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# Test methods for assessing the performance of gas-phase air cleaning media and devices for general ventilation

Part 3: Classification system for GPACDs applied to treatment of outdoor air

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# National foreword

This British Standard is the UK implementation of EN ISO 10121-3:2022. It is identical to ISO 10121-3:2022.

The UK participation in its preparation was entrusted to Technical Committee MCE/21, Filters for gases and liquids.

A list of organizations represented on this committee can be obtained on request to its committee manager.

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# Test methods for assessing the performance of gas-phase air cleaning media and devices for general ventilation - Part 3: Classification system for GPACDs applied to treatment of outdoor air (ISO 10121-3:2022)

Méthodes d'essai pour l'évaluation de la performance des médias et des dispositifs de filtration moléculaire pour la ventilation générale - Partie 3: Système de classification pour les GPACD appliqués au traitement de l'air extérieur (ISO 10121-3:2022)

Methode zur Leistungsermittlung von Medien und Vorrichtungen zur Reinigung der Gasphase für die allgemeine Lüftung - Teil 3: Klassifizierungssystem für die Behandlung von Außenluft (ISO 10121-3:2022)

This European Standard was approved by CEN on 25 September 2022.

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

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## European foreword

This document (EN ISO 10121-3:2022) has been prepared by Technical Committee ISO/TC 142 "Cleaning equipment for air and other gases" in collaboration with Technical Committee CEN/TC 195 “Cleaning equipment for air and other gases” the secretariat of which is held by UNI.

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of an identical text or by endorsement, at the latest by April 2023, and conflicting national standards shall be withdrawn at the latest by April 2023.

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## Endorsement notice

The text of ISO 10121-3:2022 has been approved by CEN as EN ISO 10121-3:2022 without any modification.

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# 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 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).

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This document was prepared by Technical Committee ISO/TC 142, *Cleaning equipment for air and other gases*, in collaboration with the European Committee for Standardization (CEN) Technical Committee CEN/TC 195, *Cleaning equipment for air and other gases,* in accordance with the Agreement on technical cooperation between ISO and CEN (Vienna Agreement).

A list of all parts in the ISO 10121 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.


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# Introduction

There is an increasing need for gas-phase filtration in general filtration applications. This demand can be expected to grow rapidly due to the increasing gaseous pollution problems in the world together with an increasing awareness that solutions to the problems are available in the form of filtration devices or, phrased more technically, gas-phase air cleaning devices (GPACD). The performance of devices relies to a large extent on the performance of the gas-phase air cleaning media (GPACM) incorporated in the device. The applications and device performance are often poorly understood by the users and suppliers of such media and devices. Media tests can be adequate to offer data for real applications if actual low concentrations (< 100 ppb) and longer exposure times (> weeks) can be used in the test, provided that the geometrical configuration, packing density and flow conditions of the small-scale test specimen are equal to those used in the real applications. Such tests are however not included in the scope of the ISO 10121 series.

ISO 10121-1 and ISO 10121-2 aim to provide laboratory test methods for GPACM and GPACD respectively. From the tests and reports produced, a person skilled in the field of molecular filtration can evaluate the performance of different products as well as comparing performance using benchmark tests for specific applications. To make these evaluations, a basic knowledge in chemistry, molecular filtration and the application at hand are necessary.

Persons not skilled in molecular filtration face challenges with increasing pollution. Annex A shows the annual average concentration of selected outdoor pollutants, the concentration differences of different urban and industrial settings as well as an example of ambient air quality guidelines. The air quality guideline is from WHO, where most countries have similar national threshold values. Due to this increasing pollution in urban areas, any building owner, facility management engineer, design engineers or maintenance personnel need to be able to evaluate GPACDs for general ventilation in buildings. Different standards classifying air filters for particle filtration (e.g. ASHRAE 52.2 and ISO 16890-1) have, together with many national standards, made a vast difference in facilitating the selection of air filters for particle filtration for general ventilation in buildings. Equivalent standards classifying molecular filtration devices, i.e. GPACDs, have not been available up to the publication of this document. This document addresses the specific case of outdoor air to buildings in cities and aim to be used in parallel with ISO 16890-1.

The ISO 10121 series consists of three parts.

— ISO 10121-1 covers three different media configurations and aims to provide a standardized interface between media suppliers and producers of air cleaning devices. It may also be used between media suppliers and end customers with regards to loose fill media properties.

— ISO 10121-2 aims to provide a standardized interface between suppliers of air cleaning devices and end customers seeking the most cost-efficient way to employ gas-phase filtration.

— ISO 10121-3 provides a classification system for the specific application of GPACDs in general, ventilation systems for cleaning of outdoor air polluted by local urban sources and/or long-range transboundary air pollution.

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# Test methods for assessing the performance of gas-phase air cleaning media and devices for general ventilation —

# Part 3: Classification system for GPACDs applied to treatment of outdoor air

## 1 Scope

This document establishes a classification system for GPACDs supplying single pass outdoor air to general ventilation systems using outdoor air polluted by local urban sources and/or long-distance pollution. The classification system is intended to aid in assessing molecular contamination in addition to the particulate contamination dealt with by ISO 16890-1.

This document specifies four reference pollutants, i.e. ozone, sulphur dioxide, nitrogen dioxide and toluene, used for the classification due to their relevance to the intended application. This document further specifies three duty levels that are assigned for each pollutant reflecting the typical performance range of devices intended for the application. Since selection of reference pollutants and duty levels are specific and unique to the intended application, all other applications are excluded. In particular, this document does not apply to GPACDs in recirculation applications and/or dealing with pollution from indoor sources as well as pharmaceutical, microelectronic, nuclear, homeland security and military applications.

## 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.

ISO 10121-2:2013, *Test methods for assessing the performance of gas-phase air cleaning media and devices for general ventilation — Part 2: Gas-phase air cleaning devices (GPACD)*

## 3 Terms and definitions

For the purposes of this document, the following terms and definitions apply.

ISO and IEC maintain 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**
**adsorption**
process in which the molecules of a *gas* (3.14) or vapour adhere by physical or chemical processes to the exposed surface of solid substances, both the outer surface and inner pore surface, with which they come into contact

[SOURCE: ISO 29464:2017, 3.5.7]

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**3.2**
**adsorbate**
molecular compound in gaseous or vapour phase that may be retained by an *adsorbent* (3.3) medium

[SOURCE: ISO 29464:2017, 3.5.3]

**3.3**
**adsorbent**
material having the ability to retain gaseous or vapour *contaminants* (3.10) on its surface by physical or chemical processes

[SOURCE: ISO 29464:2017, 3.5.4]

**3.4**
**ambient pressure**
absolute barometric pressure immediately outside the test rig

[SOURCE: ISO 29464:2017, 3.5.50, modified — The word "barometric" has been added.]

**3.5**
**adsorbate capacity**
$m_s$
maximum amount (mass or moles) of a selected *adsorbate* (3.2) that can be contained in GAPC medium or device under given test conditions and a specific end point (termination time)

Note 1 to entry: Capacity can also be negative during *desorption* (3.11).

[SOURCE: ISO 29464:2017, 3.5.12, modified — The symbol $m_s$ and the words "maximum" and "a specific" have been added.]

**3.6**
**challenge air stream**
test *contaminant(s)* (3.10) of interest diluted to the specified *concentration(s)* (3.9) of the test prior to filtration

[SOURCE: ISO 29464:2017, 3.5.13]

**3.7**
**challenge concentration**
*concentration* (3.9) of the test *contaminant(s)* (3.10) of interest in the air stream prior to filtration [*challenge air stream* (3.6)]

[SOURCE: ISO 29464:2017, 3.5.14]

**3.8**
**challenge compound**
chemical compound that is being used as the *contaminant* (3.10) of interest for any given test

[SOURCE: ISO 29464:2017, 3.5.15]

**3.9**
**concentration**
$C_n$
quantity of one substance dispersed in a defined amount of another

Note 1 to entry: Indices "n" denote location.

[SOURCE: ISO 29464:2017, 3.1.7, modified — The symbol $C_n$ and Note 1 to entry have been added.]


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**3.10**
**contaminant**
substance [solid, liquid or *gas* (3.14)] that negatively affects the intended use of a fluid

[SOURCE: ISO 29464:2017, 3.1.8, modified — The alternative term "pollutant" has been removed.]

**3.11**
**desorption**
process in which *adsorbate* (3.2) molecules leave the surface of the *adsorbent* (3.3) and re-enter the air stream

Note 1 to entry: Desorption is the opposite of *adsorption* (3.1).

[SOURCE: ISO 29464:2017, 3.5.21]

**3.12**
**downstream**
area or region into which fluid flows on leaving the *GPACD* (3.15)

[SOURCE: ISO 29464:2017, 3.1.11, modified — "GPACD" has been used instead of "test device".]

**3.13**
**face velocity**
volumetric air flow rate divided by the nominal *GPACD face area* (3.16)

Note 1 to entry: *GPACD* (3.15) face velocity is expressed in m/s.

[SOURCE: ISO 29464:2017, 3.1.15, modified — The alternative term "filter face velocity" has been removed; "GPACD face area" and "GPACD face velocity" have been used instead of "filter face area" and "filter face velocity".]

**3.14**
**gas**
substance whose vapour pressure is greater than the *ambient pressure* (3.4) at ambient temperature

[SOURCE: ISO 29464:2017, 3.1.28]

**3.15**
**gas-phase air cleaning device**
**GPACD**
assembly of a fixed size enabling the removal of specific gas- or vapour-phase *contaminants* (3.10)

Note 1 to entry: It is normally box shaped or fits into a box of dimensions between 290 mm × 290 mm × 290 mm up to approximately 610 mm × 610 mm × 610 mm or 2 ft × 2 ft × 2 ft.

[SOURCE: ISO 29464:2017, 3.5.32, modified — The box dimensions in note 1 to entry have been modified.]

**3.16**
**GPACD face area**
nominal cross-sectional area of the *GPACD* (3.15)

Note 1 to entry: For the purpose of standardizing measurements, the nominal area is calculated using 610 mm × 610 mm for a full-size filter, 610 mm × 305 mm for a half-size filter and 305 mm × 305 mm for a quarter size filter.

**3.17**
**heavy duty**
**HD**
duty level (specific dose) of a *contaminant* (3.10) that corresponds to a *removal efficiency* (3.29) versus dose performance for a *GPACD* (3.15) that is used in challenging environments (e.g. heavily polluted environments)

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