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### Indoor air —

## Part 28: Determination of odour emissions from building products using test chambers

*Air intérieur —*

*Partie 28: Détermination des émissions d'odeurs des produits de construction au moyen de chambres d'essai*

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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](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 of 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 [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*.

This second edition cancels and replaces the first edition (ISO 16000-28:2012), which has been technically revised.

The main changes compared to the previous edition are as follows:

- besides acceptability and perceived intensity, the hedonic tone is described as odour characteristic;
- a more detailed description of the comparative scale, including information on set-up, check-up and calibration devices;
- recommendation on panel sizes for the different testing procedures (acceptability, perceived intensity and hedonic tone);
- procedure in case of failing the confidence interval.

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

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).

## Introduction

Odour evaluation is a complementary method to the chemical testing of emissions from building products and materials.

The determination of odour acceptability, intensity and hedonic tone of emissions from building products and materials using test chambers has objectives such as:

- to provide manufacturers, builders and end users with data useful for the evaluation of the odour impact of building products and materials on the indoor air quality;
- to promote the development of improved products.

The method can also be used for furnishings and consumer products. For this purpose a suitable exposure scenario (according to the reference room defined in EN 16516) needs to be defined.

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# Indoor air —

## Part 28:

# Determination of odour emissions from building products using test chambers

## 1 Scope

This part of ISO 16000 specifies a laboratory test method using test chambers defined in ISO 16000-9 and further specified in EN 16516 and evaluation procedures for the determination of odours emitted from building products and materials.

Sampling, transport and storage of materials under test, as well as preparation of test specimens are described in ISO 16000-11 and further specified in EN 16516.

## 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 554, *Standard atmospheres for conditioning and/or testing — Specifications*

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*

EN 13725, *Air quality — Determination of odour concentration by dynamic olfactometry*

ISO 5492, *Sensory analysis — Vocabulary*

EN 16516, *Construction products: Assessment of release of dangerous substances — Determination of emissions into indoor air*

## 3 Terms and definitions

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

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

— IEC Electropedia: available at <http://www.electropedia.org/>

— ISO Online browsing platform: available at <http://www.iso.org/obp>

### 3.1

#### **acceptability**

assessment of an odour emission into indoor air which can be ascertained according to a scale ranging from “clearly acceptable” to “clearly unacceptable” set by value on a defined evaluation scale

### 3.2

#### **anosmia**

lack of sensitivity to some olfactory stimulus due to physiological defects, which is not reversible

**3.3  
building product**

product for incorporation in a permanent manner in construction works (see ISO 16000-9)

Note 1 to entry: A building product can be solid, liquid or combined (see ISO 16000-11).

EXAMPLE 1 Examples of solid building products include flooring, wall covering, ceiling materials.

EXAMPLE 2 Examples of liquid building products include paints, varnishes, oils, waxes, levelling compounds, plasters, mortars, concrete, adhesives, sealants, caulks, putties and surface coatings.

EXAMPLE 3 Examples of combined building products include glued applications, such as floor and wall coverings, which are fixed on the building site on to surfaces using adhesives.

**3.4  
hedonic tone**

odour quality, which can be ascertained on a scale ranging from "extremely pleasant" to "extremely unpleasant"

**3.5  
odour**

sensory attribute perceptible by the olfactory organ on sniffing certain volatile substances

**3.6  
odour sample**

air sample collected from the test chamber outlet in containers and being tested for its odour

**3.7  
off-odours**

odours released by equipment or location that might disturb the test procedure.

**3.8  
panel leader**

person whose primary duties are to manage panel activities and recruit, train and monitor the assessors

**3.9  
panel member**

person who is accepted to assess odours according to a defined method. Depending on the method panel members may need to be trained

**3.10  
perceived intensity**

parameter to assess the strength of an odour based on a comparative scale

Note 1 to entry: See ISO 5492:2008, 2.8, 2.9 and 4.30

**3.11  
recovery room**

room where the panel members can recover and acclimatize before and between odour assessments

**3.12  
sample container**

device for collection and transport of the odour sample from the test chamber to the test room and for presentation of the sample to the panel members

**3.13  
sensory adaption**

temporary modification of the sensitivity of a sense organ due to continued and/or repeated stimulation, which is reversible

Note 1 to entry: See ISO 5492:2008, definition 2.6



**3.14****sensory odour panel**

group of trained or untrained panel members performing the sensory assessment of the odour emission from building products or materials

Note 1 to entry: See ISO 5492:2008, definition 1.9.

**3.15****test room**

room where the odour assessment takes place

**3.16****test specimen**

part of a sample specially prepared for emission testing in a test chamber in order to simulate the odour emission behaviour of the material or product being tested

**4 Symbols and abbreviated terms**

For the purposes of this document, the following symbols apply (see ISO 16000-9).

Symbol	Meaning	Unit
$L$	product loading factor	square metres per cubic metre
$n$	air change rate	changes per h
$q_{V,A}$	area specific air flow rate ( $n/L$ )	cubic metres per square metre and h
$A$	surface area	square metre
$\Pi$	perceived intensity	pi
$q_{V,c}$	volumetric supply air flow rate	cubic metres per h

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

PVF	polyvinyl fluoride
PET	polyethyleneterephthalate
rH	relative humidity
VOC	volatile organic compound
PAD	photoacoustic detector
PID	photo ionization detector
FID	flame ionization detector

**5 Principle**

The odour emission from building products and materials is measured using a sensory odour panel. The odour determination may be performed in parallel to chemical emission measurements in accordance with ISO 16000-9 and further specified in EN 16516. The odour characteristics addressed in this part of ISO 16000 are the acceptability, the perceived intensity and the hedonic tone. Depending on the measurement task, the acceptability, perceived intensity, hedonic tone or a combination of those can be determined.

## 6 Test facilities

### 6.1 General

A facility designed and operated to determine odours emitted from building products and materials consists of an emission test chamber containing the test specimen. The emission test chamber shall contain a clean air generation and humidification system, an air mixing system and monitoring and control systems to ensure that the test is performed to specified conditions in accordance with ISO 16000-9 and further specified in EN 16516.

The standard procedure for odour assessment is carried out by using sample containers (see [6.3.2](#)). Alternatively direct assessment from the outlet of the emission test chamber is possible if sufficient air flow is assured (see [6.3.1](#)). In this case the outlet shall be fitted with a funnel.

NOTE Under conditions described in this standard sufficient air flow is only possible for test chambers with more than 4,3 m<sup>3</sup> volume at 0,5 h<sup>-1</sup> air change rate.

If the odour assessment is carried out directly from the outlet of the chamber, the chamber material shall be non-transparent or the chamber shall be covered in order to avoid the panel members being influenced by visual recognition of the material in test.

The test room in which the sensory assessment is performed shall comply with the general requirements described in [7.2](#). The panel members shall not be influenced by the working environment (light, acoustics, off-odours).

### 6.2 Test room and recovery room

The test room and the recovery room shall be odour-neutral, sufficiently large and unobtrusively designed. Contamination of the room air by any source, e.g. by coatings, wall and floor coverings, furniture, shall be prevented. In preparation for sensory testing, the air in the test room and the recovery room shall be assessed for acceptability or intensity ([Section 7.2.1](#)), and the requirements set out in [7.2.2-7.2.4](#) shall be complied with.

### 6.3 Odour sampling and assessment devices

The odour sampling and assessment devices shall ensure that

- the air flow is sufficient to guarantee that the panel members inhale only sample air during the assessment, and
- significant adsorption on the surfaces is avoided and the interface has no emissions of its own to interfere with the sample air.

#### 6.3.1 Funnel

The odour evaluation interface consists of a funnel, which is connected to the outlet of the sample presentation system or to the outlet of the emission test chamber. The funnel and the inner surfaces of the connection ducting shall be composed of glass or surface-treated (polished) stainless steel. The air flow at the outlet from the funnel to the panel member shall be between 0,6 l/s to 1 l/s and shall be constant for the duration of each test session. The design of the measurement funnel ensures that no ambient air is sucked in and mixed with the sample air. An opening angle (both sides) of up to 12° ensures a homogeneous outflow of sample air (funnel see [Figure 1](#)). To prevent contamination of the test room air, the excess air flow shall be extracted above the funnel.

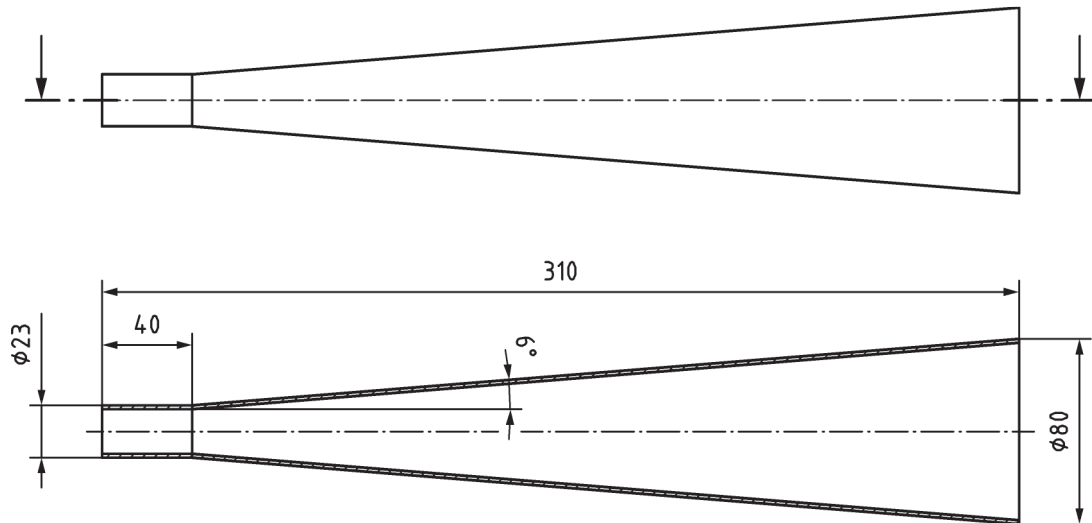


Figure 1 — Schematic of a standard funnel

### 6.3.2 Sample containers

The following materials are suitable to be used as a sample container:

- polyethylene terephthalate (PET, Nalophan<sup>®1</sup>);
- polyvinyl fluoride (PVF, Tedlar<sup>®2</sup>).

All batches of container material shall be evaluated for unusual emissions/off-odours before first use. PVF/Tedlar<sup>®</sup> containers need to be conditioned before first use, see 8.3 and Annex C.

All polymeric materials tend to affect the air sample contained within. The above mentioned materials have been tested and showed acceptable recovery for most relevant substances.

NOTE 1 Sample containers made of PET shall not be reused.

NOTE 2 Other container materials might be used if the performance is tested according to Annex C.

### 6.3.3 Sample presentation system

A sample presentation system is a device designed for providing odour samples from the sample containers to the interface (funnel) for odour testing. The size of the sample presentation system is based on the size of the sample containers. The system shall be designed to minimise influence on the odour samples and test room conditions. Any parts in direct contact with the odour sample shall be made from glass, polished stainless steel or polytetrafluoroethylene (PTFE).

NOTE For an example of a suitable sample presentation system see Annex C.

## 6.4 Comparative scale

A comparative scale offers at least six different reference stimuli by means of presentation funnels. The reference odorant is acetone (quality grade  $\geq 99,8\%$ ). The comparative scale is made up of three basic

1) Nalophan<sup>®</sup> is the trade name of a product supplied by Olfasens. 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.

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