target compound(s)* (3.14) sorbed per time unit per area at the specified *elapsed time* (3.4) from the test start

**3.2**  
**breakthrough time**  
 $t_b$   
time at which the *target compound* (3.14) concentration in the air eluting from the sample tube reaches 0,5 % of the concentration in the supplied air

**3.3**  
**degradation coefficient**  
ratio of the mass of *target compound(s)* (3.14) removed by the initial performance divided by the mass of the same compound(s) lost by deterioration

**3.4**  
**elapsed time**  
time from the start of test to the start of air sampling

Note 1 to entry: Elapsed time is expressed in hours or days.

**3.5**  
**equivalent ventilation rate per area**  
 $qV_{\text{eq}}$   
increased clean air ventilation rate giving the same reduction in *target compound* (3.14) concentration as the building material

**3.6**  
**guideline concentration**  
corresponding threshold indoor air concentration for *target compound(s)* (3.14) as specified by the WHO or an appropriate national standards body

**3.7**  
**half-lifetime**  
time elapsed from the start of the test until the *target compound* (3.14) concentration reduction performance decreases to one half of the initial concentration reduction performance

**3.8**  
**lifetime**  
 $t_t$   
time period over which the product continues to reduce *target compound* (3.14) concentrations

Note 1 to entry: The lifetime is given in days or years.

Note 2 to entry: The lifetime is estimated from the *area-specific reduction rate* (3.1) and sorption capacity measured by the sample tube test.

**3.9**  
**mass transfer coefficient**  
 $k_a$   
coefficient arising from the concentration difference between the test specimen and ambient air over its surface

Note 1 to entry: Mass transfer coefficient is expressed in metres per hour (m/h).

**3.10****recovery**

measured mass of *target compound(s)* (3.14) in the air leaving the test chamber with no sample present conditioned over a given time period divided by the mass of target compound(s) added to the test chamber in the same time period

Note 1 to entry: The recovery is expressed as a percentage and provides information about the performance of the entire method.

**3.11****saturation mass per area**

$\rho_{Aa}$

theoretical maximum mass of *target compound(s)* (3.14) that could be removed per area of the sorptive material

Note 1 to entry: Saturation mass per area is expressed in micrograms per area. It corresponds to the total mass per area of sorption at the *half-lifetime* (3.7), or is extrapolated from the *sorption capacity* (3.12) derived from the test referenced in Annex A.

**3.12****sorption capacity**

$w_s$

total mass of *target compound(s)* (3.14) sorbed at *breakthrough time* (3.2) per mass of sorbent

Note 1 to entry: Sorption capacity is expressed in micrograms per gram and is measured using the test specified in Annex A.

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

**3.13****supply air concentration**

$\rho_s$

mass concentration of *target compound(s)* (3.14) in the air for supply to the test chamber

<https://standards.iteh.ai/catalog/standards/sist/45c2702b-742f-4fe5-a011-87192a02d6be/sist-iso-16000-23-2019>

**3.14****target compound**

formaldehyde or other carbonyl compound in indoor air

**3.15****test chamber concentration**

concentration of *target compound(s)* (3.14) measured at the outlet of a test chamber, derived by dividing the mass of the target compound(s) sampled at the outlet of the chamber by the volume of sampled air

**3.16****total mass per area of sorption**

$\rho_A$

integral over time of *area-specific reduction rate* (3.1) from the start of the test to the specified *elapsed time* (3.4) measured with the test chamber

Note 1 to entry: Total mass per area of sorption is expressed in micrograms per area.

**3.17****air sampling period**

period of time during which air is sampled from the outlet of the test chamber using sampling tubes or other devices

## ISO 16000-23:2018(E)

## 4 Symbols

Symbol	Meaning	Unit
$A$	surface area of test specimen	square metres
$q_{ads}$	Area-specific reduction rate	micrograms per square metre per hour
$qV_a$	air flow rate per area	cubic metres per square metre per hour
$qV_{eq}$	equivalent ventilation rate	cubic metres per square metre per hour
$k_a$	mass transfer coefficient determined using water vapour	metres per hour
$L$	product loading factor	square metres per cubic metre
$m$	actual mass of test specimen in sample tube	grams
$n$	air change rate	changes per hour
$q_c$	air flow rate of test chamber	cubic metres per hour
$q_s$	air flow rate of sample tube	litres per minute
$t_b$	breakthrough time	minutes
$t_e$	elapsed time	hours or days
$t_{lt}$	lifetime of the pollutant-removing performance	hours, days or years
$V$	air volume of test chamber	cubic metres
$w_s$	sorption capacity measured by sample tube	micrograms per gram
$\rho_A$	mass of sorptive material per area (surface density)	grams per square metre
$\rho_{Aa}$	saturation mass per area	micrograms per square metre
$\rho_{Ac}$	total mass per area of sorption measured by chamber test	micrograms per square metre
$\rho_{in, t}$	concentration of target compound(s) at test chamber inlet at elapsed time $t$	micrograms per cubic metre
$\rho_{out, t}$	test chamber concentration at elapsed time $t$	micrograms per cubic metre
$\rho_s$	supply air concentration in sample tube	micrograms per cubic metre

## 5 Principle

The performance of a building material in reducing the concentration of target compound(s), i.e. formaldehyde and other carbonyl compounds, from the indoor air is evaluated by monitoring the reduction of the concentration of these substances in the air of a test chamber containing a specimen of the test material. The test assesses both the initial performance of the material and how long that performance is maintained.

In this test method, target compound spiked air is supplied into the test chamber. The spiked air should be prepared at approximately the guideline concentration level for the target compound(s) in indoor air. Reference to the WHO or an appropriate national standards body can be made if this is clearly highlighted in the test report.

Performance is determined by monitoring the difference in the concentration of target compound(s) at the inlet and outlet of the test chamber. Testing should be carried out for the half-lifetime, i.e. until the concentration reduction performance of target compound(s) drops to one half of the performance recorded at the start of the test under constant ventilation conditions. With this test, the area-specific reduction rate,  $\rho_{ads}$ , and total mass per area of sorption,  $\rho_{Ac}$ , at the half-lifetime are determined. The value measured for  $\rho_{Ac}$  at the half-lifetime is defined as the saturation mass per area,  $\rho_{Aa}$ .

If a test material continues to reduce target compound concentrations for longer than 28 days, the alternative methods specified in [Annex A](#) for determining  $\rho_{Aa}$  may be applied.

The performance of sorptive building materials is mainly determined by the target compound concentration, the mass transfer coefficient of target compound(s) to the surface, and the sorption characteristics of the building materials themselves (adsorption isotherm, diffusion resistance, and so