

<b>STN</b>	<b>Vzduchové filtre na všeobecné vetranie Časť 4: Metóda kondicionovania na stanovenie minimálnej frakčnej účinnosti (ISO 16890-4: 2022)</b>	<b>STN EN ISO 16890-4</b>  12 5005
------------	--	--

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

Táto norma obsahuje anglickú verziu európskej normy.  
This standard includes the English version of the European Standard.

Táto norma bola oznámená vo Vestníku ÚNMS SR č. 11/22

Obsahuje: EN ISO 16890-4:2022, ISO 16890-4:2022

Oznámením tejto normy sa ruší  
STN EN ISO 16890-4 (12 5005) z júna 2017

**135888**



EUROPEAN STANDARD

**EN ISO 16890-4**

NORME EUROPÉENNE

EUROPÄISCHE NORM

August 2022

ICS 91.140.30

Supersedes EN ISO 16890-4:2016

English Version

## Air filters for general ventilation - Part 4: Conditioning method to determine the minimum fractional test efficiency (ISO 16890-4:2022)

Filtres à air de ventilation générale - Partie 4: Méthode de conditionnement afin de déterminer l'efficacité spectrale minimum d'essai (ISO 16890-4:2022)

Luftfilter für die allgemeine Raumlufttechnik - Teil 4: Konditionierungsverfahren für die Ermittlung des Fraktionsabscheidegradminimums (ISO 16890-4:2022)

This European Standard was approved by CEN on 21 July 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**

**EN ISO 16890-4:2022 (E)**

<b>Contents</b>	<b>Page</b>
<b>European foreword.....</b>	<b>3</b>

## **European foreword**

This document (EN ISO 16890-4:2022) 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 February 2023, and conflicting national standards shall be withdrawn at the latest by February 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 EN ISO 16890-4:2016.

Any feedback and questions on this document should be directed to the users' national standards body/national committee. 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.

## **Endorsement notice**

The text of ISO 16890-4:2022 has been approved by CEN as EN ISO 16890-4:2022 without any modification.

# INTERNATIONAL STANDARD

# ISO 16890-4

Second edition  
2022-07

---

---

## Air filters for general ventilation —

Part 4:

## Conditioning method to determine the minimum fractional test efficiency

*Filtres à air de ventilation générale —*

*Partie 4: Méthode de conditionnement afin de déterminer l'efficacité spectrale minimum d'essai*



Reference number  
ISO 16890-4:2022(E)

© ISO 2022

**ISO 16890-4:2022(E)****COPYRIGHT PROTECTED DOCUMENT**

© ISO 2022

All rights reserved. Unless otherwise specified, or required in the context of its implementation, no part of this publication may be reproduced or utilized otherwise in any form or by any means, electronic or mechanical, including photocopying, or posting on the internet or an intranet, without prior written permission. Permission can be requested from either ISO at the address below or ISO's member body in the country of the requester.

ISO copyright office  
CP 401 • Ch. de Blandonnet 8  
CH-1214 Vernier, Geneva  
Phone: +41 22 749 01 11  
Email: [copyright@iso.org](mailto:copyright@iso.org)  
Website: [www.iso.org](http://www.iso.org)

Published in Switzerland

# Contents

	Page
<b>Foreword</b> .....	<b>iv</b>
<b>Introduction</b> .....	<b>v</b>
<b>1 Scope</b> .....	<b>1</b>
<b>2 Normative references</b> .....	<b>1</b>
<b>3 Terms and definitions</b> .....	<b>1</b>
<b>4 Symbols and abbreviated terms</b> .....	<b>2</b>
<b>5 General conditioning test requirements</b> .....	<b>2</b>
5.1 General.....	2
5.2 Test device requirements.....	2
5.3 Test device selection.....	2
5.4 Conditioning cabinet requirements.....	3
<b>6 Conditioning materials</b> .....	<b>3</b>
<b>7 Conditioning cabinet</b> .....	<b>4</b>
7.1 General.....	4
7.2 Conditioning cabinet dimensions and construction materials.....	4
7.3 Environment, temperature and relative humidity.....	5
<b>8 Safety issues</b> .....	<b>6</b>
<b>9 Test method</b> .....	<b>6</b>
9.1 General.....	6
9.2 Conditioning procedure.....	6
9.3 Repeat testing.....	7
<b>10 Qualification</b> .....	<b>7</b>
<b>11 Reporting results</b> .....	<b>8</b>
<b>Annex A (informative) Recommendations for health and safety aspects for the use of IPA</b> .....	<b>9</b>
<b>Bibliography</b> .....	<b>11</b>



## ISO 16890-4:2022(E)

### 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](http://www.iso.org/directives)).

Attention is drawn to the possibility that some of the elements of this document may be the subject of patent rights. ISO shall not be held responsible for identifying any or all such patent rights. Details of any patent rights identified during the development of the document will be in the Introduction and/or on the ISO list of patent declarations received (see [www.iso.org/patents](http://www.iso.org/patents)).

Any trade name used in this document is information given for the convenience of users and does not constitute an endorsement.

For an explanation of the voluntary nature of standards, the meaning of ISO specific terms and expressions related to conformity assessment, as well as information about ISO's adherence to the World Trade Organization (WTO) principles in the Technical Barriers to Trade (TBT), see [www.iso.org/iso/foreword.html](http://www.iso.org/iso/foreword.html).

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 16890-4:2016), which has been technically revised.

The main changes are as follows:

- in [7.2](#) the dimensions of the conditioning cabinet are indicated in a more flexible way. This change does not affect the test, however, it does make the procedure more reasonable for the users;
- [9.1](#) has been reworded to remove duplicate information and some parts have been moved to a new [subclause 9.3](#);
- in [9.2](#) a sentence has been added to make the proper procedure clear to the users.

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](http://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. Different classes of PM can be defined according to the particle size range. The most important ones are  $PM_{10}$ ,  $PM_{2,5}$  and  $PM_1$ . The U.S. Environmental Protection Agency (EPA), the World Health Organization (WHO) and the European Union (EU) define  $PM_{10}$  as PM which passes through a size-selective inlet with a 50 % efficiency cut-off at 10  $\mu\text{m}$  aerodynamic diameter.  $PM_{2,5}$  and  $PM_1$  are similarly defined. However, this definition is not precise if there is no further characterization of the sampling method and the sampling inlet with a clearly defined separation curve. In Europe, the reference method for the sampling and measurement of  $PM_{10}$  is described in EN 12341. The measurement principle is based on the collection on a filter of the  $PM_{10}$  fraction of ambient PM and the gravimetric mass determination (see Reference [Z]).

As the precise definition of  $PM_{10}$ ,  $PM_{2,5}$  and  $PM_1$  is quite complex and not easy to measure, public authorities, such as the U.S. EPA or the German Federal Environmental Agency (Umweltbundesamt), increasingly use in their publications the simpler denotation of  $PM_{10}$  as being the particle size fraction less than or equal to 10  $\mu\text{m}$ . Since this deviation to the above-mentioned complex “official” definition does not have a significant impact on a filter element’s particle removal efficiency, the ISO 16890 series refers to this simplified definition of  $PM_{10}$ ,  $PM_{2,5}$  and  $PM_1$ .

PM in the context of the ISO 16890 series describes a size fraction of the natural aerosol (liquid and solid particles) suspended in ambient air. The symbol  $ePM_x$  describes the efficiency of an air cleaning device to particles with an optical diameter between 0,3  $\mu\text{m}$  and  $x$   $\mu\text{m}$ . The following particle size ranges are used in the ISO 16890 series for the listed efficiency values as shown in [Table 1](#).

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

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

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 PM. 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 PM. Current regional standards are applying completely 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 show better filtration performance than the filter performance in service, i.e. overstating the particle removal efficiency of many products. With the 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 PM 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 ISO 16890-1. The particulate removal efficiency of the filter element is measured as a function of the particle size in the range of 0,3  $\mu\text{m}$  to 10  $\mu\text{m}$  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 this document and the particulate removal efficiency is repeated on the conditioned filter element. This is done to provide information about the intensity of

**ISO 16890-4:2022(E)**

any electrostatic removal mechanism which can possibly 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 (e.g.  $ePM_1$  of filter A with  $ePM_1$  of filter B). The test dust capacity and the initial arrestance of a filter element are determined as per the test procedures defined in ISO 16890-3.

The results from this document can also be used by other standards that define or classify the fractional efficiency in the size range of 0,3  $\mu\text{m}$  to 10  $\mu\text{m}$  when electrostatic removal mechanism is an important factor to consider, for example ISO 29461.

The performance results obtained in accordance with the ISO 16890 series cannot by themselves be quantitatively applied to predict performance in service with regard to efficiency and lifetime.

# Air filters for general ventilation —

## Part 4:

# Conditioning method to determine the minimum fractional test efficiency

## 1 Scope

This document establishes a conditioning method to determine the minimum fractional test efficiency.

It is intended to be used in conjunction with ISO 16890-1, ISO 16890-2 and ISO 16890-3, and provides the related test requirements for the test device and conditioning cabinet as well as the conditioning procedure to follow.

The conditioning method described in this document is referring to a test device with a nominal face area of 610 mm × 610 mm (24 inches × 24 inches).

This document refers to particulate air filter elements for general ventilation having an  $ePM_1$  efficiency less than or equal to 99 % and an  $ePM_{10}$  efficiency greater than 20 % when tested according to the procedures defined within the ISO 16890 series.

**NOTE** The lower limit for this test procedure is set at a minimum  $ePM_{10}$  efficiency of 20 % since it will be very difficult for a test filter element below this level to meet the statistical validity requirements of this procedure.

Filter elements used in portable room-air cleaners are excluded from the scope of this document.

## 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 16890-2:2016, *Air filters for general ventilation — Part 2: Measurement of fractional efficiency and air flow resistance*

**koniec náhľadu – text ďalej pokračuje v platenej verzii STN**