SLOVENSKI STANDARD
SIST EN 16589-1:2023

01-marec-2023

Nadomešča:
SIST-TP CEN/TR 16589:2014

Laboratorijske lokalne odsesovalne naprave - 1. del: Splošne zahteve in metode za preskušanje tipa členkastih odsesovalnih rok

Laboratory local exhaust devices - Part 1: General requirements and type test methods for articulated extraction arms

Lokale Absaugeinrichtungen im Labor - Teil 1: Absaugarme mit Gelenken

Dispositifs d'aspiration locale de laboratoire - Partie 1 : Exigences générales et méthodes d'essais de type pour les bras d'extraction articulés

Ta slovenski standard je istoveten z: **EN 16589-1:2022**

ICS:

71.040.10	Kemijski laboratoriji. Laboratorijska oprema	Chemical laboratories. Laboratory equipment

SIST EN 16589-1:2023 **en,fr,de**

EUROPEAN STANDARD

NORME EUROPÉENNE

EUROPÄISCHE NORM

EN 16589-1

December 2022

ICS 71.040.10

Supersedes CEN/TR 16589:2013

English Version

Laboratory local exhaust devices - Part 1: General requirements and type test methods for articulated extraction arms

Dispositifs d'aspiration locale de laboratoire - Partie 1 : Exigences générales et méthodes d'essais de type pour les bras d'extraction articulés

Lokale Absaugeinrichtungen im Labor - Teil 1: Absaugarme mit Gelenken

This European Standard was approved by CEN on 21 November 2022.

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.

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

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

Ref. No. EN 16589-1:2022 E

Contents

Page

European foreword ... 3

Introduction ... 4

1 Scope ... 5

2 Normative references ... 5

3 Terms and definitions ... 6

4 Test room and general test conditions ... 10
4.1 Dimension and construction of the test room ... 10
4.2 Test room conditions ... 10
4.3 Articulated extract arm installation ... 10
4.4 Test conditions ... 10
4.4.1 General ... 10
4.4.2 Setting extract air volume flow rate ... 10
4.4.3 Tracer gas ... 10

5 Type test methods ... 11
5.1 General ... 11
5.2 Capture zone measurement ... 11
5.2.1 General ... 11
5.2.2 Test Equipment ... 11
5.2.3 Test Principle ... 11
5.2.4 Test procedure ... 12
5.3 Capture efficiency and robustness test ... 13
5.3.1 Test equipment ... 13
5.3.2 Test principle ... 13
5.3.3 Test method ... 14
5.3.4 Test procedure ... 14
5.3.5 Data analysis and results ... 16

6 Technical performance ... 17
6.1 General ... 17
6.2 Pressure measurement ... 18
6.3 Sound pressure level ... 18
6.4 Sound power level ... 18
6.5 Reachable workspace ... 18

7 Alarms and indicators ... 18
7.1 Airflow alarms ... 18
7.2 Capture zone indicator ... 18
7.3 Measuring point for airflow control ... 19

8 Marking and labelling ... 19

9 Product manual ... 19

10 Test report ... 21

Annex A (informative) Guidance on selection and use of AEA's ... 23

Annex B (informative) Recommendations for commissioning and validation on-site ... 28

Bibliography ... 29

European foreword

This document (EN 16589-1:2022) has been prepared by Technical Committee CEN/TC 332 “Laboratory equipment”, 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 June 2023, and conflicting national standards shall be withdrawn at the latest by June 2023.

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/TR 16589:2013.

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 organisations 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.

Introduction

Articulated extraction arms are local exhaust devices consisting of capture devices that may be constructed in a variety of geometric shapes (hoods, nozzles, flat screens etc.) which are connected to or mounted on extraction arms or arms with flexible joints. They are used for a variety of different applications in the laboratory where contaminants are encountered. The design of articulated extract arms for laboratories may differ for different applications.

The ability of articulated extract arms to effectively capture contaminants is subject to a number of factors. These factors include extract volume flow, capture velocity, capture hood design, manoeuvrability, position in relation to emission source, user activity, and room conditions.

Due to the fact that the capture efficiency can be affected dramatically by a change in any of the above conditions, articulated extract arms are only useful for very small pollution sources, or when the pollution source cannot be reasonably enclosed and has distinct points where the pollution might occur.

The objective of this document is to give information relevant to articulated extraction arms and to specify type test methods for articulated extraction arms. This document offers assistance in the testing of articulated extraction arms and in the drafting of user information. It is intended to contribute towards mutual understanding amongst manufacturers, laboratory designers, users and health and safety authorities.

The performance data obtained onsite will not necessarily reflect the type test data due to environmental influences. Prior to use, the performance of the device needs to be assessed to ensure it complies with the performance benchmarks specified in the risk assessment. It is the responsibility of the user that appropriate commissioning has been carried out. The extent of the commissioning testing should be based on a risk assessment.

It is intended to work on further parts of this standard series dealing with commissioning and installation and on-site testing.

1 Scope

This document is applicable to articulated extraction arms used as a local exhaust device in laboratories and comprised of a specific capture device (receiving, enclosing or capture hood, nozzle or flat screen) connected to ducting to move air from the capture device to discharge.

This document is a product standard. This document covers product performance type test methods. Occupational health and safety assessments methods are not included in this document.

This document specifies:

- a method to assess the three-dimensional capture zone of an articulated extract arms;
- a method for assessing the isothermal and diffusive emission release capture efficiency of articulated extract arms and robustness to a challenge of air disturbance directly in front of and in close proximity to the capture hood and release source positioned on a table;
- a method for establishing the reachable, three-dimensional workspace of articulated extract arms;
- a method for measuring the pressure drop and noise level of articulated extract arms;
- instructions for marking the devices and recommended information in the product manual;
- guidance for use describing the limitations of articulated extract arms for different airflow rates;
- guidance on selection, installation, commissioning, and testing of articulated extract arms and the associated local exhaust ventilation systems.

The test procedure for capture efficiency and the guidance included in Annex A and B does not apply to particle sources or point sources which release contaminants with initial velocity of above 0,5 m/s due to temperature, pressure release, work process or similar.

The scope does not include filtration requirements and impact of fully or partly recirculated airflow extracted by an articulated extract arm.

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 1093-4, *Safety of machinery — Evaluation of the emission of airborne hazardous substances — Part 4: Capture efficiency of an exhaust system — Tracer method*

EN ISO 5167-1:2003, *Measurement of fluid flow by means of pressure differential devices inserted in circular cross-section conduits running full — Part 1: General principles and requirements*

EN ISO 11204, *Acoustics - Noise emitted by machinery and equipment - Determination of emission sound pressure levels at a work station and at other specified positions applying accurate environmental corrections (ISO 11204:2010)*

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

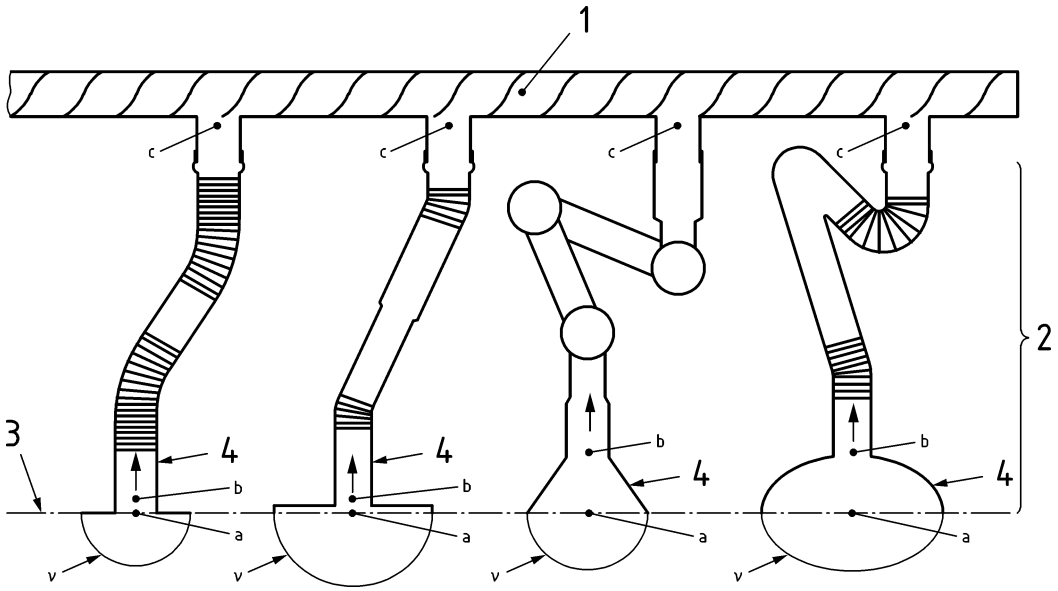
3.1
capture device
equipment designed to capture or collect air pollutants near their source connected directly to a duct or mounted on an extraction arm

Note 1 to entry: Examples of capture devices are e.g. hood, flat screen, suction nozzle.

3.2
extraction arm
fixed, flexible or articulated ducting connecting the capture device with the main extract air duct

3.3
articulated extraction arm
AEA
articulated extract ducting assembly including capture device

Note 1 to entry: The articulated extraction arm can be moved and positioned so that the capture zone of the hood is located at the identified hazard release zone. See examples in Figure 1.



Key

v schematic capture zone
a centre point of entry plane
b duct of capture device
c duct connecting to main duct
1 main duct
2 articulated extraction arms
3 entry plane
4 capture device

Figure 1 — Example of common designs of capture devices and extraction arms

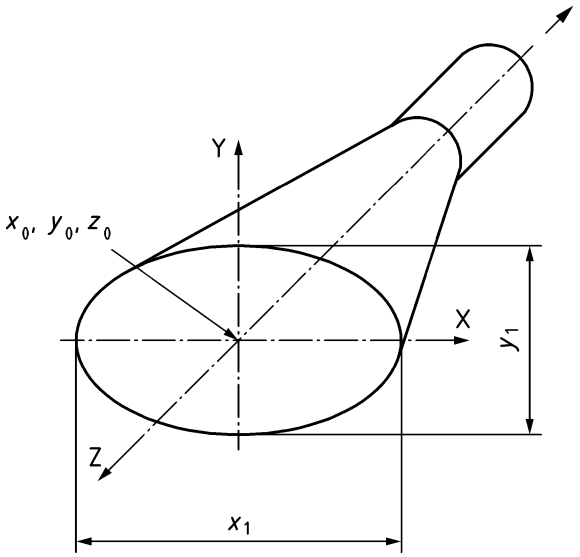
3.4
capture zone
three-dimensional space in front of the entry plane of a capture device in which the air velocity is greater than or equal to the minimum air velocity required for effective capture of pollutants

3.5
entry plane
plane touching the outermost parts of the capture device regardless of the shape

Note 1 to entry: A schematic expression of entry plane independent on the shape is given in Figure 1 and 3.

3.6
aspect ratio
ratio of the lengths x and y in the entry plane, with $x_1 > y_1$

Note 1 to entry: Schematic layout of an ellipse capture device see Figure 2. The aspect ratio is 1 for a circular device and greater than 1 for other shapes.



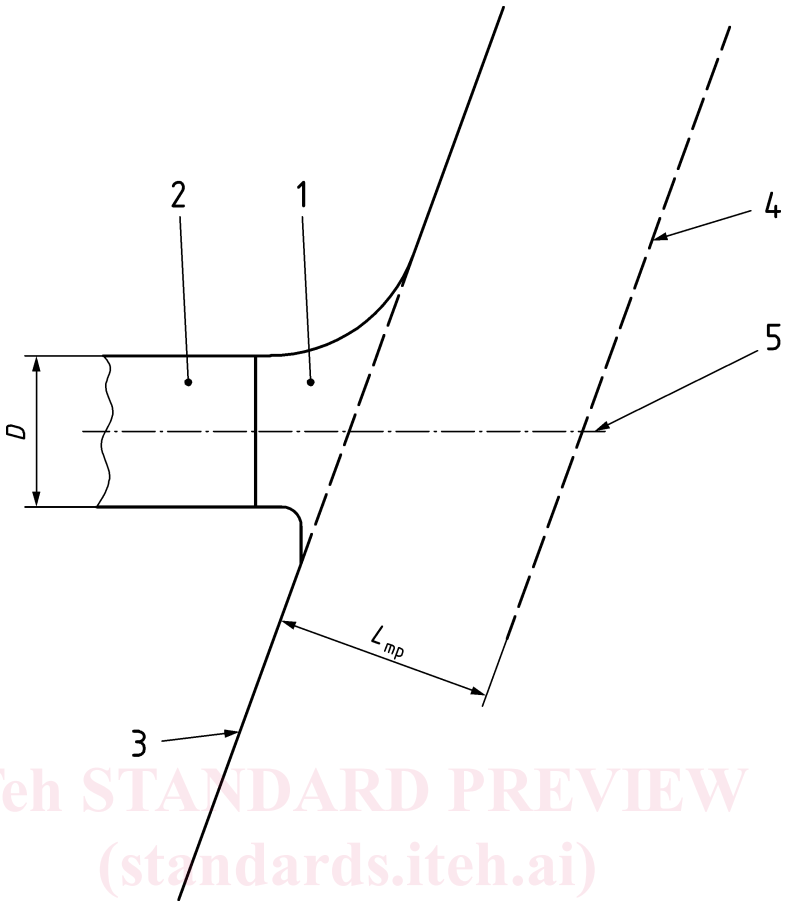
Key

x_0, y_0, z_0	centre point of the entry plane and origin for the measurement point co-ordinates
x_1	length of the entry plane of the capture device in the x-direction ($x_1 > y_1$)
y_1	length of the entry plane of the capture device in the y-direction ($x_1 > y_1$)

Figure 2 — Schematic layout of an ellipse capture device

3.7
measurement plane
two-dimensional area in front of the capture device and parallel to the entry plane

Note 1 to entry: Distance from the measuring position to the entry plane (L_{mp}) is specified in the air velocity measurement procedure. A schematic layout showing position of the measurement plane in relation to the entry plane is included in Figure 3.



Key

1	Capture device
2	Duct of capture device
3	Entry plane
4	Measurement plane
5	Center line
D	Internal diameter of the duct of the capture device
L_{mp}	Measurement plane distance from the capture device entry plane specified in the air velocity measurement procedure

Figure 3 — Schematic layout showing position of the measurement plane in relation to the entry plane

3.8
reachable workspace
three-dimensional workspace in which the positioning of the entry plane is achievable with movement of an articulated extraction arm

Note 1 to entry: The capture zone extract volume flow can vary with changes in the articulated extraction arm configuration.

4 Test room and general test conditions

4.1 Dimension and construction of the test room

The test room shall consist of an enclosure of cuboid shape, constructed of suitable materials. The internal width and length shall be not less than 4,0 m and the ceiling height shall be not less than 2,7 m. The ceiling and floor shall be level and the room shall be devoid of internal supports, internal walls or other obstacles to the airflow.

The test zone boundary shall extend approximately 1,5 m from the capture device opening in all directions and over the full room height.

NOTE If larger arms or arms with higher air volume flow rates are tested, a larger room may be necessary.

4.2 Test room conditions

The room air temperature shall be (23 ± 3) °C. The make-up air temperature during measurements shall be room air temperature ± 1 °C. Temperature gradients shall be avoided to the greatest possible extent. The make-up air shall be supplied at a distance greater than 2 m from the front of the capture device.

Room extract air shall be extracted symmetrically on the opposite side to the make-up air supply and from outside the test zone. The air speed shall be less than 0,10 m/s at the test zone boundaries. Care shall be taken regarding uncontrolled air streams and draughts entering the test room.

Any device the temperature of which exceeds 40 °C, shall be located outside the test zone boundaries.

The air extracted from the test room shall be discharged to atmosphere in such a way as to prevent its re-entrainment in the make-up air.

4.3 Articulated extract arm installation

The articulated extract arm shall be installed centrally in the test room.

The test shall be carried out on articulated extract arm installed in the test room in accordance with the manufacturer's installation instructions.

4.4 Test conditions

4.4.1 General

No person other than the operator(s) shall be present in the test room during the measurements. No person shall remain in the test zone during the measurements. There shall be no unnecessary obstructions or equipment within the test zone.

Windows and doors of the test room shall remain closed during measurements.

4.4.2 Setting extract air volume flow rate

Tests shall be performed with extract air volume flow rates in the capture device duct corresponding to set air velocities of 5 m/s, 9 m/s, 12 m/s and 15 m/s and higher at position b in Figure 1. Air velocity of 15 m/s and higher can be excluded if specified by the manufacturer. The flow rate shall be measured in the extract duct in accordance with EN ISO 5167-1:2003. The uncertainty of measurement shall not exceed ± 5 %.

The calculated volume flow rate depends on the dimension of the articulated extraction arm.

4.4.3 Tracer gas

The tracer gas shall be nitrooxide N2O, if allowed in national regulation, or equivalent.