SLOVENSKI STANDARD
oSIST prEN ISO 16890-3:2015

01-julij-2015

Zračni filtri pri splošnem prezračevanju - 3. del: Ugotavljanje gravimetrijske učinkovitosti in odpornosti pretoka zraka v odvisnosti od mase zajetega preskusnega prahu (ISO/DIS 16890-3:2015)

Air filters for general ventilation - Part 3: Determination of the gravimetric efficiency and the airflow resistance versus the mass of test dust captured

Luftfilter für die allgemeine Raumlufttechnik - Teil 3: Ermittlung des gravimetrischen Wirkungsgrades sowie des durchflusswiderstandes im Vergleich zu der aufgenommenen Masse von Prüfstaub

Filtres à air pour ventilation générale - Partie 3: Détermination de l'efficacité gravimétrique et de la résistance à l'écoulement de l'air par rapport à la quantité de poussière retenue

Ta slovenski standard je istoveten z: **prEN ISO 16890-3**

ICS:

91.140.30	Prezračevalni in klimatski sistemi	Ventilation and air-conditioning

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Air filters for general ventilation —

Part 3:
Determination of the gravimetric efficiency and the air flow resistance versus the mass of test dust captured

Filtres à air pour ventilation générale —

Partie 3: Détermination de l'efficacité gravimétrique et de la résistance à l'écoulement de l'air par rapport à la quantité de poussière

ICS: 91.140.30

ISO/CEN PARALLEL PROCESSING

This draft has been developed within the International Organization for Standardization (ISO), and processed under the **ISO lead** mode of collaboration as defined in the Vienna Agreement.

This draft is hereby submitted to the ISO member bodies and to the CEN member bodies for a parallel five month enquiry.

Should this draft be accepted, a final draft, established on the basis of comments received, will be submitted to a parallel two-month approval vote in ISO and formal vote in CEN.

To expedite distribution, this document is circulated as received from the committee secretariat. ISO Central Secretariat work of editing and text composition will be undertaken at publication stage.

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Contents

Page

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).

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).

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

For an explanation on the meaning of ISO specific terms and expressions related to conformity assessment, as well as information about ISO's adherence to the WTO principles in the Technical Barriers to Trade (TBT) see the following URL: Foreword - Supplementary information

ISO 16890-3 was prepared by Technical Committee ISO/TC 142, *Air filters for general ventilation*.

ISO 16890 (all parts) replaces ISO/TS 21220:2009.

ISO 16890 consists of the following parts, under the general title *Air filters for general ventilation*:

— *Part 1: Technical specifications, requirements and efficiency classification system based upon Particulate Matter (PM)*

— *Part 2: Measurement of fractional efficiency and air flow resistance*

— *Part 3: Determination of the gravimetric efficiency and the airflow resistance versus the mass of test dust captured*

— *Part 4: Conditioning method to determine the minimum fractional test efficiency*

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 particulate matter can be defined according to the particle size range. The most important ones are PM10, PM2,5 and PM1. The U.S. Environmental Protection Agency (EPA), the World Health Organization (WHO) or the European Union define PM10 as particulate matter which passes through a size-selective inlet with a 50% efficiency cut-off at 10 µm aerodynamic diameter. PM2,5 and PM1 are similarly defined. However, this definition is not precise as long as there are no further definition 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 PM10 is that described in EN 12341 "Air Quality – Field Test Procedure to Demonstrate Reference Equivalence of Sampling Methods for the PM10 fraction of particulate matter". The measurement principle is based on the collection on a filter of the PM10 fraction of ambient particulate matter and the gravimetric mass determination (see EU Council Directive 1999/30/EC of 22 April 1999).

As the precise definition of PM10, PM2,5 and PM1 is quite complex and not simple to measure, public authorities, like e.g. the US EPA or the German Federal Environmental Agency (Umweltbundesamt), increasingly use in their publications the more simple denotation of PM10 as being the particle size fraction less or equal to 10 µm. Since this deviation to the above mentioned complex "official" definition does not have a significant impact on a filter elements particle removal efficiency as reported by ISO 16890, this simplified definition of PM10, PM2,5 and PM1 will be utilized within ISO 16890 documents.

Particulate Matter in the context of this standard describes a size fraction of the natural aerosol (liquid and solid particles) suspended in ambient air, with the symbol PM*x* where *x* defines the size range of the aerodynamic diameter ≤ *x* µm. The following particle size fractions are used in this standard:

Fraction	Size range
PM_{10}	≤ 10 µm
$PM_{2,5}$	≤ 2,5 µm
PM_1	≤ 1 µm

Air filters used for general ventilation are widely used in heating, ventilation and air-conditioning applications of buildings. In this application they 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 properly 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 to each other, and hence, hinder global trade with common products. Additionally, the current standards have known limitations and generate results which are sometimes far away from filter performance in service. With this new international standard, a completely new approach for a classification system is adopted, which gives better and more meaningful results compared to the existing standards. Additionally, this new approach shall overcome major concerns related to the former approach of ISO/TS 21220.

ISO 16890 (all parts) 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 (PM) reporting system.

Air filter elements according to this series of standards are evaluated in the laboratory by their ability to remove aerosol particulate to PM_1, $PM_{2,5}$ and PM10 aerosol fractions and then the air filter elements can be classified per the procedures defined in part 1. The particulate removal efficiency of the filter element is measured as a function of the particle size in the range of 0,3 to 10 µm of the unloaded and unconditioned filter element per the procedures defined in part 2. The air filter element is then

conditioned per the procedures defined in part 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 results from this second particle collection efficiency step are used to shift the fractional efficiency curve of the filter element to be used to calculate the average efficiency in each of the PM_1, $PM_{2,5}$ and PM_{10} ranges by weighting the fractional efficiency values according to the standardized and normalized particle size distribution of the related fraction of the ambient aerosol.

Air filters for general ventilation —

Part 3:
Determination of the gravimetric efficiency and the air flow resistance versus the mass of test dust captured

1 Scope

This part of ISO 16890 specifies the test equipment and the test methods used for measuring the gravimetric efficiency and air flow resistance of air filter for general ventilation.

It is intended for use in conjunction with ISO 16890-1, ISO 16890-2 and ISO 16890-4.

The test method described in this standard is applicable for air flow rates between 0,25 m^3/s (900 m^3/h, 530 ft^3/min) and 1,5 m^3/s (5400 m^3/h, 3178 ft^3/min), referring to a test rig with a nominal face area of 610 mm x 610 mm (24 inch x 24 inch).

ISO 16890 (all parts) refers to particulate air filter elements for general ventilation having an initial efficiency less than or equal to 99 % with respect to PM_1 aerosol fraction and greater than 20 % with respect to PM_{10} aerosol fraction when tested per the procedures defined within parts 1-4 of ISO 16890.

Air filter elements outside of this aerosol fraction are evaluated by other applicable test methods, (see ISO 29463, part 1-5).

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

The performance results obtained in accordance with this series of standards cannot by themselves be quantitatively applied to predict performance in service with regard to efficiency and lifetime.

2 Normative references

The following referenced documents are indispensable for the application 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/DIS 16890-1, *Air filters for general ventilation — Part 1: Technical specifications, requirements and efficiency classification system based upon Particulate Matter (PM)*

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

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

EN ISO 5167-1, *Measurement of fluid flow by means of pressure differential devices — Part 1: Orifice plates, nozzles and Venturi tubes inserted in circular cross-section conduits running full (ISO 5167-1:1991).*

ISO 2854, *Statistical interpretation of data — Techniques of estimation and tests relating to means and variances.*

ISO 12103-1, *Road vehicles — Test dust for filter evaluation — Part 1: Arizona test dust.*

ISO 14644-3, *Cleanrooms and associated controlled environments — Part 3: Test methods.*

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

ISO 29463, *High-efficiency filters and filter media for removing particles in air*

ISO 29494, *Cleaning equipment for air and other gases — Terminology*

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 passing through the filter per unit time

[SOURCE: ISO 29464:2011; 3.2.38]

3.1.2
nominal air flow rate
air flow rate specified by the manufacturer

3.1.3
face velocity
air flow rate divided by the face area (expressed in m/s)

3.1.4
resistance to airflow
difference in pressure between two points in an airflow system at specified conditions, especially when measured across the filter element

3.1.5
recommended final differential pressure
maximum operating differential pressure of the filter as recommended by the manufacturer (expressed in Pa)

[SOURCE: ISO 29464:2011; 3.1.139]

3.1.6
final differential pressure
differential pressure up to which the filtration performance is measured for classification purposes (expressed in Pa)

[SOURCE: ISO 29464:2011; 3.1.138]

3.1.7
initial differential pressure
differential pressure of the clean filter operating at its test air flow rate (expressed in Pa).

[SOURCE: ISO 29464:2011; 3.1.140]

3.1.8
test air
air to be used for testing purposes.

3.2 Test device

3.2.1
test device
filter element to be tested per this standard

3.2.2
filter element
filtering material in a preformed shape being a part of a complete filter

[SOURCE: ISO 29464:2011; 3.1.67]

3.2.3
upstream, U/S
direction opposite to the flow

[SOURCE: ISO 29464:2011; 3.1.157]

3.2.4
downstream, D/S
area following the filter in the direction of fluid flow

[SOURCE: ISO 29464:2011; 3.2.28]

3.2.5
charged filter
filter in which the filter medium is electrostatically charged or polarized

[SOURCE: ISO 29464:2011; 3.1.75]

3.2.6
coarse filter
a filtration device with particle removal efficiency < 50 % in the PM_{10} particle range

3.2.7
fine filter
a filtration device with particle removal efficiency ≥ 50 % in the PM_{10} particle range

3.2.8
final filter
air filter used to collect the loading dust passing through or shedding from the filter under test

[SOURCE: ISO 29464:2011; 3.1.86]

3.2.9
effective filter media area
area of the media contained in the filter (without adhesive spaces or ligament) and passed by air during operation (expressed in m^2).

[SOURCE: ISO 29464:2011; 3.1.11]

3.2.10
media velocity
air flow rate divided by the effective filter media area (expressed in m/s to an accuracy of three significant figures).

3.3 gravimetric 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 weight percentage.

[SOURCE: ISO 29464:2011; 3.1.14]

3.3.2
initial arrestance
value of arrestance determined after the first loading cycle in a filter test expressed as a weight percentage

[SOURCE: ISO 29464:2011; 3.1.16]

3.3.3
average arrestance
ratio of the total amount of loading dust retained by the filter to the total amount of dust fed up to final test pressure differential.

[SOURCE: ISO 29464:2011; 3.1.15]

3.3.4
dust holding capacity
DHC
amount of loading dust retained by the filter up to final pressure differential (expressed in grams)

[SOURCE: ISO 29464:2011; 3.1.19]

3.3.5
loading dust
synthetic dust formulated specifically for determination of the test dust capacity and arrestance of air filters

[SOURCE: ISO 29464:2011; 3.1.54]

3.3.6
particle size
geometric diameter (equivalent spherical, optical or aerodynamic, depending on context) of the particles of an aerosol.

[SOURCE: ISO 29464:2011; 3.1.126]

3.6 Other terms

3.6.1
HEPA filter
filters with performance complying with requirements of filter class ISO 35:— ISO 45 as per ISO 29463-1

[SOURCE: ISO 29464:2011; 3.1.88]

3.6.2
reference device
primary device possessing accurately known parameters used as a standard for calibrating secondary devices

[SOURCE: ISO 29464:2011; 3.1.39]

3.6.3
face area
area of the inside section of the test duct immediately upstream of the filter under test (nominal values 0,61 m × 0,61 m = 0,37 m^2)

3.6.4
re-entrainment
release to the air flow of particles previously collected on the filter

[SOURCE: ISO 29464:2011; 3.1.142]