SIST

SLOVENSKI STANDARD
oSIST prEN ISO 29462:2020

01-junij-2020

Terensko preskušanje splošnih prezračevalnih filtrirnih naprav in sistemov na kraju samem (kraju vgradnje) glede učinkovitosti odstranjevanja delcev po njihovi velikosti in glede upornosti proti zračnemu toku (ISO/DIS 29462:2020)

Field testing of general ventilation filtration devices and systems for in situ removal efficiency by particle size and resistance to airflow (ISO/DIS 29462:2020)

Betriebserprobung von Filtereinrichtungen und -systemen für die allgemeine Lüftung hinsichtlich ihrer Abscheideeffizienz im eingebauten Zustand bezogen auf die Partikelgröße und den Druckverlust (ISO/DIS 29462:2020)

Essais in situ de filtres et systèmes de ventilation générale pour la mesure de l'efficacité en fonction de la taille des particules et de la perte de charge (ISO/DIS 29462:2020)

Ta slovenski standard je istoveten z: **prEN ISO 29462**

ICS:

13.040.20	Kakovost okoljskega zraka	Ambient atmospheres
23.120	Zračniki. Vetrniki. Klimatske naprave	Ventilators. Fans. Air-conditioners
91.140.30	Prezračevalni in klimatski sistemi	Ventilation and air-conditioning systems

oSIST prEN ISO 29462:2020 **en,fr,de**

DRAFT INTERNATIONAL STANDARD
ISO/DIS 29462

ISO/TC **142** Secretariat: **UNI**

Voting begins on: **2020-04-14** Voting terminates on: **2020-07-07**

Field testing of general ventilation filtration devices and systems for in situ removal efficiency by particle size and resistance to airflow

Essais in situ de filtres et systèmes de ventilation générale pour la mesure de l'efficacité en fonction de la taille des particules et de la perte de charge

ICS: 91.140.30

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ISO/CEN PARALLEL PROCESSING

Reference number
ISO/DIS 29462:2020(E)

Contents

Page

Foreword

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

This second edition cancels and replaces the first edition (ISO 29462:2013), which has been technically revised.

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 purpose of this International Standard is to provide a test procedure for evaluating the in-situ performances of general ventilation filtration devices and systems. Although any filter with a filtration efficiency at or above 99% or at or below 30% when measured at 0,4 µm could theoretically be tested using this International Standard, it may be difficult to achieve statically acceptable results for these type of filtration devices.

Supply air to the Heating, Ventilation and Air-Conditioning (HVAC) system contains viable and non-viable particles of a broad size range. Over time these particles will cause problems for fans, heat exchangers and other system parts, decreasing their function and increasing energy consumption and maintenance. For health issues, the fine particles (<2,5 µm) are the most detrimental.

Particles in the 0,3 µm to 5,0 µm size range are typically measured by particle counters that can determine the concentration of particles in specific size ranges. These instruments are commercially available and will determine particle size along with the concentration level by several techniques (e.g., light scattering, electrical mobility separation, or aerodynamic drag). Devices based on light scattering are currently the most convenient and commonly used instruments for this type of measurement and are therefore the type of device used within this International Standard.

Particles in the size range 1,0 µm to 5,0 µm are present in low numbers (less than 1%, by count) in outdoor and supply air and have higher sampling-system losses. Results in the range >1,0 µm will therefore have lower accuracy and so the results should be interpreted with respect to this.

During in-situ measurement conditions, the optical properties of the particles may differ from the optical properties of the particles used for calibrating the particle counter and testing it in the laboratory. Thus the particle counter could size the particles differently but count the overall number of particles correctly.

By adding an extra reference filter, the effect of varying measuring conditions can be reduced. Additionally, using this enhanced test method, the results can be used to correct the measured efficiencies in relation to the efficiency of the reference filter measured in laboratory using a standardized test aerosol.

The results from using the standard method or the enhanced method will give both users and manufacturers a better knowledge of actual filter and installation properties.

It is important to note that field measurements generally result in larger uncertainties in the results compared to laboratory measurements. Field measurements may produce uncertainty from temporal and spatial variability in particle concentrations, from limitations on sampling locations due to air handling unit configurations, and from the use of field instrumentation. These factors may result in lower accuracy and precision in the calculated fractional efficiencies compared to laboratory measurements. This International Standard is intended to provide a practical method in which the accuracy and precision of the result are maximized (and the precision of the result quantified) by recommending appropriate sampling locations, sample quantities, and instrumentation. This International Standard is not intended to serve as a filter performance rating method. ***The results obtained from the test method described in this International Standard do not replace those obtained through tests conducted in the laboratory.***

Field testing of general ventilation filtration devices and systems for in situ removal efficiency by particle size and resistance to airflow

1 Scope

This International Standard describes a procedure for measuring the performance of general ventilation air cleaning devices in their end use installed configuration. The performance measurements include removal efficiency by particle size and the resistance to airflow. The procedures for test include the definition and reporting of the system airflow.

The procedure describes a method of counting ambient air particles of 0,3 µm to 5,0 µm upstream and downstream of the in-place air cleaner(s) in a functioning air handling system. The procedure describes the reduction of particle counter data to calculate removal efficiency by particle size.

Since filter installations vary dramatically in design and shape, a protocol for evaluating the suitability of a site for filter evaluation and for system evaluation is included. When the evaluated site conditions meet the minimum criteria established for system evaluation, the performance evaluation of the system can also be performed according to this procedure.

This International Standard also describes performance specifications for the testing equipment and defines procedures for calculating and reporting the results. This International Standard is not intended for measuring performance of portable or movable room air cleaners or for evaluation of filter installations with and expected filtration efficiency at or above 99 % or at or below 30 % when measured at 0,4 µm.

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 7726, *Ergonomics of the thermal environment — Instruments for measuring physical quantities*

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

ISO 21501-4, *Determination of particle size distribution — Single particle light interaction methods — Part 4: Light scattering airborne particle counter for clean spaces*

3 Terms, definitions, and abbreviations

3.1 Terms and definitions

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

3.1.1
air filter bypass
unfiltered air that has passed through the AHU filter installation but remained unfiltered because it bypassed the installed air filters

3.1.2
air velocity
rate of air movement at the filter

Note 1 to entry: It is expressed in m/s (fpm) to three significant figures.

[SOURCE: ISO 29464:2017; 3.1.2]

3.1.3
allowable measurable concentration of the particle counter
fifty percent of the maximum measurable concentration as stated by the manufacturer of the *particle counter* (3.1.12)

[SOURCE: ISO 29464:2017; 3.2.115]

3.1.4
coefficient of variation
CV
standard deviation of a group of measurements divided by the mean

[SOURCE: ISO 29464:2017; 3.2.31]

3.1.5
coincidence error
error which occurs because at a given time more than one particle is contained in the measurement volume of a particle counter

Note 1 to entry: The coincidence error leads to a measured number *concentration* (3.1.7) which is too low and a value for the *particle diameter* (3.2.124) which is too high.

[SOURCE: ISO 29464:2017; 3.2.32]

3.1.6
diluter
dilution system
system for reducing the sampled concentration to avoid coincidence error in the particle counter

[SOURCE: ISO 29464:2017; 3.2.46]

3.1.7
filter efficiency
removal efficiency of a filter as determined by this International Standard, where upstream and downstream particle count measurements are taken close to the filter being tested

3.1.8
filter installation
filtration devices and systems such as a single filter or a group of filters mounted together with the same inlet and outlet of air

[SOURCE: ISO 29464:2017; 3.2.85]

3.1.9
general ventilation
process of moving air from outside the space, recirculated air, or a combination of these into or about a space or removing it from the space

[SOURCE: ISO 29464:2017; 3.2.100]

3.1.10
isoaxial sampling
sampling in which the flow in the sampler inlet is moving in the same direction as the flow being sampled

[SOURCE: ISO 29464:2017; 3.2.104]

3.1.11
isokinetic sampling
technique for air sampling such that the probe inlet air velocity is the same as the velocity of the air surrounding the sampling point

[SOURCE: ISO 29464:2017; 3.2.105]

3.1.12
particle counter
device for detecting and counting numbers of discrete airborne particles present in a sample of air

[SOURCE: ISO 29464:2017; 3.2.114]

3.1.13
particle size range
defined particle counter channel

[SOURCE: ISO 29464:2017; 3.2.137]

3.1.14
reference filter
small dry media-type filter that has been laboratory tested for removal efficiency by particle size

3.1.15
removal efficiency by particle size
removal efficiency
ratio of the number of particles retained by the filter to the number of particles measured upstream of the filter for a given particle-size range

[SOURCE: ISO 29464:2017; 3.2.149]

3.1.16
resistance to airflow
loss of static pressure caused by the filter and filter loading which is measured with the filter operating at the measured air velocity

Note 1 to entry: It is expressed in Pa (in WG) to two significant figures.

3.1.17
system efficiency
removal efficiency of a filter system where upstream and downstream particle count measurements may be across several filter banks or other system components

[SOURCE: ISO 29464:2017; 3.2.163]

3.2 Abbreviations

AHU Air Handling Unit

CV Coefficient of Variation

D/S Downstream of test device

HEPA High Efficiency Particle Air (as per ISO 29463-1)

HVAC Heating, Ventilating and Air-Conditioning

MERV Minimum Efficiency Reporting Value

OPC Optical Particle Counter

RH Relative Humidity

U/S Upstream of test device

ULPA Ultra Low Penetration Air

VAV Variable Air Volume

VFD Variable Frequency Drive

4 Test equipment and setup

4.1 Particle counter

The particle counter should be capable of measuring particles in the size range 0,3 µm — 5,0 µm, in a minimum of four ranges with a minimum of two ranges below 1,0 µm (for example: 0,3 µm — 0,5 µm, 0,5 µm — 1,0 µm, 1,0 µm — 2,0 µm and 2,0 µm — 5,0 µm). For maintenance and calibration of the particle counter, see 4.9

4.2 Diluter

A dilution system capable of diluting the aerosol concentration so the particle concentration level is within the acceptable concentration limit may be used. Choose a suitable dilution ratio so that the measured concentration of particles is well within the allowable measurable concentration limits of the particle counter so as to achieve good statistical data (see 9.1.2). If a dilution system is used, it is to be used for both upstream and downstream sampling. The dilution system shall not change air flow to the particle counter.

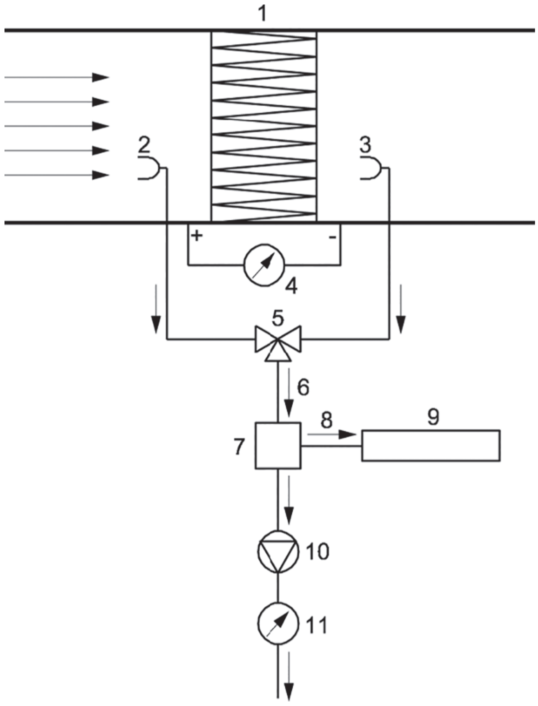
4.3 Pump

A pump may be used to control the rate of the sample flow (q_s) through the sampling probes. A pump is not necessary when the counter flow (q_{pc}) to the counter or diluter is sufficient for isokinetic sampling. In this case the sample flow (q_s) and the counter flow (q_{pc}) are the same.

4.4 Sampling system

4.4.1 General

Figure 1 shows the elements of a typical sampling system.



Key

1 test device
2 U/S Probe
3 D/S Probe
4 manometer
5 sample valve
6 q_s – primary flow
7 isokinetic sampler
8 q_{pc} – flow to particle counter
9 particle counter
10 pump
11 flow meter

Figure 1 — Sampling system

4.4.2 Sampling probes

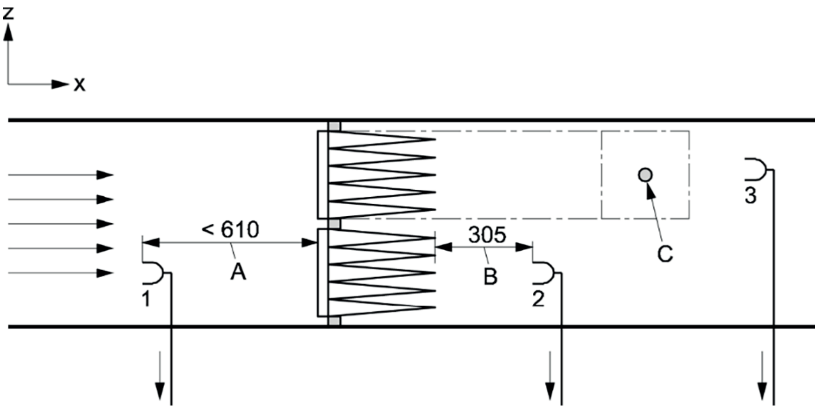
The sampling probe should consist of a sharp edged nozzle connected to the sample line leading to the auxiliary pump or particle counter. The diameter of the nozzle is dependent on the sample flow (q_s) in order to get isokinetic sampling. The diameter should not be less than 8 mm.

4.4.3 Sampling lines

Sampling lines upstream and downstream should be of equal length and as short as possible to avoid losses. Material should preferably be of a type with minimum particle losses for filter installations. Software is available to calculate line losses[2].

4.4.4 Sampling locations

Sampling locations should be placed close to the filter as shown in Figure 2. If the system efficiency is to be tested, the sampling locations should be further away to achieve good mixing of airflow through filters, frames, doors, etc. The measurement of the system efficiency is more difficult and therefore it is good practice to plan the measurement carefully and describe in detail how it was made.



Key

A minimum distance between the sampling probe and the filter

B distance between the end of the filter and the sampling probe

C location of sample points in y-z plane for filter efficiency tests

1 U/S sampling probe location

2 D/S sampling probe location for a filter efficiency test

3 D/S sampling probe location for a system efficiency test

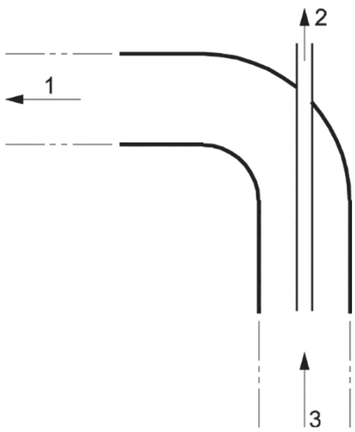
Figure 2 — Sampling locations

4.4.5 Valve (manual or automatic)

A valve may be used to switch between upstream and downstream sample locations. The valve should be constructed so that particle losses are identical in upstream and downstream measurements. No influence on efficiency due to the valve construction is permitted (for example, four-point ball valves of sufficient diameter may be used).

4.4.6 Isoaxial sampling nozzle

If a pump (see 4.3) is used to obtain isokinetic sampling, the sample line should then be fitted with an isoaxial sampling nozzle directly connected to the particle counter or diluter as shown in Figure 3.



Key

1 pump flow

2 q_{pc} – flow to particle counter

3 q_s – sample flow

Figure 3 — Isoaxial sampling line to particle counter

4.4.7 Flow meter

A flow meter is necessary if a pump is part of the sampling system. The flow meter should be located in-line with the pump inlet or outlet.

4.5 Air velocity measurement instrument

The instrument used to measure the air velocity should have sufficient operational limits such that the system airflow is within the limits of the instrument. The instrument should be chosen in accordance with ISO 7726 . An instrument that records data values and will average those values is recommended. Ideally, the instrument should have the ability to correct measurements to standard sea level atmospheric pressure conditions.

4.6 Relative humidity measurement instrument

The instrument used to measure the relative humidity of the system airflow should have sufficient operational limits such that the system relative humidity is within the limits of the instrument and should be chosen in accordance with ISO 7726. An instrument that records data values and will average those values over time is recommended.

4.7 Temperature measurement instrument

The instrument used to measure the temperature of the system airflow should have sufficient operational limits such that the system temperature is within the limits of the instrument and should be chosen in accordance with ISO 7726. An instrument that records data values and will average those values over time is recommended.

4.8 Resistance to airflow measurement instrument

The instrument used to measure the resistance of the filter bank should have sufficient operational limits such that the filter bank resistance is within the limits of the instrument, and should be chosen in accordance with ISO 14644-3. An instrument that records data values and will average those values over time is recommended.

4.9 Test equipment maintenance and calibration

Maintenance items and schedules should conform to Table 1.

Table 1 — Apparatus maintenance schedules

Maintenance item	Incorporated into each test	Annually	After a change that may alter performance	Comment
Particle counter zero check	X			
Sampling system zero check	X			
Resistance to airflow	X			
Air velocity	X			
Temp, RH in sample air stream and at particle counter	X			
Upstream concentration test	X			
Reference filter test (field)	optional			
Reference filter test (lab)		X	X	
Particle counter primary calibration		X	X	