
**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
résistance à l'écoulement de l'air*



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

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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).

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 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.

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 29462:2013), which has been technically revised.

The main changes are as follows:

- [subclause 4.2](#) has been modified;
- some editorial corrections have been made.

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 document 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 can theoretically be tested using this document, it can 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 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 ($< 2,5 \mu\text{m}$) 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 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 document.

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 $> 1,0 \mu\text{m}$ therefore have lower accuracy and should be interpreted accordingly.

During in situ measurement conditions, the optical properties of the particles can differ from the optical properties of the particles used for calibrating the particle counter and testing it in the laboratory. Thus the particle counter can 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 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 can 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 can result in lower accuracy and precision in the calculated fractional efficiencies compared to laboratory measurements. This document 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 document is not intended to serve as a filter performance rating method. The results obtained from the test method described in this document 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 document 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 test procedures 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 document also describes performance specifications for the testing equipment and defines procedures for calculating and reporting the results. This document is not intended for measuring performance of portable or movable room air cleaners or for evaluation of filter installations with an expected filtration efficiency at or above 99 % or at or below 30 % when measured at 0,4 μm .

2 Normative references

There are no normative references in this document.

3 Terms, definitions, and abbreviated terms

3.1 Terms and definitions

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

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

- ISO Online browsing platform: available at <https://www.iso.org/obp>
- IEC Electropedia: available at <https://www.electropedia.org/>

3.1.1

air filter bypass

proportion of the challenge air stream that passes around an air cleaner without interacting with the air cleaner (test device)

[SOURCE: ISO 29464:2017; 3.1.3, modified — The preferred terms "bypass" and "sneakage" have been deleted and "(test device)" has been added.]

3.1.2

air velocity

rate of air movement at the test device

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