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Resilient, textile and laminate floor coverings — Test method for volatile organic compound (VOC) emissions

Revêtements de sol résilients, textiles ou stratifiés — Méthode d'essai des émissions de composés organiques volatils (COV)

Reference number
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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

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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.

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 10580 was prepared by Technical Committee ISO/TC 219, *Floor coverings*.

Introduction

The health and comfort of the occupants of indoor spaces are influenced by the indoor climate that exists in a room (in particular, ventilation, temperature and relative humidity) and by potential indoor air pollutants. Such pollutants may have a variety of sources. International bodies have already dealt with the assessment of VOC emissions from building products. The results of their work have been published in reports, which contain sufficiently detailed information to be considered as “pre-normative” documents. The main purpose of this International Standard is to give guidance to those organizations that protect consumers from exposure to chemical pollutants (i.e. carcinogens, teratogens, irritants, odours) and resulting adverse health effects which could be caused by chemical emissions from materials. This protection can be effectively achieved by supporting the market demand for low-emitting flooring materials. In response to the need for improved consumer protection, different kinds of systems for evaluating material emissions have been developed in many countries and by industrial organizations.

This International Standard refers to existing international test methods related to VOC emissions from textile, resilient and laminate floor coverings.

Please be aware that some countries have legal regulations and requirements for emissions of VOC and formaldehyde based on mandatory test methods other than this method. The test method for VOC and formaldehyde described in this International Standard offers an alternative, but is not intended to replace existing legislative test methods.

Resilient, textile and laminate floor coverings — Test method for volatile organic compound (VOC) emissions

1 Scope

This International Standard specifies a general laboratory test method for determination of the area-specific emission rate of volatile organic compounds (VOC) and/or the vapour-phase VOC concentration under defined climate conditions.

This International Standard describes emission test chambers used for the determination of the emission of volatile organic compounds from resilient, textile and laminate floor coverings.

A description of an emission test chamber is given in Annex A. Annex B provides details of the evaluation systems used in Europe and North America, respectively.

Studies of the emission of volatile organic compounds from unused (pre-installation) floor covering products in test chambers require proper handling of the product prior to testing, and during the testing period. For each type of floor covering product, specifications are given for the sampling procedures, transport conditions and storage parameters that can affect emissions of volatile organic compounds. For each type of floor covering product, the preparation of a test specimen is prescribed.

NOTE Depending on the non-homogeneity of the product, it can be necessary to make measurements on multiple test specimens from the same sample in order to determine the specific emission rate.

2 Normative references

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 16000-3, *Indoor air — Part 3: Determination of formaldehyde and other carbonyl compounds — Active sampling method*

ISO 16000-6:2004, *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/FID*

ISO 16000-9:2006, *Indoor air — Part 9: Determination of the emission of volatile organic compounds from building products and furnishing — Emission test chamber method*

ISO 16000-11:2006, *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*

ISO 16017-1:2000, *Indoor, ambient and workplace air — Sampling and analysis of volatile organic compounds by sorbent tube/thermal desorption/capillary gas chromatography — Part 1: Pumped sampling*

ASTM D5197, *Standard Test Method for Determination of Formaldehyde and Other Carbonyl Compounds in Air (Active Sampler Methodology)*

3 Terms and definitions

For the purposes of this document, the following terms and definitions (as presented in ISO 16000-9 and ISO 16000-11) apply.

3.1
air change rate
ratio of the volume of clean air brought into the emission test chamber per hour to the free emission test chamber volume measured in identical units

3.2
air flow rate
air volume entering into the emission test chamber per time

3.3
air velocity
air speed over the surface of the test specimen

3.4
area-specific air flow rate
ratio between the supply-air flow rate and the area of the test specimen

3.5
emission test chamber
enclosure with controlled operational parameters for the determination of volatile organic compounds emitted from floor coverings

3.6
emission test chamber concentration
concentration of a specific volatile organic compound, VOC$_i$, (or group of volatile organic compounds) measured in the emission test chamber outlet

3.7
product loading factor
ratio of exposed surface area of the test specimen and the free emission test chamber volume

3.8
recovery
measured mass of a target volatile organic compound in the air leaving the emission test chamber during a given time period divided by the mass of target volatile organic compound added to the emission test chamber in the same time period

NOTE 1 The recovery is expressed in percent.

NOTE 2 The recovery provides information about the performance of the entire method.

3.9
sample
part or piece of a floor covering that is representative of the product

3.10
area-specific emission rate
SERa
mass of a volatile organic compound emitted from a unit area of product per unit time at a given time from the start of the test

NOTE 1 The area-specific emission rate is expressed in micrograms per square metre and hour ($\mu g/m^2h$).

NOTE 2 The term “area-specific emission rate” is sometimes used in parallel with the term “emission factor”.

3.11
test specimen
part of the sample specially prepared for emission testing in an emission test chamber in order to simulate the emission behaviour of the material or product that is tested

3.12
volatile organic compound
VOC
compound, as specified in ISO 16000-6, which elute between and including *n*-hexane and *n*-hexadecane (excluding formaldehyde) on a non-polar capillary chromatographic column, measured in the test chamber air by active sampling on Tenax TA sorbent, thermal desorption (TD) and gas chromatography (GC) using mass spectrometry (MS) or flame ionization detection (FID)

3.13
total volatile organic compound
TVOC
sum of the concentrations of identified and unidentified volatile organic compounds eluting between and including *n*-hexane and *n*-hexadecane on a non-polar capillary gas chromatography column

NOTE 1 For quantification of the identified compounds, their individual response is used. The areas of the unidentified peaks are converted on molecular mass basis to concentrations using the toluene response factor (Reference [2] in the Bibliography).

NOTE 2 Due to practical reasons to be taken into account for test chambers, this definition differs slightly from the specification in ISO 16000-6:2004. In ISO 16000-6, TVOC are related to the sampling medium Tenax TA®[1)] on which the TVOC are adsorbed.

NOTE 3 The emission test method described in this International Standard is optimum for the range of compounds specified by the definition of total volatile organic compounds (TVOC).

3.14
carbonyl compounds

low-molecular-mass aldehyde and ketone volatile organic compounds which are measured in the test chamber air by active sampling on cartridges containing a solid support coated with an acid solution of 2,4-dinitrophenylhydrazine (DNPH) as a derivatizing reagent

3.15
mass concentration
C_i
ratio of mass of VOC_i per volume in the emission test chamber

NOTE Mass concentration is expressed in micrograms per cubic metre.

3.16
detection limit
minimum quantity which can be detected analytically with this test method

NOTE A detection limit of 2 µg/m^3 is defined for use in this International Standard.

3.17
determination limit
minimum quantity of a detected substance above which quantification is possible

NOTE Due to technical restriction of the apparatus and the accuracy of the test method, a determination limit of 10 µg/m^3 is defined for use in this International Standard.

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1) Tenax TA® is the trade name of a product manufactured by Enka Research Institute NV (NL) and Buchem BV (NL). This information is given for the convenience of users of this document and does not constitute an endorsement by ISO of the product named. Equivalent products may be used if they can be shown to lead to the same results.

4 Symbols and abbreviated terms

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

Symbol	Meaning	Unit
C_i	mass concentration of a VOC_i in the emission test chamber	micrograms per cubic metre
L	product loading factor	square metres per cubic metre
n	air change rate	changes per hour
q	area-specific air flow rate ($= n/L$)	cubic metres per square metre and hour
SERa	area-specific emission rate	micrograms per square metre and hour
t	time after start of the test	hours or days

5 Apparatus

The equipment necessary for carrying out an emission test next to ordinary laboratory apparatus is listed below.

5.1 Emission test chamber system

5.1.1 Clean-air supply, e.g. pressurized purified air or synthetic air in gas cylinders.

5.1.2 Humidification system.

5.1.3 Air humidity, temperature and air velocity monitoring systems meeting the following accuracy: temperature ±1,0 °C, relative humidity ±3 %, air flow rate ±3 %.

5.1.4 Equipment for measurement of air mixing.

5.1.5 Thermal desorption apparatus.

5.1.6 Cleaning agent, for the emission test chamber walls or equipment for thermal desorption.

5.1.7 Gas chromatographic system, fitted with a flame ionization detector and/or mass spectrometric detector.

5.2 Sorbent tube. Use a 6,4 mm or 6,0 mm outer diameter (OD) stainless-steel (5 mm inner diameter, ID) or glass (4 mm ID) tube packed with at least 200 mg of Tenax TA (mesh size between 30 and 80 mesh) such that the sorbent bed length is at least 40 mm.

NOTE Tenax TA is a relatively weak sorbent. Its specification in ISO 16000-6 and in this International Standard assumes that the most volatile compound of interest is *n*-hexane. However, if a user of this International Standard is following an emission test protocol that calls for analysis of more volatile compounds and/or volatile polar compounds, stronger sorbents will be needed in the vapour sampling tube. Consult ISO 16017-1 for guidance on sorbent selection in this case.

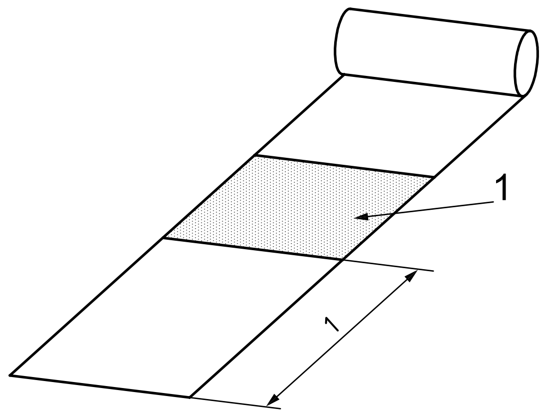
6 Sampling the product and transport and storage of sample

6.1 Sampling

6.1.1 Selection of samples from rolls

See Figure 1.

Dimensions in metres



Key

1 sample

Figure 1 — Procedure for sampling products from rolls

Discard the outer layer of the roll to take the sample.

The sample shall have an area corresponding to at least 50 cm in the production direction over the width of the produced roll.

After taking the sample, it is rolled immediately at right angles to the direction of the production roll, secured with staples or a non-emitting fastening, wrapped in aluminium foil, and placed in an unprinted, airtight polyethylene bag and sealed. Each bag shall contain only one sample.

The packed samples shall be sent to the testing laboratory with the shortest possible delay.

6.1.2 Selection of samples of rigid products such as tiles and planks

Select an unopened and undamaged standard package of the product. Alternatively, remove four or more pieces from the centre of a product package leaving the outer pieces. Stack a minimum of four pieces and tightly wrap the stack in two layers of aluminium foil and treat as described for rolls in 6.1.1.

6.2 Sample packaging and transport

Samples shall be thoroughly protected from chemical contamination, such as fuel vapours or any physical exposure, e.g. heat, light and humidity during transportation and storage prior to testing.

This can be achieved by wrapping each sample or package of samples in aluminium foil and in a sealed polyethylene bag or, alternatively, in aluminized packaging lined with polyethylene or clear polyvinyl fluoride film. Each bag shall contain only one sample.

NOTE The transportation of collected samples can affect the emission characteristics of the product. The possible effects of temperature and humidity are of particular concern.

6.3 Sample description

The outer packaging of the sample shall be labelled with the details of the type of product, date or week of manufacture (if known) and/or any identification numbers, e.g. batch numbers (see also ISO 16000-9).