SLOVENSKI STANDARD
SIST ENV 13419-2:2000

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Gradbeni proizvodi - Določ evanje emisije hlapnih organskih snovi - 2. del: Emisija, metoda s preskusno celico

Building products - Determination of the emission of volatile organic compounds - Part 2: Emission test cell method

Bauprodukte - Bestimmung der Emission von flüchtigen organischen Verbindungen - Teil 2: Emissionprüfzellen- Verfahren

Produits de construction - Détermination des émissions de composés organiques volatils - Partie 2: Méthode de la cellule d'essai d'émission

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English version

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This European Prestandard (ENV) was approved by CEN on 6 May 1999 as a prospective standard for provisional application.

The period of validity of this ENV is limited initially to three years. After two years the members of CEN will be requested to submit their comments, particularly on the question whether the ENV can be converted into a European Standard.

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EUROPEAN COMMITTEE FOR STANDARDIZATION
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Central Secretariat: rue de Stassart, 36 B-1050 Brussels

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Contents

Foreword

This European Prestandard has been prepared by Technical Committee CEN/TC 264 "Air quality", the secretariat of which is held by DIN.

This prestandard consists of four parts:
- Part 1: Emission test chamber method;
- Part 2: Emission test cell method;
- Part 3: Procedure for sampling, storage of samples and preparation of test specimens;
- Part 4: Determination of VOCs; active sampling on Tenax TA, thermal desorption and gas chromatographic method.

Part 4 is under preparation within ISO/TC 146. It is intended that after the final voting stage, the CEN prestandard (Parts 1-3) will be taken over by ISO and the ISO standard (Part 4) will be taken over by CEN.

According to the CEN/CENELEC Internal Regulations, the national standards organizations of the following countries are bound to announce this European Prestandard: Austria, Belgium, Czech Republic, Denmark, Finland, France, Germany, Greece, Iceland, Ireland, Italy, Luxembourg, Netherlands, Norway, Portugal, Spain, Sweden, Switzerland and the United Kingdom.

Introduction

The determination of volatile organic compounds (VOCs) emitted from building products using emission test cells has objectives such as:

- To provide manufacturers, builders, and end users with emission data useful for the evaluation of the impact of building products on the indoor air quality.

- To promote the development of improved products.

- On-site (factory) quality control of products emitting volatile organic compounds.

- On-site investigation of building product surfaces.

The method can in principle be used for most building products used indoors.

1 Scope

This prestandard specifies a general laboratory test method for determination of the area specific emission rate of volatile organic compounds (VOCs) from newly produced building products under defined climate conditions. The method can in principle also be applied to aged products. The emission data obtained can be used to calculate concentrations in a model room.

According to the definition of an emission test cell, it is also possible to perform non-destructive emission measurements on building products on-site in buildings. However, the procedure for such measurements is not described in this prestandard.

Sampling, transport and storage of materials to be tested, and preparation of test specimens are described in ENV 13419-3. Air sampling and analytical methods for the determination of VOCs are described in part 4 of this prestandard.

An example of an emission test cell is described in annex C of this prestandard.

This prestandard is not applicable for the determination of formaldehyde emissions from wood-based panels, for this purpose refer to ENV 717 „Wood-based panels - Determination of formaldehyde release - Part 1: Formaldehyde emission by the chamber method".

2 Normative references

This European Standard incorporates by dated or undated reference, provisions from other publications. These normative references are cited at the appropriate places in the text and the publications are listed hereafter. For dated references, subsequent amendments to or revisions of any of these publications apply to this European Standard only when incorporated in it by amendment or revisions. For undated references the latest edition of the publication referred to applies:

- **ISO 554**,	Standard atmospheres for conditioning and / or testing - Specifications;
- **ISO 1765**,	Machine-made textile floor coverings - Determination of thickness;
- **ISO 8543**,	Textile floor coverings - Methods for determination of mass;
- **EN 428**,	Resilient floor coverings - Determination of overall thickness;
- **EN 430**,	Resilient floor coverings - Determination of mass per unit area;
- **ENV 13419-3**,	Building products - Determination of the emission of volatile organic compounds - Part 3: Procedure for sampling, storage of samples and preparation of test specimens;
- **ENV 717-1**,	Wood-based panels - Determination of formaldehyde release - Part 1: Formaldehyde emission by the chamber method"

3 Definitions, abbreviations, symbols and units

3.1 Symbols and units

C_x	is the concentration of a VOCx in the emission test cell, in micrograms per cubic metre;
L	is the product loading factor, in square metres per cubic metre;
n	is the air exchange rate, in changes per hour;
q	is the area specific air flow rate (= n/L), in cubic metres per square metre and hour;
SER_a	is the area specific emission rate, in micrograms per square metre and hour ;
SER_l	is the length specific emission rate, in micrograms per meter and hour;
SER_v	is the volume specific emission rate, in micrograms per cubic metre and hour;
SER_u	is the unit specific emission rate, in micrograms per unit and hour;
t	is the time after start of the test, in hours or days.

3.2 Definitions and abbreviations

For the purposes of this prestandard the following definitions apply:

3.2.1 air exchange rate: The ratio of the volume of clean air brought into the emission test cell hourly and the free emission test cell volume measured in identical units, expressed in air changes per hour.

3.2.2 air flow rate: Air volume entering into the emission test cell per unit time.

3.2.3 air velocity: Air speed over the surface of the test specimen.

3.2.4 area specific air flow rate: Ratio between the supply air flow rate and the area of the test specimen.

3.2.5 building product: Product produced for incorporation in a permanent manner in construction works.

3.2.6 emission test cell: Portable device for the determination of volatile organic compounds emitted from building products. The emission test cell is placed against the surface of the test specimen, which thus becomes part of the emission test cell.

3.2.7 emission test cell concentration: The concentration of a specific volatile organic compound, VOC_x, (or groups of volatile organic compounds) measured in the emission test cell outlet.

3.2.8 product loading factor: Ratio of exposed surface area of the test specimen and the free emission test cell volume.

3.2.9 recovery: Percent of measured mass of a target volatile organic compound in the air leaving the emission test cell during a given time period divided by the mass of target volatile organic compound added to the emission test cell in the same time period.

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

3.2.10 sample: A part or a piece of a building product which is representative of the production.

3.2.11 specific emission rate (SER): Product specific rate describing the mass of a volatile organic compound emitted from a product per unit time at a given time from the start of the test.

NOTE Area specific emission rate, SER_a, is used in this prestandard, describing the emitted volatile organic compounds per exposed area per unit time.

3.2.12 target volatile organic compounds: Product specific volatile organic compounds.

3.2.13 test specimen: Part of the sample specially prepared for emission testing in an emission test cell in order to simulate the emission behaviour of the material or product which is tested.

3.2.14 total volatile organic compounds (TVOC): The sum of the concentrations of identified and unidentified volatile organic compounds between and including n-hexane and n-hexadecane; the areas of the unidentified peaks are converted to concentrations using the toluene response factor.

3.2.15 volatile organic compounds (VOC): In this prestandard, volatile organic compounds are defined as the organic compounds that are emitted from the test specimen and all those detected in the test cell outlet air. The emission test method described in this prestandard is optimum for the range of compounds specified by the definition of total volatile organic compounds (TVOC).

4 Principle

The principle of the test is to determine the area specific emission rates of VOCs emitted from the surface of a product test specimen. The test is performed in an emission test cell at constant temperature, relative humidity, and area specific air flow rate. The air in the emission test cell is fully

mixed, and measurements of the VOC concentration in the air at the outlet are representative of the air in the emission test cell
Area specific emission rates at a given time, *t*, are calculated from the emission test cell air concentrations and the area specific air flow rate, *q*, (see clause 11).

With knowledge of the concentration in the air, the air flow through the emission test cell, and the surface area of the test specimen, the area specific emission rates of VOCs from the product under test can be determined.

5 Apparatus

An emission test cell system designed and operated to determine area specific emission rates of VOCs from building products shall contain the following: emission test cell, clean air generation and humidification system, monitoring and control systems, to ensure that the test is carried out according to specified conditions.

For solid products with smooth surface, the emission test cell is placed directly against the surface of the product test specimen. Other products shall be placed in specially constructed test specimen holders.

General specifications and requirements which apply to all types of emission test cells in this prestandard are given in 5.1 to 7.5 below.

The types of quality assurance / quality control activities carried out are described in annex A.

5.1 Emission test cell materials

The emission test cell and the parts of the sampling system coming in contact with the emitted VOCs (all tubings and couplings) shall be made of surface treated (polished) stainless steel or glass.

The sealing material which links together the emission test cell and the test specimen shall be low emitting and low adsorbing and shall not contribute to the emission test cell background concentration.

5.2 Air supply and mixing facilities

The emission test cell shall be supplied with pure and humidified air and have a device for controlling the air flow rate with an accuracy of ±3%. The supply air can be synthetic air in gas cylinders and the flow rate shall provide the emission test cell with realistic area specific air flow rates. The air velocity in the emission test cell shall be evenly distributed over the test specimen surface.

5.3 Air tightness

The emission test cell shall be airtight in order to avoid uncontrolled air exchange with external air.

The emission test cell shall be operated slightly above atmospheric pressure to avoid any influence from the laboratory atmosphere.

The emission test cell is considered sufficiently tight if the inlet and outlet air flows differ by less than 3%.

Products with a large air permeability, shall be placed in airtight test specimen holders to avoid permeation through the surface of the test specimen.

5.4 Air sampling devices

The exhaust air (at the emission test cell outlet) shall be used for sampling. Sampling of the outlet air (e.g. with a sampling pump) is achieved by connecting adsorbent tubes to the outlet couplings.

The sum of sampling air flows shall be smaller than the inlet air flow to the emission test cell.

A multiport sampling manifold can provide the flexibility for duplicate air sampling. The sampling manifold shall enter directly to the outlet air stream If a duct shall be used, it shall be as short as possible and maintained at the same temperature as the emission test cell.

NOTE The exhaust from the emission test cell should be ducted into a fume hood, ensuring that any chemicals emitted from the test material are isolated from the laboratory environment.

5.5 Recovery and sink effects

The recovery of a target VOC can be determined using a VOC source of known specific emission rate in the emission test cell. The concentrations generated shall be of similar magnitude as those expected during the emission tests of building products.

The emission test cell performance shall ensure a mean recovery greater than 90% for toluene and n-dodecane. The recovery of other target VOCs shall also be stated.

NOTE 1 Dehumidified air should be present in the case of determination of the recovery of hygroscopic VOCs.

NOTE 2 Sink effects, leaks or poor calibration can cause difficulties to meet the minimum requirements. Sink and adsorption characteristics are very much dependent on the type of compound emitted. Additional recovery tests using target VOCs with different molecular weight and polarity can be used to increase understanding of these effects.

5.6 Equipment

Equipment necessary for carrying out an emission test are listed below:

- clean air supply (e.g. pressurised purified air or synthetic air in gas cylinders);
- emission test cell system;
- humidification system;
- humidity and temperature monitoring systems;
- air flow meters;
- cleaning agent for the emission test cell;
- oven for heating and cleaning the emission test cell;
- facilities for recovery testing.

6 Test conditions

The test conditions shall comply with 6.1 to 6.4.

6.1 Temperature and relative humidity

Temperature and relative humidity shall comply with ISO 554 (23°C, 50% RH) during the emission test. The equipment shall be capable of controlling within the following limits:

Emission test: Temperature: 23°C ± 1,0°C Relative humidity: 50% RH ± 5% RH

6.2 Supply air quality and background concentration

Supply air shall not contain any VOCs at levels greater than the emission test cell background requirements.

Background concentrations shall be low enough not to interfere with the emission determinations beyond quality assurance limits.

The TVOC background concentration shall be lower than 10 µg/m^3. The background concentration of any single target VOC shall be lower than 2 µg/m^3.

The water used for humidification shall not contain interfering VOCs.

6.3 Air velocity

The air velocity over the surface of the test specimen shall be in the range of 0,003 m/s to 0,3 m/s.

NOTE 1 The air velocity can be important for evaporative controlled emissions, e.g. from liquid products. This depends on the substrate.

NOTE 2 For certain product types, secondary source emissions can occur at high air velocities.

6.4 Area specific air flow rate and air exchange rate

At steady state, the emission test cell concentration depends on the area specific air flow rate which is selected as a parameter in designing the test conditions. Realistic area specific air flow rates shall be achievable.

NOTE 1 It is recommended that the area specific air flow rate is adjusted in such a way that analytical needs are met.

NOTE 2 Examples of area specific air flow rates are given in annex B of this prestandard.

7 Verification of the test conditions

All control measures shall be traceable to a certified standard according to the quality assurance and quality control schemes (annex A of this prestandard).

7.1 Temperature and relative humidity control systems

Control of temperature can be made by placing the emission test cell within a location controlled to the required temperature.

Control of relative humidity and temperature can be made by various systems with e.g. built-in humidity control of the supply air.

Temperature and relative humidity shall be monitored continuously and independently of the systems for controlling the temperature and relative humidity.