

This is a preview of "ISO 16000-8:2007". [Click here to purchase the full version from the ANSI store.](#)

First edition
2007-06-15

Corrected version
2007-10-15

Indoor air —

Part 8:

Determination of local mean ages of air in buildings for characterizing ventilation conditions

Air intérieur —

*Partie 8: Détermination des âges moyens locaux de l'air dans des
bâtiments pour caractériser les conditions de ventilation*



Reference number
ISO 16000-8:2007(E)

© ISO 2007

This is a preview of "ISO 16000-8:2007". [Click here to purchase the full version from the ANSI store.](#)

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.



COPYRIGHT PROTECTED DOCUMENT

© ISO 2007

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
Web www.iso.org

Published in Switzerland

This is a preview of "ISO 16000-8:2007". Click here to purchase the full version from the ANSI store.

Contents

Page

Foreword.....	iv
Introduction	vi
1 Scope	1
2 Normative references	1
3 Terms and definitions.....	1
4 Principles of tracer gas measurements for determining of ventilation conditions	2
4.1 General principles.....	2
4.2 Selected tracer gas methods	3
5 Measurement planning.....	3
5.1 General.....	3
5.2 Identification of the ventilated system	4
5.3 Identification of zones	4
5.4 Choice of measurement method	4
5.5 Determination of measurement points	5
6 Tracer gases and equipment for determining ventilation conditions	6
6.1 Choice of tracer gas	6
6.2 Tracer gas concentration standard.....	6
6.3 Equipment for feeding the tracer gas	6
6.4 Sampling the tracer gas	7
6.5 Determination of tracer gas concentration	8
7 Measurement methods.....	8
7.1 Decay method	8
7.2 Active homogeneous emission method	10
7.3 Passive homogeneous emission method	11
8 Application of results	12
9 Test report	12
Annex A (informative) Explanation of some terms and definitions	13
Annex B (informative) General requirements of tracer gases, background contents and methods of detection of the most important ones	14
Annex C (informative) Estimation of uncertainty of measured local mean ages of air.....	17
Annex D (informative) Examples of measurement procedure, calculation and estimation of uncertainty.....	20
Annex E (informative) Air quality relevance of local mean age of air and expression of results	37
Bibliography	41

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 16000-8 was prepared by Technical Committee ISO/TC 146, *Air quality*, Subcommittee SC 6, *Indoor air*.

ISO 16000 consists of the following parts, under the general title *Indoor air* :

- *Part 1: General aspects of sampling strategy*
- *Part 2: Sampling strategy for formaldehyde*
- *Part 3: Determination of formaldehyde and other carbonyl compounds — Active sampling method*
- *Part 4: Determination of formaldehyde — Diffusive sampling method*
- *Part 5: Sampling strategy for volatile organic compounds (VOCs)*
- *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/FID*
- *Part 7: Sampling strategy for determination of airborne asbestos fibre concentrations*
- *Part 8: Determination of local mean ages of air in buildings for characterizing ventilation conditions*
- *Part 9: Determination of the emission of volatile organic compounds from building products and furnishing — Emission test chamber method*
- *Part 10: Determination of the emission of volatile organic compounds from building products and furnishing — Emission test cell method*
- *Part 11: Determination of the emission of volatile organic compounds from building products and furnishing — Sampling, storage of samples and preparation of test specimens*
- *Part 12: Sampling strategy for polychlorinated biphenyls (PCBs), polychlorinated dibenzo-p-dioxins (PCDDs), polychlorinated dibenzofurans (PCDFs) and polycyclic aromatic hydrocarbons (PAHs)*
- *Part 13: Determination of total (gas and particle-phase) polychlorinated dioxin-like biphenyls (PCBs) and polychlorinated dibenzo-p-dioxins/dibenzofurans (PCDDs/PCDFs) — Collection on sorbent-backed filters*

This is a preview of "ISO 16000-8:2007". [Click here to purchase the full version from the ANSI store.](#)

- *Part 14: Determination of total (gas and particle-phase) polychlorinated dioxin-like biphenyls (PCBs) and polychlorinated dibenzo-p-dioxins/dibenzofurans (PCDDs/PCDFs) — Extraction, clean-up and analysis by high-resolution gas chromatography/mass spectrometry*
- *Part 15: Sampling strategy for nitrogen dioxide (NO₂)*
- *Part 16: Detection and enumeration of moulds — Sampling by filtration*
- *Part 17: Detection and enumeration of moulds — Culture-based method*
- *Part 23: Performance test for evaluating the reduction of formaldehyde concentrations by sorptive building materials*

The following parts are under preparation:

- *Part 18: Detection and enumeration of moulds — Sampling of moulds by impaction*
- *Part 24: Performance test for evaluating the reduction of the concentrations of volatile organic compounds and carbonyl compounds (except formaldehyde) by sorptive building materials*
- *Part 25: Determination of the emission of semi-volatile organic compounds by building products — Micro-chamber method*

Furthermore, the two International Standards, ISO 16017-1 on pumped sampling and ISO 16017-2 on diffusive sampling, focus on volatile organic compound (VOC) measurements.

This corrected version of ISO 16000-8:2007 incorporates the following corrections:

- Equation (D.2) (and the line of text immediately preceding this equation), Equation (D.5) and Equation (D.11) have been corrected.
- In Clause 2, the reference to the ISO/IEC Guide 98 was changed and footnote 1) was added.
- In 7.1.5, 7.2.5, 7.3.4, C.1.1 and D.1, the reference to ISO/IEC Guide 98:1995 was changed to GUM:1995.
- In B.3, footnote 1) was renumbered as footnote 2).

Introduction

An adequate air change is of fundamental importance for indoor air quality. Proper ventilation of all buildings is necessary for the health and comfort of the occupants as well as to protect against damage (e.g. due to excessive atmospheric humidity). However, the present-day use of tightly sealed windows, for example in residential and office buildings, can lead to insufficient ventilation. This situation in turn may lead to an increase in the concentration of substances emitted indoors. Manual ventilation by the occupants or the use of mechanical ventilation systems is thus required. However, excessive ventilation can lead to discomfort and increased energy consumption.

Building regulations make provision for ventilation to control moisture and other pollutants. Measurements of the ventilation conditions allow confirmation of whether these requirements are met in practice. Knowledge of the ventilation conditions is important in order to be able to analyse the possible causes of poor indoor air quality. Thus, ideally, sampling and analysis of contaminants indoors should be accompanied by ventilation measurement, making it possible to estimate the strengths of contaminant sources.

This part of ISO 16000 describes the use of single tracer gas for determining the age of air in a building which is naturally or mechanically ventilated. The age of air is an important factor in assessing the adequacy of ventilation. The concept local mean age of air (and its inverse the local effective air change rate) is used for assessing the ventilation conditions in the building. The mean age of air in a building zone indicates the average time the air in a zone has spent in the building accumulating contaminants. It is closely connected to the time it takes to exchange the air within a zone. The concentration of a contaminant released from continuous indoor sources increases with the length of time the air has spent indoors. The lower the age of air in a space, the lower the concentration. Normally, the ventilation air is supplied at selected parts of the building envelope, and seeks its way to the different building spaces. Thus, before the ventilation air reaches a specific room, a significant portion of the air may have spent time in other rooms, accumulating contaminants. Therefore, the local mean age of air, which describes how long the air in a particular space has spent indoors, needs to be considered in relation to air quality.

The purpose of this part of ISO 16000 is to describe the use of ventilation measurement techniques suitable for air quality studies. For this purpose, the ventilation rate and the air distribution patterns in the building should be measured for representative conditions of interest.

ISO 12569 describes the use of tracer gas dilution for determining the air change rate in a single zone. The procedures for tracer gas dilution include concentration decay, constant injection and constant concentration. ISO 12569 should be used when studying the thermal performance of buildings.

In the case where a zone exchanges air only with the outside (i.e. has no inflow of air from other parts of the building), the tracer gas concentration within the zone can be characterized with a single value, and the ventilation conditions are constant over the measurement period; this part of ISO 16000 and ISO 12569 should, in theory, provide identical results. The methods described in this part of ISO 16000 can, however, be used beyond these conditions, for example in spaces with several zones, which may exchange air with each other, and in cases where the ventilation conditions vary during the measurement period.