# SLOVENSKI STANDARD
# oSIST prEN ISO 10121-3:2021

**01-julij-2021**

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**Preskusna metoda za ocenjevanje zmogljivosti sredstev in naprav za čiščenje plinske faze za splošno prezračevanje - 3. del: Sistem klasifikacije za GPACD, ki se uporablja za obdelavo zraka na prostem (ISO/DIS 10121-3:2021)**

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/DIS 10121-3:2021)



Methode zur Leistungsermittlung von Medien und Vorrichtungen zur Reinigung der Gasphase für die allgemeine Lüftung - Teil 3: Klassifizierungssystem für die Behandlung von Außenluft (ISO/DIS 10121-3:2021)



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/DIS 10121-3:2021)

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| 91.140.30 | Prezračevalni in klimatski sistemi | Ventilation and air-conditioning systems |

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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

ICS: 91.140.30





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# Foreword

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This document was prepared by Technical Committee ISO/TC 142, *Cleaning equipment for air and other gases.*

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.

 

# Introduction

There is an increasing use and need for gas-phase filtration in general filtration applications. This demand can be expected to increase 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 a gas-phase air cleaning media (GPACM) incorporated in the device. Still applications and device performance are often poorly understood by the users and suppliers of such media and devices. Media tests may also 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 ISO 10121.

ISO 10121 parts 1 and 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 by benchmark tests for specific applications. However, to make these evaluations a basic knowledge in chemistry, molecular filtration and the application at hand are necessary.

Today, not only persons skilled in molecular filtration face challenges with increasing pollution. Annex A shows 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 Malaysia, but 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 needs to be able to evaluate GPACD's for general ventilation in buildings. Different standards classifying air filters for particle filtration e.g. ASHRAE 52.2, and ISO 16890 have together with many national standards made a vast difference in assisting selection of air filters for particle filtration for general ventilation in buildings. Such standards classifying molecular filtration devices i.e. GPACD's have to this date not been available. Part three of this series addresses the specific case of outdoor air to buildings in cities and aim to be used in parallel with ISO 16890-1.



ISO 10121 consists of three parts:

— ISO 10121-1 covers three different media configurations and is targeted towards giving 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 give 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 GPACD's to general ventilation of outdoor air polluted by local urban sources and/or long-distance pollution.

 

# Test methods for assessing the performance of gas-phase air cleaning media and devices for general ventilation — Part 3: Classification system for GPACD's applied to treatment of make-up air

## 1 Scope

This part of ISO 10121 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 pollution in addition to the particulate pollution dealt with by ISO 16890-1.

The selected normative pollutants are ozone, sulphur dioxide, nitrogen dioxide and toluene due to their relevance to the intended application. Three duty levels are assigned for each pollutant reflecting the typical performance range of devices intended for the application. The duty levels are related to the performance needed, but it is not in the scope of this classification to relate a specific duty level need to a certain place or city size. The air flow type to be covered is outdoor air to buildings *i.e.* a one pass filtration from a vast outdoor recipient of known fairly stable concentrations even if the concentration may have daily and yearly variations and/or local increased concentrations due to main traffic routes. The testing is performed according to clause 5, clause 6 and ISO 10121-2.



The classification is expressed as an integrated removal efficiency for the highest duty level that the device may be awarded. A separate class is given for each of the four normative pollutants. Since selection of normative pollutants and duty levels are specific and unique to the intended application, all other applications are excluded. In particular, GPACDs in recirculation applications and/or dealing with pollution from indoor sources as well as pharmaceutical, microelectronic, nuclear, homeland security and military applications are specifically excluded.



## 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, *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)*

ISO 16890-1, *Air filters for general ventilation - Part 1: Technical specifications, requirements and classification system based upon particulate matter efficiency (ePM)*

## 3 Terms and definitions

For the purposes of this document, the terms and definitions given in ISO 29464 and the following apply.

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

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

— IEC Electropedia: available at http://www.electropedia.org/

**3.1**
**adsorption**
process in which the molecules of a gas 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]

**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 on its surface by physical or chemical processes

[Source: ISO 29464:2017; 3.5.3]

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



[Source: ISO 29464:2017; 3.5.50, modified]

**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]

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

[Source: ISO 29464:2017; 3.5.13]

**3.7**
**challenge concentration**
concentration 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 - *C*n and note 1 to entry have been added]

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

[Source: ISO 29464:2017; 3.1.8]

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

Note 1 to entry: Desorption is the opposite of adsorption.

[Source: ISO 29464:2017; 3.5.21]



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



[Source: ISO 29464:2017; 3.1.11, modified – GPACD is used instead of test device]

**3.13**
**Normative Dose**
$D_N$
dose [mass/GPACD face area] that reaches a GPACD calculated from air flow in [volume/time], time, pollution concentration [mass /volume] and GPACD face area

**3.14**
**efficiency vs. capacity curve**
plot of the GPACD *removal efficiency* (3.30) against the integrated capacity over the duration of a challenge test for a particular *challenge concentration* (3.7) and airflow

[Source: ISO 29464:2017; 3.5.22]

**3.15**
**efficiency vs. time curve**
plot of the GPACD *removal efficiency* (3.30) against time over the duration of a challenge test for a particular *challenge concentration* (3.7) and airflow

[Source: ISO 29464:2017; 3.5.23]

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

 

Note 1 to entry: GPACD face velocity is expressed in m/s.

[Source: ISO 29464:2017; 3.1.15, modified – GPACD face area is used instead of filter face area]

**3.17**
**gas**
substance whose vapour pressure is greater than the *ambient pressure* (3.4) at ambient temperature

[Source: ISO 29464:2017; 3.1.28]

**3.18**
**gas-phase air cleaning device**
GPACD
assembly of a fixed size enabling the removal of specific gas- or vapour-phase contaminants

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

[Source: ISO 29464:2017; 3.5.32, modified – Note has been modified.]

**3.19**
**GPACD face area**
nominal cross-sectional area of the GPACD



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



**3.20**
**heavy-duty**
**HD**
corresponds to a removal efficiency versus dose performance for a GPACD that is used in challenging environments e.g. heavily polluted environments.

**3.21**
**initial efficiency**
removal efficiency of an unexposed filter or GPACD calculated as soon as possible after the start of a test

Note 1 to entry: For gas-phase, this should be calculated as soon as a steady reading can be obtained.

**3.22**
**integrated removal efficiency**
$E_{\Sigma}$
the numerically integrated fraction or percentage of a challenge contaminant that is removed by a GPACD over a specified time or dose period

**3.23**
**light-duty**
**LD**
corresponds to a removal efficiency versus dose performance for a GPACD that is used as an entry level solution, for low concentrations or intermittent contamination episodes

 