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

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Template for comments and secretariat observations

Date: xx/xx/20xx	Document: ISO/DIS xxxx
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1	2	(3)	4	5	(6)	7
MB	Clause No./ Subclause No./Annex (e.g. 3.1)	Paragraph/ Figure/Table/Note	Type of comment	Comment (justification for change) by the MB	Proposed change by the MB	Secretariat observations on each comment submitted
	3.1	Definition 1	ed	Definition is ambiguous and needs clarifying.	Amend to read '...so that the mains connector to which no connection...'	
	6.4	Paragraph 2	te	The use of the UV photometer as an alternative cannot be supported as serious problems have been encountered in its use in the UK.	Delete reference to UV photometer.	



DRAFT International Standard

ISO/DIS 16890-1

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

Filtres à air de ventilation générale —

*Partie 1: Spécifications techniques, exigences et système de
classification fondé sur l'efficacité des particules en suspension
(ePM)*

ICS: 91.140.30

This document is circulated as received from the committee secretariat.

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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).

This second edition cancels and replaces the first edition (ISO 16890-1:2016), which has been technically revised.

The main changes are as follows:

- correction of [Formula 2](#) and [3](#) in [Section 7.1](#);
- addition of [Annex D](#) Filtration efficiency against biological aerosols;
- a list of all parts in the ISO 16890 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

The effects of particulate matter (PM) on human health have been extensively studied in the past decades. The results are that fine dust can be a serious health hazard, contributing to or even causing respiratory and cardiovascular diseases. For the outdoor environment, the U.S. Environmental Protection Agency (EPA), the World Health Organization (WHO), the European Union, and other national agencies have established acceptable air quality standards according to concentrations of particulate matter classified per their aerodynamic sizes, defined as PM_{2,5} and PM₁₀, and measured according to strict prescriptive methods and sampling times.

Since there is growing interest in relating indoor air quality to outdoors, ISO 16890 series of standards classifies ventilation filters according to their efficiencies measured with an optical diameter between 0,3 µm and x µm and relating the result to historic global average ambient PM concentrations. Although not exactly equivalent to filter performance at national ambient air quality standards at PM, the classification scheme presented in the standards will yield a level correspondence to the effectiveness of the filter for ambient particle concentrations. It is however recognized that the correspondence based on global averages may not be exactly the same at a specific location since local ambient particle concentration may be different than the global average.

The particle size ranges described in [Table 1](#) are used in the ISO 16890 series for the listed efficiency values and noted as ePM_x .

Table 1 — Optical particle diameter size ranges for the definition of the efficiencies, ePM_x

Efficiency	Size range, µm
ePM_{10}	$0,3 \leq x \leq 10$
$ePM_{2,5}$	$0,3 \leq x \leq 2,5$
ePM_1	$0,3 \leq x \leq 1$

Air filters for general ventilation are widely used in heating, ventilation and air-conditioning applications of buildings. In this application, air filters significantly influence the indoor air quality and, hence, the health of people, by reducing the concentration of particulate matter. To enable design engineers and maintenance personnel to choose the correct filter types, there is an interest from international trade and manufacturing for a well-defined, common method of testing and classifying air filters according to their particle efficiencies, especially with respect to the removal of particulate matter. Current regional standards are applying totally different testing and classification methods, which do not allow any comparison with each other, and thus hinder global trade with common products. Additionally, the current industry standards have known limitations by generating results which often are far away from filter performance in service, i.e. overstating the particle removal efficiency of many products. With this new ISO 16890 series, a completely new approach for a classification system is adopted, which gives better and more meaningful results compared to the existing standards.

The ISO 16890 series describes the equipment, materials, technical specifications, requirements, qualifications and procedures to produce the laboratory performance data and efficiency classification based upon the measured fractional efficiency converted into a particulate matter efficiency (ePM) reporting system.

Air filter elements according to the ISO 16890 series are evaluated in the laboratory by their ability to remove aerosol particulate expressed as the efficiency values ePM_1 , $ePM_{2,5}$ and ePM_{10} . The air filter elements can then be classified according to the procedures defined in this part of ISO 16890. The particulate removal efficiency of the filter element is measured as a function of the particle size in the range of 0,3 µm to 10 µm of the unloaded and unconditioned filter element as per the procedures defined in ISO 16890-2. After the initial particulate removal efficiency testing, the air filter element is conditioned according to the procedures defined in ISO 16890-4 and the particulate removal efficiency is repeated on the conditioned filter element. This is done to provide information about the intensity of any electrostatic removal mechanism which may or may not be present with the filter element for test. The average efficiency of the filter is determined by calculating the mean between the initial efficiency and the conditioned efficiency for each size range. The average efficiency is used to calculate the ePM_x efficiencies by weighting these values to the standardized and normalized particle size distribution of the related ambient aerosol fraction. When comparing filters tested

in accordance with the ISO 16890 series, the fractional efficiency values shall always be compared among the same ePM_x class (ex. ePM_1 of filter A with ePM_1 of filter B). The test dust capacity and the arrestance of a filter element are determined as per the test procedures defined in ISO 16890-3. The performance results obtained in accordance with ISO 16890 series cannot by themselves be quantitatively applied to predict performance in service with regard to efficiency and lifetime. Other factors influencing performance to be taken into account are described in [Annex A](#).

Air filters for general ventilation —

Part 1: Technical specifications, requirements and classification system based upon particulate matter efficiency (ePM)

1 Scope

This document specifies an efficiency classification system of air filters for general ventilation based upon particulate matter (PM). It also provides an overview of the test procedures, and specifies general requirements for assessing and marking the filters, as well as for documenting the test results. It is intended for use in conjunction with ISO 16890-2, ISO 16890-3 and ISO 16890-4.

The test method described in this part of ISO 16890 is applicable for air flow rates between 0,25 m³/s (900 m³/h, 530 ft³/min) and 1,5 m³/s (5 400 m³/h, 3 178 ft³/min), referring to a test rig with a nominal face area of 610 mm × 610 mm (24 inch × 24 inch).

This document refers to particulate air filter elements for general ventilation having an ePM₁ efficiency less than or equal to 99 % and an ePM₁₀ efficiency greater than 20 % when tested as per the procedures defined in the ISO 16890 series.

NOTE The lower limit for this test procedure is set at a minimum ePM₁₀ efficiency of 20 % since it is very difficult for a test filter element below this level to meet the statistical validity requirements of this procedure.

This document does not apply to filter elements used in portable room-air cleaners.

2 Normative references

The following documents, in whole or in part, are normatively referenced in this document and are indispensable for its application. For dated references, only the edition cited applies. For undated references, the latest edition of the referenced document (including any amendments) applies.

ISO 15957, *Test dusts for evaluating air cleaning equipment*

ISO 16890-2:2022, *Air filters for general ventilation — Part 2: Measurement of fractional efficiency and air flow resistance*

ISO 16890-3:2024, *Air filters for general ventilation — Part 3: Determination of the gravimetric efficiency and the air flow resistance versus the mass of test dust captured*

ISO 16890-4:2022, *Air filters for general ventilation — Part 4: Conditioning method to determine the minimum fractional test efficiency*

ISO 29464:2024, *Cleaning of air and other gases — Vocabulary*

3 Terms and definitions

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

3.1 Air flow and resistance

3.1.1

air flow rate

volume of air flowing through an air cleaner per unit time

[SOURCE: ISO 29464:2024, 3.1.29, modified — The preferred term "flow rate" has been removed.]

3.1.2

nominal air flow rate

air flow rate (3.1.1) specified by the manufacturer

3.1.3

test air flow rate

air flow rate (3.1.1) used for testing

3.1.4

resistance to air flow

difference in absolute (static) pressure between two points in an air flow system at specified conditions, especially when measured across the *filter element* (3.2.2)

Note 1 to entry: Resistance to air flow is measured in Pa (inches of water).

[SOURCE: ISO 29464:2024, 3.1.43, modified — The admitted terms have been removed; "at specified conditions, especially when measured across the filter element" has been added.]

3.1.5

final resistance to air flow

resistance to air flow (3.1.2) up to which the filtration performance is measured to determine the *test dust capacity* (3.3.4)

Note 1 to entry: Final resistance to air flow is measured in Pa (inches of water).

[SOURCE: ISO 29464:2024, 3.2.142, modified – "for classification or other purposes" has been replaced with "to determine the test dust capacity".]

3.2 Test Device

3.2.1

test device

air cleaner that is being subjected to performance testing

[SOURCE: ISO 29464:2024, 3.1.45, modified — The preferred terms "device under test" and "DUT" have been removed.]

3.2.2

filter element

structure made of the filtering material, its supports and its interfaces with the filter housing

[SOURCE: ISO 29464:2024, 3.2.59]

3.2.3

upstream

U/S

area or region from which fluid flows as it enters an air cleaner

[SOURCE: ISO 29464:2024, 3.1.46, modified — "U/S" has been added as an admitted term.]

3.2.4

downstream

D/S

area or region into which fluid flows on leaving an air cleaner

[SOURCE: ISO 29464:2024, 3.1.16, modified — "D/S" has been added as an admitted term.]

3.3 Arrestance and efficiency

3.3.1

arrestance

measure of the ability of a filter to remove a standard test dust from the air passing through it under given operating conditions

Note 1 to entry: This measure is expressed as a mass fraction.

[SOURCE: ISO 29464:2024, 3.2.15, modified — The preferred term "gravimetric arrestance" has been removed; "mass percentage" has been replaced by "mass fraction" in note 1 to entry.]

3.3.2

initial arrestance

ratio of the mass of a standard test dust retained by the filter to the mass of dust fed after the first increment of dust load

Note 1 to entry: This measure is expressed as a mass fraction.

Note 2 to entry: For example, see the procedure in ISO 29461-1 or this document.

[SOURCE: ISO 29464:2024, 3.2.17, modified — The preferred term "initial gravimetric arrestance" has been removed; "mass percentage" has been replaced by "mass fraction" in note 1 to entry; the reference to "ISO 16890-3" has been replaced by "this document" in note 2 to entry.]

3.3.4

efficiency

fraction or percentage of a challenge contaminant that is removed by a filter

3.3.5

fractional efficiency

ability of an air cleaning device to remove particles of a specific size or size range

Note 1 to entry: The efficiency plotted as a function of *particle size* (3.7.1) gives the particle size efficiency spectrum.

[SOURCE: ISO 29464:2024, 3.2.135, modified – the preferred term "fractional removal Efficiency" has been replaced by "fractional efficiency".]

3.3.6

particulate matter efficiency

ePM_x

efficiency (3.1.4) of an air cleaning device to reduce the mass concentration of particles with an optical diameter between 0,3 μm and x μm

3.4 Particulate matter

3.4.1

particulate matter

PM

solid and/or liquid particles

[SOURCE: ISO 29464:2024, 3.2.123]

3.5.2

particulate matter PM_{10}

particulate matter (3.5.1) which passes through a size-selective inlet with a 50 % efficiency cut-off at 10 μm aerodynamic diameter

[SOURCE: ISO 29464:2024, 3.2.125]