ISO ~~/FDIS~~ 16000-~~-~~44:2023(E)

~~**2023-06-21**~~

ISO TC 146/SC 6/WG 25

Secretariat: DIN

Indoor air — Part 44: Test method for ~~measuring~~the measurement of the perceived indoor air quality ~~for use in testing~~used to test the performance of gas-phase air cleaners

First edition

Date: 2023-~~06-21~~

09-04

Contents

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~~document 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~~ISO draws attention to the possibility that ~~some of~~ the ~~elements~~implementation of this document may ~~be~~involve the ~~subject~~use of (a) patent(s). ISO takes no position concerning the evidence, validity or applicability of any claimed patent rights in respect thereof. As of the date of publication of this document, ISO had not received notice of (a) patent(s) which may be required to implement this document. However, implementers are cautioned that this may not represent the latest information, which may be obtained from the patent database available at www.iso.org/patents~~.~~. 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).~~

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.

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

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.

Introduction

There is an increased interest in the development of air cleaners removing gaseous pollutants. Such air cleaners are also called air purifiers. They have been marketed for reducing concentrations of gaseous pollutants using different removal principles including among others physical and physicochemical sorption or oxidation (mineralization).

The performance of gas phase air cleaners can be evaluated by their removal efficiency defined by the ratio of concentration of pollutants downstream and upstream an air cleaner in the case of single pass efficiency. Removal efficiency can also be obtained by determining the change of concentration in a room where an air cleaner is in operation. Removal efficiency is consequently used to calculate clean air delivery rate i.e~~.~~, the equivalent airflow delivered by an air cleaner that does not contain pollutants that were removed by an air cleaner (unpolluted air).

The removal efficiency is usually determined using a single pollutant or a mixture of up to a few pollutants thus not capturing the entire spectrum of pollutants present. For this purpose, sensory assessment of air quality made by human subjects can be made. The ratings of air quality as perceived by people are not normally used (seldom) to assess the removal efficiency of air cleaners although, based on them, ventilation requirements prescribed by standards in many parts of the world have been determined. Because measurements of chemical compounds will seldom capture all pollutants and because no models exist to describe how they will be perceived by building occupants, examining the effect of the air quality of an air cleaner ~~air quality~~ as perceived by humans ~~{~~[so-called perceived air quality~~, [PAQ]~~]] seems relevant and should be considered as a supplementary method to chemical measurements.

There are different methods used to determine PAQ. The two most frequently used are the assessments of odour intensity of the air and acceptability of air quality; the latter can be used to determine the percentage of dissatisfied people. The measurements are made by human subjects (sensory panels) who use their olfactory sense to determine PAQ. Specially trained subjects (so-called trained panels) and untrained subjects (so-called untrained panels) can be used.

Historically, when ventilation requirements were determined in the 1930s by Yaglou and his colleagues, odour intensity was used to determine PAQ based on which ventilation requirements were prescribed. Yaglou's results were subsequently used in standards and handbooks in many parts of the world have been fundamentally based on his work. In the later research in the 1980s among others by Fanger and his colleagues, the ratings of acceptability were used to describe PAQ and ventilation requirements prescribed in the standards were subsequently revised.

Considering the above, there is a need for a standard to assess the performance of gas phase air cleaners based on sensory ratings of air quality so that it can be compatible with the current ventilation standards. ~~Present standard~~This document describes a ~~harmonized~~ test method that can be used to evaluate the performance of air cleaners that primarily remove gaseous pollutants from the air based on the ratings of PAQ.

Indoor air — Part 44: Test method for ~~measuring~~the measurement of the perceived indoor air quality ~~for use in testing~~used to test the performance of gas-phase air cleaners

1 Scope

This document specifies a laboratory test method for measuring perceived air quality using human subjects that can be used for assessing the performance of air cleaners removing gas-phase pollutants. The method describes the performance of gas-phase air cleaners with respect to removal of pollutants that can be sensed by human subjects.

The method has a reference to sensory tests specified in ISO 16000-28.

Air cleaners removing particles and aerosols (mechanical or electronic filters) can also remove pollutants responsible for sensory response. The method described in ~~the present standard~~this document does not apply to testing of these air cleaners.

~~NOTE 1 It is important to underline that before performing sensory test using described method, it must be documented that no compounds are present in the air that are toxic, carcinogenic or harmful to people performing sensory evaluations at the inhalation doses (concentration and exposure time) received during testing. Fulfilling this requirement will comply with general requirements set by the ethical committees worldwide.~~

~~3~~2 Normative references

The following documents are referred to in the text in such a way that some or all of their content ~~is used to form the~~constitutes requirements ~~in the present~~of this document. For ~~standards with date~~dated references, only the edition cited applies. For ~~with no date~~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-~~-~~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 organic compounds (VVOC, VOC, SVOC) in indoor and test chamber air by active sampling ~~in~~on sorbent tubes, 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*

ISO 16000-~~-~~28, *Indoor air — Part 28: Determination of odour emissions from building products using test chambers*

~~ISO 16000-30, *Indoor air — Part 30: Sensory testing of indoor air*~~

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

43 Terms and definitions

For the ~~purpose~~purposes of this document, the following terms and definitions ~~presented in the following~~ apply.

ISO and IEC maintain ~~terminological~~terminology 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
acceptability
~~a~~ parameter used to describe indoor air quality as it is perceived by people

Note 1 to entry: Acceptability describes overall perception of the quality of air indoors taking into account intensity and hedonic character.

Note 2 to entry: Acceptability can be assessed with the dichotomous or continuous visual-analogue scale; the latter is frequently used. The ~~endpoints~~end points are clearly acceptable and clearly unacceptable.

3.2
air cleaner
~~an~~ apparatus that reduces concentration of indoor pollutants using active or passive method

Note 1 to entry: An air cleaner in this document is understood as an electrically-powered device that is basically built of components having the ability to capture gas-phase pollutants and a fan drawing the air through it.

Note 2 to entry: An air cleaner is the device that can be installed either in a room ~~and/~~or in a duct, or both.

3.3
odour intensity
~~a~~ parameter used to describe the intensity of odour caused by indoor pollutants as it is perceived by people

Note 1 to entry: Odour intensity is assessed using a continuous scale having ~~endpoints~~end points "no odour" and "overpowering odour" and four intermediate equally distanced levels: "slight odour", "moderate odour", "strong odour" and "very strong odour".

Note 2 to entry: Odour intensity can also be measured using other methods than described in ~~the~~ Note 1 to entry. ISO 16000-28 provides a method using the perceived intensity with the unit pi. The method presented in ~~the~~ Note 1 to entry and pi method are well correlated.

3.4
panel
~~a~~ group of people (assessors or subjects) performing sensory evaluation of *air quality* (3.6)

3.5
panel member

~~a~~ member of a *panel* (3.4) performing sensory evaluation of *air quality* (3.6)

3.6
perceived air quality
~~a~~ parameter used to describe the quality of indoor air as perceived by people and evaluated in terms of either *acceptability* (3.1) or *odour intensity* (3.3~~)~~), or *both*

~~5~~4 Principle

The aim of this document is to describe the method for measuring the perceived air quality indoors when gas-phase air cleaner(s) is(are) in operation. The perceived air quality is determined using subjective evaluations of either acceptability ~~and/~~or odour intensity, or both. The air assessed by a panel is presented via a sniffing device (a funnel). The perceived air quality is used to determine the removal efficiency of an air cleaner(s). If the equivalent measurement accuracy can be guaranteed, the alternative method can be used where panel members directly enter the test chamber to perform sensory evaluations. Follow the method ~~is~~ specified in Annex C.

The assessments are made in a test chamber having a general room volume size. The test method consists of two steps:

a) a sensory test without air cleaner(s), and

b) a sensory test with an air cleaner(s).

Before performing a sensory test using the described method, it must be documented that no compounds are present in the air that are toxic, carcinogenic or harmful to people performing sensory evaluations at the inhalation doses (concentration and exposure time) received during testing. Fulfilling this requirement will comply with general requirements set by the ethical committees worldwide.

~~6~~5 Apparatus, materials and sensory panel

5.1 Test chamber. A space large enough to room air cleaner, pollution sources and people - volunteer(s) staying inside for the purpose of emitting pollutants (a source of human bioeffluents) (see Figure 1) should be used as a test chamber. The room shall guarantee the same conditions as the test chamber specified in ISO 16000-9.

Test room shall have a suitable environmental control system to maintain a constant temperature and humidity, and provide ventilation with outdoor (unpolluted) air.

The room shall be kept clean and be characterized as low–polluting, i.e. the emissions of pollutants inside the room should be kept as low as possible to ensure proper background reference. The removal capacity of the test chamber for gaseous pollutants through e.g. ~~,~~ adsorption should be sufficiently low not to compete with an air cleaner being tested.

The test chamber shall be equipped with a fan ensuring that the air is well mixed within the entire volume thus complying with relevant specifications and requirements of ISO 16000-9. The mixing of the air shall be documented. No air shall be allowed to circulate from the air exhaust to air supply terminals.