



SLOVENSKI STANDARD

SIST EN 16637-3:2024

01-april-2024

Nadomešča:

SIST-TS CEN/TS 16637-3:2017

Gradbeni proizvodi - Ocenjevanje sproščanja nevarnih snovi - 3. del: Horizontani preskus precejanja v koloni s tokom navzgor

Construction products - Assessment of release of dangerous substances - Part 3: Horizontal up-flow percolation test

Bauprodukte - Bewertung der Freisetzung von gefährlichen Stoffen - Teil 3: Horizontale Perkulationsprüfung im Aufwärtsstrom

Produits de construction - Évaluation du relargage de substances dangereuses - Partie 3 : Essai horizontal de percolation à écoulement ascendant

Ta slovenski standard je istoveten z: EN 16637-3:2023

<https://standards.iteh.ai/catalog/standards/sist/b07eeca5-00d2-4ba1-8e79-884d7c56548d/sist-en-16637-3-2024>

ICS:

13.020.99	Drugi standardi v zvezi z varstvom okolja	Other standards related to environmental protection
91.100.01	Gradbeni materiali na splošno	Construction materials in general

SIST EN 16637-3:2024

en,fr,de

EUROPEAN STANDARD

EN 16637-3

NORME EUROPÉENNE

EUROPÄISCHE NORM

September 2023

ICS 91.100.01

Supersedes CEN/TS 16637-3:2016

English Version

Construction products: Assessment of release of dangerous substances - Part 3: Horizontal up-flow percolation test

Produits de construction - Évaluation du relargage de substances dangereuses - Partie 3 : Essai horizontal de percolation à écoulement ascendant

Bauprodukte - Bewertung der Freisetzung von gefährlichen Stoffen - Teil 3: Horizontale Perkolationsprüfung im Aufwärtsstrom

This European Standard was approved by CEN on 30 July 2023.

CEN members are bound to comply with the CEN/CENELEC Internal Regulations which stipulate the conditions for giving this European Standard the status of a national standard without any alteration. Up-to-date lists and bibliographical references concerning such national standards may be obtained on application to the CEN-CENELEC Management Centre or to any CEN member.

This European Standard exists in three official versions (English, French, German). A version in any other language made by translation under the responsibility of a CEN member into its own language and notified to the CEN-CENELEC Management Centre has the same status as the official versions.

CEN members are the national standards bodies of Austria, Belgium, Bulgaria, Croatia, Cyprus, Czech Republic, Denmark, Estonia, Finland, France, Germany, Greece, Hungary, Iceland, Ireland, Italy, Latvia, Lithuania, Luxembourg, Malta, Netherlands, Norway, Poland, Portugal, Republic of North Macedonia, Romania, Serbia, Slovakia, Slovenia, Spain, Sweden, Switzerland, Türkiye and United Kingdom.

SIST EN 16637-3:2024

<https://standards.iteh.ai/catalog/standards/sist/b07eeca5-00d2-4baf-8e79-884d7c56548d/sist-en-16637-3-2024>



EUROPEAN COMMITTEE FOR STANDARDIZATION
COMITÉ EUROPÉEN DE NORMALISATION
EUROPÄISCHES KOMITEE FÜR NORMUNG

CEN-CENELEC Management Centre: Rue de la Science 23, B-1040 Brussels

Contents	Page
European foreword	4
Introduction	6
1 Scope.....	7
2 Normative references.....	7
3 Terms and definitions	8
4 Symbols and abbreviations	11
4.1 Symbols	11
4.2 Abbreviations.....	11
5 Principle.....	12
5.1 General principles	12
5.2 Number of eluates.....	12
6 Reagents.....	13
7 Equipment.....	14
8 Sample preparation	16
8.1 General.....	16
8.2 Preparation of the test sample.....	16
8.2.1 Principles.....	16
8.2.2 Rules of application.....	16
8.3 Test portion	17
8.4 Drying.....	17
8.5 Subsampling	17
8.6 Sieving of samples into fractions.....	18
8.7 Size reduction of particles	18
9 Test procedure.....	18
9.1 Temperature.....	18
9.2 Determination of dry residue.....	18
9.3 Pre-treatment of the column	18
9.4 Packing of the column	19
9.4.1 General.....	19
9.4.2 Equilibration.....	19
9.4.3 Calculation of the flow rate	19
9.5 Collection of eluates.....	19
9.6 Further preparation of the eluates for analysis	22
9.7 Blank test	22
10 Evaluation of measurement results	22
10.1 Expression of results in concentrations	22
10.2 Expression of results in terms of mass related release	22
11 Documentation and test report	23
12 Test performance.....	25
13 Indirect methods.....	25
13.1 Definition	25

13.2 Provisions	25
13.3 Examples of indirect methods	25
Annex A (informative) Examples of sample preparation procedures	26
Annex B (informative) Illustration of the column and accompanying equipment	29
Annex C (informative) Procedures for packing and saturation of the column	30
Annex D (informative) Assessment of release mechanism(s)	33
Annex E (informative) Summary of cumulative results for $L/S = 2$ and $L/S = 10$	53
Bibliography	69

iTeh Standards
(<https://standards.iteh.ai>)
Document Preview

[SIST EN 16637-3:2024](https://standards.iteh.ai/catalog/standards/sist/b07eeca5-00d2-4baf-8e79-884d7c56548d/sist-en-16637-3-2024)

<https://standards.iteh.ai/catalog/standards/sist/b07eeca5-00d2-4baf-8e79-884d7c56548d/sist-en-16637-3-2024>

EN 16637-3:2023 (E)**European foreword**

This document (EN 16637-3:2023) has been prepared by Technical Committee CEN/TC 351 “Construction products: Assessment of release of dangerous substances”, the secretariat of which is held by NEN.

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 May 2024 and conflicting national standards shall be withdrawn at the latest by May 2024.

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 CEN/TS 16637-3:2016.

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

- transfer of technical specification into a European Standard;
- addition of validation data from interlaboratory validation on repeatability and reproducibility (see Clause 12 and Annex E);
- addition of requirements on the number of eluates (see 5.2);
- alignment of the test conditions with the test conditions which are specified in EN 17516;
- updating of normative and informative cross-references.

This document has been prepared under a standardization request addressed to CEN by the European Commission. The Standing Committee of the EFTA States subsequently approves these requests for its Member States.

This document was elaborated on the basis of CEN/TS 14405 [1].⁰²⁴

<https://standards.iteh.ai/catalog/standards/sist/b07ecca5-00d2-4baf-8e79-884d7c56548d/sist-en-16637-3-2024>

This document specifies an up-flow percolation test to determine the leaching behaviour of granular construction products under standardized percolation conditions.

EN 16637, *Construction products: Assessment of release of dangerous substances*, consists of the following parts:

- *Part 1: Guidance for the determination of leaching tests and additional testing steps;*
- *Part 2: Horizontal dynamic surface leaching test;*
- *Part 3: Horizontal up-flow percolation test.*

EN 16637-1 deals with the determination and use of test methods for leaching of construction products taking specific situations into account. EN 16637-2 specifies a dynamic surface leaching test for determination of surface dependent release of substances from monolithic or plate-like or sheet-like construction products or granular construction products with low hydraulic conductivity under standardized conditions.

Background information on characterization of leaching behaviour of construction products can be found in Technical Reports provided by CEN/TC 351 (i.e. CEN/TR 16098 [2], CEN/TR 16496 [3]).

Any feedback and questions on this document should be directed to the users' national standards body. A complete listing of these bodies can be found on the CEN website.

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

iTeh Standards
(<https://standards.iteh.ai>)
Document Preview

[SIST EN 16637-3:2024](https://standards.iteh.ai/catalog/standards/sist/b07eeca5-00d2-4baf-8e79-884d7c56548d/sist-en-16637-3-2024)

<https://standards.iteh.ai/catalog/standards/sist/b07eeca5-00d2-4baf-8e79-884d7c56548d/sist-en-16637-3-2024>

EN 16637-3:2023 (E)**Introduction**

The European Standards EN 16637-1, EN 16637-2 and EN 16637-3 are developed to assess the release of regulated dangerous substances (RDS) from construction products into soil, surface water and groundwater in the framework of Mandate M/366. The horizontal test methods developed under the Mandate M/366 are intended to be used to show compliance with notified regulations. The tests cover the release of substances from construction products and in particular, those that are regulated in notified regulations in one or more EU Member States.

EN 16637-1 specifies how the CEN Technical Product Committees and EOTA experts should determine the appropriate leaching test for the determination of the release of RDS from a construction product into soil, surface water and groundwater. EN 16637-1 gives background information for CEN Technical Product Committees on the following aspects:

- a) description of the intended conditions of use of the construction product (e.g. above ground exposed to the precipitation, or shielded from direct infiltration, in surface or groundwater) with respect to the release of RDS into soil, surface water and groundwater;
- b) identification of main release mechanisms, and the appropriate leaching test for a given construction product.

EN 16637-2 specifies a horizontal test to assess surface dependent release from monolithic, plate-like or sheet-like construction products (tank test).

EN 16637-3 specifies a horizontal test to assess release from granular construction products.

The test methods can be used for both steps in the hierarchy (type testing (TT) and factory production control (FPC)) and form the reference tests for the intended uses and conditions specified in EN 16637-1. In this hierarchy of testing conditionally “indirect tests” can be used, but are not specified.

The release of substances upon contact with water results in a potential risk to the environment during the intended use of construction products. The intent of these tests is to identify the leaching behaviour of construction products and thereby allow assessments of the release of RDS from such products to soil, surface water and groundwater under intended conditions of use in relation to CE marking and assessment and verification of constancy of performance.

This document does not address impact assessment. However, since the test methods described in the document may be used in the context of impact assessments and regulation based on impact assessments, some guidance on this issue is provided in EN 16637-1:2023, Annex A (informative).

In addition to existing validation results, in 2011 CEN/TC 351 began an extensive research program on robustness validation of the existing tank leaching and percolation tests. This was carried out by a consortium of European experts on 20 construction products to unify differences from the protocols of the different CEN Members and to check the influence of testing conditions on the test result (e.g. temperature, flow rate, renewal scheme). The results ([4], [22]) of the research program confirmed the robustness of the horizontal tests known from former works. Conclusions from the program have been implemented into the Technical Specifications for the test methods. The performance of the leaching tests regarding repeatability and reproducibility was deduced from a second validation step and respective data ([5], [6]) are included in EN 16637-2 and in this document.

1 Scope

This document specifies an up-flow percolation test (PT) which is applicable to determine the leaching behaviour of inorganic and non-volatile organic substances from granular construction products. The test is not suitable for substances that are volatile under ambient conditions. The construction products are subjected to percolation with water as a function of liquid to solid ratio under specified percolation conditions. The method is a once-through column leaching test.

NOTE 1 Volatile organic substances include the low molecular weight substances in mixtures such as mineral oil.

This up-flow percolation test is performed under specified test conditions for construction products and does not necessarily produce results that mimic specific intended use conditions. This test method produces eluates, which can subsequently be characterized by physical, chemical and ecotoxicological methods according to existing standard methods. The results of eluate analysis are presented as a function of the liquid/solid ratio. The test results enable the distinction between different leaching behaviour.

NOTE 2 It is not always possible to adjust test conditions simultaneously for inorganic and organic substances. Test conditions can also vary between different groups of organic substances. Test conditions for organic substances are generally more stringent than those for inorganic substances. The test conditions are generally described in a way that they fit testing organic substances and are also applicable to inorganic substances depending on the set-up.

NOTE 3 For ecotoxicity testing, eluates representing the release of both inorganic and organic substances are needed. In this document, ecotoxicological testing is meant to include also genotoxicological testing.

NOTE 4 Construction products with a low hydraulic conductivity that can cause detrimental pressure build-up are not supposed to be subjected to this test.

NOTE 5 This procedure is generally not applicable to products that are easily biologically degradable and products reacting with the leachant, leading, for example, to excessive gas emission or excessive heat release, impermeable hydraulically bound products or products that swell in contact with water.

In this document the same test conditions as for EN 17516 (CEN/TC 444/WG 1) are applied in order to allow full comparability of testing construction products and waste derived construction products to avoid double testing. The EN 17516 test results are eligible in the context of testing construction products as well.

NOTE 6 If a leaching test according to EN 17516 has been performed, additional EN 16637-3 testing does not need to be carried out.

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 933-1, *Tests for geometrical properties of aggregates — Part 1: Determination of particle size distribution — Sieving method*

EN 15934, *Sludge, treated biowaste, soil and waste — Calculation of dry matter fraction after determination of dry residue or water content*

EN 16637-1, *Construction products: Assessment of release of dangerous substances — Part 1: Guidance for the determination of leaching tests and additional testing steps (under development)*

EN 16687:2023, *Construction products: Assessment of release of dangerous substances — Terminology*

EN 16637-3:2023 (E)

EN 17195, *Construction products: Assessment of release of dangerous substances — Analysis of inorganic substances in eluates*

EN ISO 5667-3, *Water quality — Sampling — Part 3: Preservation and handling of water samples (ISO 5667-3)*

3 Terms and definitions

For the purposes of this document, the terms and definitions in EN 16687:2023 and the following apply.

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

- IEC Electropedia: available at <https://www.electropedia.org/>
- ISO Online browsing platform: available at <https://www.iso.org/obp/>

3.1**eluate**

solution obtained from a leaching test

[SOURCE: EN 16687:2023, 3.3.2.8, modified — Note 1 to entry deleted]

3.2**granular product**

product composed of solid particles with a particle size smaller than a specified size or grading

Note 1 to entry: Granular products are usually tested by a percolation test.

[SOURCE: EN 16687:2023, 3.1.2.1]

3.3**laboratory sample**

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

Note 1 to entry: When the laboratory sample is further prepared by subdividing, cutting, sawing, coring, drying, grinding, mixing, curing 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.

Note 2 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.

[SOURCE: EN 16687:2023, 3.2.2.1]

3.4**leachant**

liquid that is brought into contact with the test portion in the leaching procedure

Note 1 to entry: Usually demineralized water is used as leachant for laboratory leaching tests.

[SOURCE: EN 16687:2023, 3.3.2.7]

3.5**leaching behaviour**

release and change with time in release from a solid product in contact with a leachant as a function of major release controlling factors

Note 1 to entry: Such factors are diffusion, pH, L/S -ratio or time.

[SOURCE: EN 16687:2023, 3.3.2.10]

3.6**liquid to solid ratio** **L/S**

ratio between the total volume of liquid (L) percolated through the solid product and of solid product (S) packed into the column

Note 1 to entry: L/S is expressed in l/kg dry matter.

[SOURCE: EN 16687:2023, 3.3.2.14]

3.7**local equilibrium****LE**

situation where chemical equilibrium exists between a substance in solution and the same substance in the solid phase at any point in the column

Note 1 to entry: Even when local equilibrium exists at all points along the column the equilibrium concentrations may be different at different points.

[SOURCE: EN 16687:2023, 3.3.2.15]

3.8**percolation test****PT**

column test

release test method to determine the release of substances from a granular construction product packed in a column with a leachant percolating through it

[SOURCE: EN 16687:2023, 3.3.2.5]

3.9**release****emission**

liberation of chemical substances (e.g. non-volatile organic compounds, heavy metals, salts) from a construction product into soil, surface water or groundwater into the leachant of a test facility

Note 1 to entry: Release to soil, surface and groundwater may be expressed in terms of area related release (tank leaching test, e.g. mg/m²) or in terms of mass related release (percolation test, e.g. mg/kg).

Note 2 to entry: The terms "emission" and "release" have fundamentally the same meaning. However, it is often a tradition to use the term "emission" when describing liberation of chemical substances or radiation into air and to use the term "release" when describing the liberation of chemical substances into soil or water.

[SOURCE: EN 16687:2023, 3.3.2.16]

EN 16637-3:2023 (E)**3.10****release mechanism**

physical-chemical processes that control the release of substances from a solid construction product into a leachant

Note 1 to entry: In case of granular products the main release mechanisms are washout and solubility control. Diffusion and additional factors like pH or DOC also have influence on the mechanism of the release.

Note 2 to entry: The release mechanism for every substance can be determined using the results of the release test (tank leaching test, percolation test). Determination of the release mechanism is relevant for modelling of the source term and so for determination of the effects on soil and water over a time period.

[SOURCE: EN 16687:2023, 3.3.2.18, modified — notes edited to refer to percolation only]

3.11**sample**

portion of material selected from a larger quantity of material

Note 1 to entry: The manner of selection of the sample should be prescribed in a sampling plan.

Note 2 to entry: The term “sample” is often accompanied by a prefix (e.g. laboratory sample, test sample) specifying the type of sample and/or the specific step in the sampling process to which the obtained material relates.

[SOURCE: EN 16687:2023, 3.2.1.5]

3.12**sampling plan**

predetermined procedure for the selection, withdrawal, on-site pre-treatment — if necessary, preservation and transportation of samples to be removed from a population

[SOURCE: EN 16687:2023, 3.2.1.6]

3.13**test portion**

analytical portion
amount of the test sample taken for testing/analysis purposes, usually of known dimension, mass or volume

[SOURCE: EN 16687:2023, 3.2.2.3, modified — Examples deleted]

3.14**test sample**

analytical sample

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

[SOURCE: EN 16687:2023, 3.2.2.2]

3.15**limit of quantification****LOQ**

lowest value of an analyte (determinant) that can be determined with an acceptable level of accuracy and precision, generally determined as three times the limit of detection of the method

[SOURCE: EN 16687:2023, 3.3.1.14]

4 Symbols and abbreviations

4.1 Symbols

For the purposes of this document, the following symbols apply.

c_i	concentration of the substance concerned in the eluate fraction i , in $\mu\text{g/l}$
D_{max}	sieve diameter, in mm NOTE Common sizes are 31,5 mm, 45 mm or 63 mm.
d_i	inner diameter of the column, in mm
d_p	density of the construction product, expressed in kilograms per cubic metre (kg/m^3)
E_i	released quantity of a substance per quantity of sample for analysis in eluate fraction i , in mg/kg dry matter
h	height or layer thickness of the construction, in m
k_c	constant that represents the speed of the release of a certain substance
k_e	number of eluates collected in the test
m_d	dry mass of the test portion, in g
m_r	mass of the undried test portion, in g
m_w	mass of the (moist) test portion in the column, in g
S_{cs}	sieve diameter for test sample preparation (crushing) to reduce the amount of oversized product to fit the inner column diameter, in mm
t	execution time of the test, in days
U_n	measured cumulative release of a substance for cumulative L/S ratio n including fraction $i = 1$ to n , in mg/kg dry matter
V_i	volume of the eluate fraction i , in l
V_L	linear velocity of the leachant through the empty column, in mm per day
w_{dr}	dry residue of the construction product, in %
Φ	leachant flow rate, in ml per hour

4.2 Abbreviations

For the purposes of this document, the following abbreviations apply.

DL	detection limit
DOC	dissolved organic carbon
EC	electrical conductivity
EOTA	European organization for technical assessment
ETA	European technical assessment
ETFE	ethylene tetrafluoroethylene
FEP	fluorinated ethylene propylene

EN 16637-3:2023 (E)

FPC	factory production control
GLHC	test method for granular products with low hydraulic conductivity
HDPE	high-density polyethylene
hEN	harmonized European Standard
PAH	polycyclic aromatic hydrocarbon
PCTFE	polychlorotrifluoroethylene
PT	percolation test
PTFE	polytetrafluorethylene
RDS	regulated dangerous substances
TPH	total petroleum hydrocarbons
TT	type testing

5 Principle**5.1 General principles**

The percolation test described in this document starts with the representative laboratory sample. The methodology for the collection of a representative laboratory sample is part of the respective product standard.

This document describes a method to determine the release of substances from a construction product, with or without size reduction to a maximum particle size, packed in a column with a leachant percolating through it. Pre-equilibration is applied to approach (local) equilibrium at the start. The column size is related to the amount of eluate needed for subsequent analysis and testing and the size of the largest particles in the test portion. A continuous vertical up-flow is used, so that the column is water saturated. The test conditions, including the flow rate of the leachant, enable a conclusion to be drawn from the results as to which substances are rapidly being washed out and which substances are released under the influence of interaction with the matrix. The method is a once-through column leaching test. It is assumed that conditions approach local equilibrium between construction product and leachant (for inorganic substances) in the test.

NOTE The results obtained under local equilibrium (LE) can be up-scaled and used in the modelling of in-use conditions for various scenarios.

The eluate is collected in fractions that are characterized physically and chemically and possibly ecotoxicologically according to existing standards. The results of the test are expressed as a function of the L/S ratio, in terms of mg of the substances released cumulatively per kg of product or of mg of substance determined per litre of eluate.

The procedure described in this document is based on the more stringent test requirements for determining the release of organic substances and/or for subsequent ecotoxicological testing. If only the release of inorganic substances is to be measured, requirements on equipment (e.g. column and tubing material, centrifugation) are specified in the relevant clauses for some steps of the procedure.

5.2 Number of eluates

By reference the percolation test requires the analysis of seven eluates to determine the release of dangerous substances for a L/S ratio up to 10. These results are needed for characterization of the construction product and allow the determination of the release mechanism according to Annex D.