SIST

SLOVENSKI STANDARD
SIST EN 16402:2019

01-april-2019

Nadomešča:
SIST EN 16402:2014

Barve in laki - Ocenjevanje emisij snovi iz premazov v notranji zrak - Vzorčenje, priprava vzorcev in preskušanje

Paints and varnishes - Assessment of emissions of substances from coatings into indoor air - Sampling, conditioning and testing

Beschichtungsstoffe - Bestimmung der Emissionen regulierter gefährlicher Stoffe von Beschichtungen in die Innenraumluft - Probenahme, Probenvorbereitung und Prüfung

Peintures et vernis - Evaluation des émissions de substances émanant des revêtements dans l'air intérieur - Echantillonnage, conditionnement et essais

Ta slovenski standard je istoveten z: EN 16402:2019

ICS:

13.040.20	Kakovost okoljskega zraka	Ambient atmospheres
87.040	Barve in laki	Paints and varnishes

SIST EN 16402:2019 **en,fr,de**

EUROPEAN STANDARD

NORME EUROPÉENNE

EUROPÄISCHE NORM

EN 16402

February 2019

ICS 13.040.20; 87.040

Supersedes EN 16402:2013

English Version

Paints and varnishes - Assessment of emissions of substances from coatings into indoor air - Sampling, conditioning and testing

Peintures et vernis - Évaluation des émissions de substances émanant des revêtements dans l'air intérieur - Échantillonnage, conditionnement et essais

Beschichtungsstoffe - Bestimmung der Emissionen regulierter gefährlicher Stoffe von Beschichtungen in die Innenraumluft - Probenahme, Probenvorbereitung und Prüfung

This European Standard was approved by CEN on 14 December 2018.

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Ref. No. EN 16402:2019 E

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European foreword

This document (EN 16402:2019) has been prepared by Technical Committee CEN/TC 139 “Paints and varnishes”, the secretariat of which is held by DIN.

This European Standard shall be given the status of a national standard, either by publication of an identical text or by endorsement, at the latest by August 2019, and conflicting national standards shall be withdrawn at the latest by August 2019.

Attention is drawn to the possibility that some of the elements of this document may be the subject of patent rights. CEN shall not be held responsible for identifying any or all such patent rights.

This document supersedes EN 16402:2013.

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

— alignment with horizontal standard EN 16516:2017 (especially Clauses 10 to 14);

— terms and definitions updated;

— new product category “Reactive coatings for fire protection of metallic substrates” added;

— new Clause 7.1 “Intended conditions of use and emission scenario” added;

— new Clause 7.2 “Reference room and emission scenario” added;

— Clause 9.2 “Preparation of test specimen: Coatings” revised;

— new Table 4 “Preconditioning of Reactive coatings for fire protection of metallic substrates” added;

— new informative Annex A “Repeatability and reproducibility” added;

— annex on simplified, screening, secondary, derived or alternative methods revised;

— standard editorially revised.

According to the CEN-CENELEC Internal Regulations, the national standards organisations of the following countries are bound to implement this European Standard: Austria, Belgium, Bulgaria, Croatia, Cyprus, Czech Republic, Denmark, Estonia, Finland, Former Yugoslav Republic of Macedonia, France, Germany, Greece, Hungary, Iceland, Ireland, Italy, Latvia, Lithuania, Luxembourg, Malta, Netherlands, Norway, Poland, Portugal, Romania, Serbia, Slovakia, Slovenia, Spain, Sweden, Switzerland, Turkey and the United Kingdom.

Introduction

This document aligns with the horizontal method (see EN 16516:2017) for emission testing of construction products (developed in according to the Mandate M/366) and specifies the product specific details for architectural coatings (and their relevant product categories) and reactive coatings for fire protection of metallic substrates, as described in Clause 5. Clauses 10 to 12, 13.6, Clause 14, Annexes B, and D to H are adopted from EN 16516:2017 without modifications.

Architectural/decorative coatings are not included in the Construction Products Regulation (CPR).

The determination of emission into indoor air is to be made under the conditions of use during the service life. The determination of emissions specified in this document is associated with an emission scenario which specifies the climate and ventilation conditions of the air surrounding the product in a reference room. It is not applicable for the determination of emissions during the application.

A reference room is needed since it is not possible to evaluate emissions by testing in all possible use situations. The reference room dimensions and the resulting loading factors, the climate and ventilation conditions are the reference representing the general indoor air conditions. Based on the huge amount of available European experience, it was possible to identify one emission scenario and one reference room including a set of loading factors to be used.

This method is using a test chamber in which emissions are generated under conditions maintained constant during the test. These conditions are selected so that the results could be expressed either as emission rates or converted to concentrations in the reference room by calculations within the ranges where such calculations are valid.

This document also addresses separately (see Clause 14 and informative Annex B) the simplified test methods, indirect test methods, secondary/alternative test methods that provide within their specific field of application a result comparable or correlated to the result of the reference method. Such methods can be easier to apply and/or cheaper. They can be used especially for Factory Production Control testing (FPC).

The aim of this document is not to develop a new testing method but to combine by normative references the use of existing standards complemented, when necessary, with additional and/or modified requirements so that architectural coatings for fire protection or metallic substrates can be evaluated under comparable conditions with regard to emission into indoor air.

In particular, the horizontal test methods for emission testing of construction products (see EN 16516:2017) as developed regarding to Mandate M/366 have been considered and will be taken into account for further revisions of this document to ensure that comparable methods are applied for construction products as defined in Mandate M/366 and coatings covered by the horizontal standard EN 16516:2017.

1 Scope

This document specifies a reference method for the determination of emissions from coatings into indoor air. This method is applicable to volatile organic compounds, semi-volatile organic compounds and volatile aldehydes.

NOTE 1 This document is aimed at describing the overall procedure and makes use of existing standards mainly by normative reference complemented when necessary with additional or modified normative requirements.

This document is mainly aimed at determining emission data in indoor air for the purpose of meeting national legislation requirements, and for the voluntary labelling of products.

NOTE 2 Harmonized product standards for coatings falling under the CPR can refer to this standard for the intended conditions of use.

This document applies to coatings for indoor use as listed in Clause 5.

It is not applicable for:

— coatings that are applied off site or coatings that are applied on site, prior to the structure being permanently weatherproof except for the product type category 7 as listed in Clause 5;

— tinting pastes that are not ready for use as coating;

— non film-forming products like e.g. waxes and impregnations.

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.

EN 13300, *Paints and varnishes — Water-borne coating materials and coating systems for interior walls and ceilings — Classification*

EN 15824, *Specifications for external renders and internal plasters based on organic binders*

EN 16623, *Paints and varnishes — Reactive coatings for fire protection of metallic substrates — Definitions, requirements, characteristics and marking*

EN ISO 13137, *Workplace atmospheres — Pumps for personal sampling of chemical and biological agents — Requirements and test methods (ISO 13137)*

EN 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 16000-9:2006)*

EN 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 16000-11:2006)*

EN 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 (ISO 16017-1)*

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 volatile organic compounds in indoor and test chamber air by active sampling on Tenax TA sorbent, thermal desorption and gas chromatography using MS or MS-FID*

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 Terms relating to sampling and product

3.1.1
sampling plan
predetermined procedure for the selection, withdrawal, preservation and transportation of product samples

[SOURCE: CEN/TR 16220:2011, 2.3]

3.1.2
sample
representative portion of product or material selected from a larger quantity of product or material

Note 1 to entry: The term "sample" is often accompanied by a prefix (e.g. laboratory sample, test sample, test specimen) specifying the type of sample and/or the specific step in the sampling process to which the obtained material relates.

[SOURCE: IUPAC:1990, 2.1.1, modified — Note 1 to entry was added]

3.1.3
laboratory sample
sample or sub-sample(s) sent to or received by the laboratory

Note 1 to entry: The laboratory sample is the final sample from the point of view of sample collection but it is the initial sample from the point of view of the laboratory.

Note 2 to entry: When the laboratory sample is further prepared by mixing, drying, grinding or by combinations of these operations, the result is the test sample. When no preparation of the laboratory sample is required, the laboratory sample is the test sample. A test portion is removed from the test sample for the performance of the test/analysis or for the preparation of a test specimen.

[SOURCE: IUPAC:1990, 2.5.5, modified — Notes 1 and 2 to entry were added]

3.1.4
curing
hardening of freshly prepared mixtures under well-defined conditions (time, temperature, humidity, etc.)

3.1.5
curing time
minimal time defined necessary for curing before an emission test can be executed to obtain test results that are relevant to in use conditions

[SOURCE: EN 16516:2017, 3.1.1.3]

3.2 Terms relating to emissions into indoor air and associated laboratory testing

3.2.1
emission
liberation of chemical substances from a product into air

3.2.2
emission test chamber
enclosure with controlled operational parameters for the determination of volatile organic compounds emitted from products

[SOURCE: EN ISO 16000-9:2006, 3.6]

3.2.3
intended conditions of use
conditions that a product is expected to experience during service life and that influence its emission behaviour

[SOURCE: EN 16516:2017, 3.1.2.8]

3.2.4
test sample
sample, prepared from the laboratory sample, from which test portions are removed for testing or for analysis

[SOURCE: IUPAC:1990, 2.5.6]

3.2.5
test portion
quantity or volume removed from the test sample for analysis purposes, generally of known weight or volume

[SOURCE: IUPAC:1990, 2.5.7]

3.2.6
product loading factor
ratio of exposed surface area of the test specimen and the free emission test chamber volume

[SOURCE: EN ISO 16000-9:2006, 3.8]

3.2.7
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 under intended conditions of use

[SOURCE: EN 16516:2017, 3.1.2.16]

3.2.8
air flow rate
ventilation rate
air volume entering into the emission test chamber per unit of time

Note 1 to entry: Air flow rate is expressed in litres per second or in cubic metres per hour (l/s, m^3/h).

[SOURCE: EN ISO 16000-9:2006, 3.2 modified — The synonym ventilation rate and note 1 to entry were added]

3.2.9
air change rate
ratio of the volume of air brought into the test chamber per hour and the volume of the empty test chamber

Note 1 to entry: Air change rate is expressed as h^{-1}.

[SOURCE: EN 16516:2017, 3.1.2.1]

3.2.10
specific air flow rate
q
ratio of air change rate and product loading factor

Note 1 to entry: Specific air flow rate can be expressed as the area specific air flow rate q_A, equivalent to ratio of the air flow rate and the surface area of the test specimen in $[m^3/m^2 \cdot h]$, which is equivalent to the expression [m/h].

[SOURCE: EN 16516:2017, 3.1.2.12; modified — Note 2 to entry was deleted]

3.2.11
emission test chamber concentration
mass concentration of a specific vapour phase organic compound (VVOC, VOC or SVOC) (or group of vapour phase organic compounds) in test chamber air measured at the emission test chamber outlet

[SOURCE: EN 16516:2017, 3.1.2.7]

3.2.12
reference room
room with specified dimensions, climate and ventilation used as a reference for calculating and reporting product emissions, assuming inert surfaces

Note 1 to entry: In this document, a reference room is specified in 7.2.

Note 2 to entry: The reference room serves as a convention and is a model that does not represent a real room.

[SOURCE: EN 16516:2017, 3.1.2.11; modified — Note 1 to entry was editorially revised and the reference was changed to 7.2]

3.2.13
mass concentration of the compound in the reference room air
calculated concentration of a specific vapour phase organic compound (VVOC, VOC or SVOC) or group of vapour phase organic compounds in the reference room

[SOURCE: EN 16516:2017, 3.1.2.9]

3.2.14
specific emission rate
SER
emission factor
mass of a vapour phase organic compound emitted (VVOC, VOC or SVOC) per unit of product per unit of time at a given time from the start of the test

Note 1 to entry: This definition is intended to avoid confusion between the terms q (in 3.1.2.13) and q_x with a subscript (q_A, q_L, q_v, q_m, q_u used for specific air flow rate in EN ISO 16000-9:2006). The specific emission rate can be related to area, length, volume, mass or unit, expressed as SERA in μg/(m^2·h), SERL in μg/(m·h), SERV in μg/(m^3·h), SERm in μg/(kg·h), or SERU expressed in μg/(u·h).

[SOURCE: EN 16516:2017, 3.1.2.13, modified — Emission factor included as synonym instead of as part of the abbreviation]

3.2.15
chamber blank value
test result obtained by carrying out the test procedure in the absence of a test specimen

Note 1 to entry: Blank value is expressed in micrograms per cubic metre (μg/m^3).

3.3 Terms relating to determination of emitted substances

3.3.1
LCI value
Lowest Concentration of Interest
substance-specific value, quoted in terms of mass concentration in the air of the reference room, for health- related evaluation of emission levels from construction products

Note 1 to entry: This term can be used in conjunction with any available list of LCI values.

3.3.2
limit value
numerical limit derived from national, European or contractual provisions

3.3.3
***R* value**
sum of all *Ri* values obtained during a given test

3.3.4
R_i value
ratio C_i / LCI_i, where

— C_i is the mass concentration in the air of the reference room;

— LCI_i is the LCI value of compound *i*.

3.3.5
semi-volatile organic compound
SVOC
organic compounds which elute after n-hexadecane and up to and including n-docosane, on the gas chromatographic column specified as a 5 % phenyl / 95 % methyl polysiloxane capillary column minus all compounds listed in Annex G, which are considered to be VOCs and not SVOCs even if they elute after n-hexadecane under the specific test conditions

3.3.6
target compound
compound for which the test result is compared with a compound specific limit value

[SOURCE: adapted from EN ISO 16000-9:2006, 3.12]

3.3.7
total semi-volatile organic compounds
TSVOC
sum of the concentrations of the identified and unidentified semi-volatile organic compounds, as defined in 3.3.5, calculated by summing the reference room concentrations of every individual compound (target and non-target, identified and unidentified) eluting after n-hexadecane and up to and including n-docosane using the specified column, and calculated using the TIC response factor for toluene after subtracting the blank values and after excluding compounds calculated to be below 5 µg/m³ using the TIC response factor for toluene, excluding all compounds listed in Annex G even if they elute after n-hexadecane under the specific test conditions

[SOURCE: EN 16516:2017, 3.1.3.7]

3.3.8
total volatile organic compounds
TVOC
sum of the concentrations of the identified and unidentified volatile organic compounds as defined in 3.3.11, calculated by summing the reference room concentrations of every individual compound (target and non-target, identified and unidentified) eluting between n-hexane and n-hexadecane inclusively using the specified column, and calculated using the TIC response factor for toluene after subtracting the blank values and after excluding compounds calculated to be below 5 µg/m³ using the TIC response factor for toluene, additionally all compounds listed in Annex G are included even if they elute after n-hexadecane or before n-hexane under the specific test conditions

[SOURCE: EN 16516:2017, 3.1.3.8]

3.3.9
vapour phase-organic compound
VVOC, VOC, SVOC
all very volatile, volatile and semi volatile organic compounds

3.3.10
very volatile organic compound
VVOC
volatile organic compound eluting before n-hexane on the gas chromatographic column specified as a 5 % phenyl/ 95 % methyl polysiloxane capillary column, excluding all compounds listed in Annex G, which are considered to be VOCs even if they elute before n-hexane under the specific test conditions

3.3.11
volatile organic compound
VOC
organic compound eluting between and including n-hexane and n-hexadecane on the gas chromatographic column specified as a 5 % phenyl / 95 % methyl polysiloxane capillary column, including all compounds listed in Annex G, which are considered to be VOCs even if they elute after n-hexadecane or before n-hexane under the specific test conditions

[SOURCE: Adapted from EN ISO 16000-9:2006, 3.15]

3.4 Abbreviations

GC	Gas Chromatography
HPLC	High performance liquid chromatography
LCI	Lowest Concentration of Interest
MS	Mass Spectrometry
q	Specific Air Flow Rate
R	Ratio of concentration and limit value
SER	Specific Emission Rate
SVOC	Semi-Volatile Organic Compound
TIC	Total Ion Chromatogram
TSVOC	Total Semi-Volatile Organic Compound
TVOC	Total Volatile Organic Compound
VOC	Volatile Organic Compound
VVOC	Very Volatile Organic Compound

4 Principle

This document combines by normative references the use of existing standards complemented, when necessary, with additional and/or modified requirements for the determination of emissions from coatings into indoor air.

This document is not applicable to determine the emissions from a liquid or paste product during its drying and/or curing period. In this document, emissions of volatile components emitted from the dried and/or cured coating into the vapour-phase are determined in time intervals. For this purpose, the following definitions apply:

— the intended use of the coating as defined in Clause 5;

— the emission scenario which specifies the typical dimensions of the reference room, the climate and ventilation conditions of the air surrounding the product according to Clause 10;

NOTE 1 It is not possible to evaluate emissions by testing in all possible use situations.

— the test chamber of the reference method according to Clause 10 in which emissions are generated under conditions that are kept constant during the test. These conditions are selected in the way that the results can be expressed directly in terms of vapour concentration in the reference room so that they can be converted for calculations according to Clause 12;

— the definition of sampling times for the emitted volatile compounds in the test chamber. These time intervals are intended to give representative results for the long term emissions of the tested coating at the service time and intended use.

This document also specifies requirements and gives examples of simplified test methods, indirect test methods or secondary/alternative test methods (see Clause 14) that provide within their specific field of application a result which correlates with the result of the reference method. Such methods can be easier to apply and/or cheaper.

NOTE 2 In EN ISO 16000-9 the specifications regarding the dimensions of the reference room are informative (i.e. left to the choice of the user). In this document they are normative in order to provide comparability. Furthermore, the preparation of test specimen from liquid samples is not defined in the normative part of EN ISO 16000-9.

5 Product categories

Only coatings and coating systems that are listed in Table 1 shall be tested according to this document.

Tinted products shall be tested in the same way as for white products.

The following product categories given in Table 1 for the intended use are addressed in this document and detailed conditions for emission testing are described for them:

Table 1 — Product categories

Nr.	Product category	Description
1	Interior wall paints	This category covers all coatings and coating systems for interior surfaces with decorative and/or functional end use according to EN 13300 independent of the chemical type of binder or other specific properties. Typical substrates are e.g. mineral substrates, plasters, gypsum boards, wall papers. Intended use can be on walls, ceilings or both.
2	Interior plasters with organic binder	According to EN 15824. Intended use can be on walls, ceilings or both.
3	Interior coatings, trim paints and lacquers (small surfaces)	This category covers all coatings and coating systems for interior surfaces with decorative and/or functional end use other than described in EN 13300 and having an intended use on significantly smaller surfaces than walls, floors or ceiling. Typical examples of this category of intended use are e.g. coating systems for doors, windows, furniture or radiators. Typical substrates are e.g. wood, wood-based materials, metal and plastics. If the intended use is for large surfaces, category 4 is applicable instead of category 3.
4	Interior varnishes and wood stains (large surfaces)	This category covers all coatings and coating systems for interior surfaces with decorative and/or functional end use other than described in EN 13300 and having an intended use on large surfaces e.g. coating systems for walls, ceiling except for floor coatings. Typical substrates are e.g. wood and wood-based panels.
5	Interior floor coatings	This category covers all coatings and coating systems for interior floors with decorative end use.
6	Interior fillers	Coating material with a high proportion of extender, in powder or paste form, intended primarily to even out irregularities in all backgrounds or substrates, including masonry and coating materials, and/or to improve their surface appearance in order to prepare them to receive when required a paint or related system or a bonded cover. Intended use can be on walls, ceilings, both of them or on small surfaces for repair purpose.
7	Reactive coatings for fire protection of metallic substrates	Reactive materials, as defined in EN 16623, which are specifically formulated to provide a chemical reaction upon heating such that their physical form changes and in so doing provide fire protection by thermal insulative and cooling effects. These coatings can be applied on-site and off-site.