
**High-efficiency filters and filter media for
removing particles in air —**

**Part 3:
Testing flat sheet filter media**

*Filtres à haut rendement et filtres pour l'élimination des particules dans
l'air —*

Partie 3: Méthode d'essai des filtres à feuille plate

iTeh Standards
(<https://standards.iteh.ai>)
Document Preview

ISO 29463-3:2011

<https://standards.iteh.ai/catalog/standards/iso/20dc55e4-480d-4d45-9b37-6fbb72256b3d/iso-29463-3-2011>



Reference number
ISO 29463-3:2011(E)

iTeh Standards
(<https://standards.iteh.ai>)
Document Preview

ISO 29463-3:2011

<https://standards.iteh.ai/catalog/standards/iso/20dc55e4-480d-4d45-9b37-6fbb72256b3d/iso-29463-3-2011>



COPYRIGHT PROTECTED DOCUMENT

© ISO 2011

All rights reserved. Unless otherwise specified, no part of this publication may be reproduced or utilized in any form or by any means, electronic or mechanical, including photocopying and microfilm, without permission in writing from either ISO at the address below or ISO's member body in the country of the requester.

ISO copyright office
Case postale 56 • CH-1211 Geneva 20
Tel. + 41 22 749 01 11
Fax + 41 22 749 09 47
E-mail copyright@iso.org
Web www.iso.org

Published in Switzerland

Contents

Page

Foreword	iv
Introduction.....	v
1 Scope	1
2 Normative references	1
3 Terms and definitions	1
4 Symbols and abbreviations	1
5 Principle	3
6 Sampling of sheet filter media	3
7 Test apparatus	3
7.1 Test arrangements for testing with mono-disperse test aerosol	5
7.2 Test arrangements for testing with a poly-disperse test aerosol	5
7.3 Test filter mounting assembly	7
7.4 Determination of the filter medium face velocity	8
8 Requirements for the test air	8
9 Testing procedure	9
9.1 Preparatory checks	9
9.2 Procedure	9
9.3 Reference test method.....	10
10 Evaluation	10
11 Test report.....	11
12 Maintenance and inspection of the test apparatus.....	11
13 Production test for media	12
13.1 Measurement of differential pressure	12
13.2 HEPA filter media penetration test	12
14 Physical property test of filter media	12
Annex A (informative) Example of an application with evaluation	13
Annex B (informative) Production testing of filter media	17
Annex C (informative) Media physical properties	18
Bibliography.....	20

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.

International Standards are drafted in accordance with the rules given in the ISO/IEC Directives, Part 2.

The main task of technical committees is to prepare International Standards. Draft International Standards adopted by the technical committees are circulated to the member bodies for voting. Publication as an International Standard requires approval by at least 75 % of the member bodies casting a vote.

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.

ISO 29463-3 was prepared by Technical Committee ISO/TC 142, *Cleaning equipment for air and other gases*.

ISO 29463 consists of the following parts, under the general title *High-efficiency filters and filter media for removing particles in air*:

- Part 1: Classification, performance, testing and marking
- Part 2: Aerosol production, measuring equipment, particle-counting statistics
- Part 3: Testing flat sheet filter media
- Part 4: Test method for determining leakage of filter element — Scan method
- Part 5: Test method for filter elements

Introduction

ISO 29463 (all parts) is derived from EN 1822 (all parts) with extensive changes to meet the requests from non-EU p-members. It contains requirements, fundamental principles of testing and the marking for high-efficiency particulate air filters with efficiencies from 95 % to 99,999 995 % that can be used for classifying filters in general or for specific use by agreement between users and suppliers.

ISO 29463 (all parts) establishes a procedure for the determination of the efficiency of all filters on the basis of a particle counting method using a liquid (or alternatively a solid) test aerosol, and allows a standardized classification of these filters in terms of their efficiency, both local and overall efficiency, which actually covers most requirements of different applications. The difference between ISO 29463 (all parts) and other national standards lies in the technique used for the determination of the overall efficiency. Instead of mass relationships or total concentrations, this technique is based on particle counting at the most penetrating particle size (MPPS), which, for micro-glass filter mediums, is usually in the range of 0,12 µm to 0,25 µm. This method also allows testing ultra-low penetration air filters, which was not possible with the previous test methods because of their inadequate sensitivity. For membrane filter media, separate rules apply, and they are described in ISO 29463-5:2011, Annex B. Although no equivalent test procedures for testing filters with charged media is prescribed, a method for dealing with these types of filters is described in ISO 29463-5:2011, Annex C. Specific requirements for test method, frequency, and reporting requirements can be modified by agreement between supplier and customer. For lower efficiency filters (group H, as described below), alternate leak test methods described in ISO 29463-4:2011, Annex A can be used by specific agreement between users and suppliers, but only if the use of these other methods is clearly designated in the filter markings as described in ISO 29463-4:2011, Annex A.

There are differences between ISO 29463 (all parts) and other normative practices common in several countries. For example, many of these rely on total aerosol concentrations rather than individual particles. For information, a brief summary of these methods and their reference standards are provided in ISO 29463-5:2011, Annex A.

<https://standards.iteh.ai/iso-29463-3-2011>

<https://standards.iteh.ai/catalog/standards/iso/20dc55e4-480d-4d45-9b37-6fbb72256b3d/iso-29463-3-2011>

High-efficiency filters and filter media for removing particles in air —

Part 3: Testing flat sheet filter media

1 Scope

This part of ISO 29463 specifies the test procedure for testing the efficiency of flat sheet filter media. It is intended for use in conjunction with ISO 29463-1, ISO 29463-2, ISO 29463-4 and ISO 29463-5.

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 29463-1:2011, *High-efficiency filters and filter media for removing particles in air — Part 1: Classification, performance, testing and marking*

ISO 29463-2:2011, *High-efficiency filters and filter media for removing particles in air — Part 2: Aerosol production, measuring equipment, particle-counting statistics*

ISO 29463-4:2011, *High-efficiency filters and filter media for removing particles in air — Part 4: Test method for determining leakage of filter element — Scan method*

ISO 29463-5:2011, *High-efficiency filters and filter media for removing particles in air — Part 5: Test method for filter elements*

ISO 29464¹⁾, *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 29463-1, ISO 29463-2 and ISO 29464 apply.

4 Symbols and abbreviations

Table 1 presents the quantities (terms and symbols) used in this part of ISO 29463 to represent measurement variables and calculated values. The values should be inserted in the equation given for these calculations in the units specified.

1) To be published.

Table 1 — Quantities, symbols and units

Term	Symbol	Unit	Equation for the calculation
Measured variables			
Exposed area	A	cm ²	
Test volume flow rate	\dot{V}	cm ³ /s	
Pressure drop	Δp	Pa	
Mean particle diameter	\bar{d}_p	µm	
Particle number	N	—	
Sampling volume flow rate	\dot{V}_s	cm ³ /s	
Sampling duration	t	s	
Calculated quantities			
Filter medium face velocity	u	cm/s	$u = \frac{V}{A}$
Mean differential pressure	$\Delta \bar{p}$	Pa	$\Delta \bar{p} = \frac{1}{n} \sum_{i=1}^n \Delta \bar{p}_i$
Particle number concentration	c_N	cm ⁻³	$c_N = \frac{N}{\dot{V}_s \cdot t}$
Penetration for particles in size range i	P_i	a	$P_i = \frac{c_{N,d,i}}{c_{N,u,i}}$ b
Mean penetration	\bar{P}	a	$\bar{P} = \frac{1}{n} \sum_{i=1}^n P_i$
Mean efficiency	\bar{E}	a	$\bar{E} = 1 - \bar{P}$
Number of particles for the upper or lower limit of the 95 % level of confidence	$N_{95 \%}$	—	ISO 29463-2:2011, Clause 7
Penetration as upper limit value for the 95 % level of confidence	$P_{95 \%, i}$	a	$P_{95 \%, i} = \frac{c_{N,d,95 \%, i}}{c_{N,u,95 \%, i}}$ b
Mean penetration as upper limit value for the 95 % level of confidence	$\bar{P}_{95 \%}$	a	$\bar{P}_{95 \%} = \frac{1}{n} \sum_{i=1}^n P_{95 \%, i}$
Mean efficiency as lower limit value for the 95 % level of confidence	$\bar{E}_{95 \%}$	a	$\bar{E}_{95 \%} = 1 - \bar{P}_{95 \%}$
^a These quantities are usually given as a percentage. ^b The index, u, refers to upstream particle counts, and the index, d, refers to downstream particle counts.			

5 Principle

When testing the sheet filter medium, the particle size efficiency is determined using a particle counting method. The testing may use a mono-disperse or a poly-disperse test aerosol. The methods differ in terms of both the production of the aerosol and the particle counter used. Furthermore, the measurement of the pressure drop is made at the prescribed filter medium velocity.

Specimens of the sheet filter medium are fixed in a test filter assembly and subjected to the test air flow corresponding to the prescribed filter medium velocity. The test aerosol from the aerosol generator is conditioned (e.g. vaporization of a solvent), then neutralized, mixed homogeneously with filtered test air and directed to the test filter assembly.

In order to determine the efficiency, partial flows of the test aerosol are sampled upstream and downstream of the filter medium. Using a particle counting instrument, the number concentration of the particles contained is determined for various particle sizes. The results of these measurements are used to draw a graph of efficiency against particle size for the filter medium, and to determine the particle size for which the efficiency is a minimum. This particle size is known as the most penetrating particle size (MPPS).

When measuring the particles on the upstream side of the filter medium, it can be necessary to use a dilution system in order to reduce the concentration of particles down to the measuring range of the particle counter used.

Additional equipment is required to measure the absolute pressure, temperature and relative humidity of the test aerosol and to measure and control the test volume flow rate.

6 Sampling of sheet filter media

The testing of the sheet filter medium shall be carried out on at least five samples.

The samples shall be handled with care; the area being tested shall be free from all folds, kinks, holes or other irregularities.

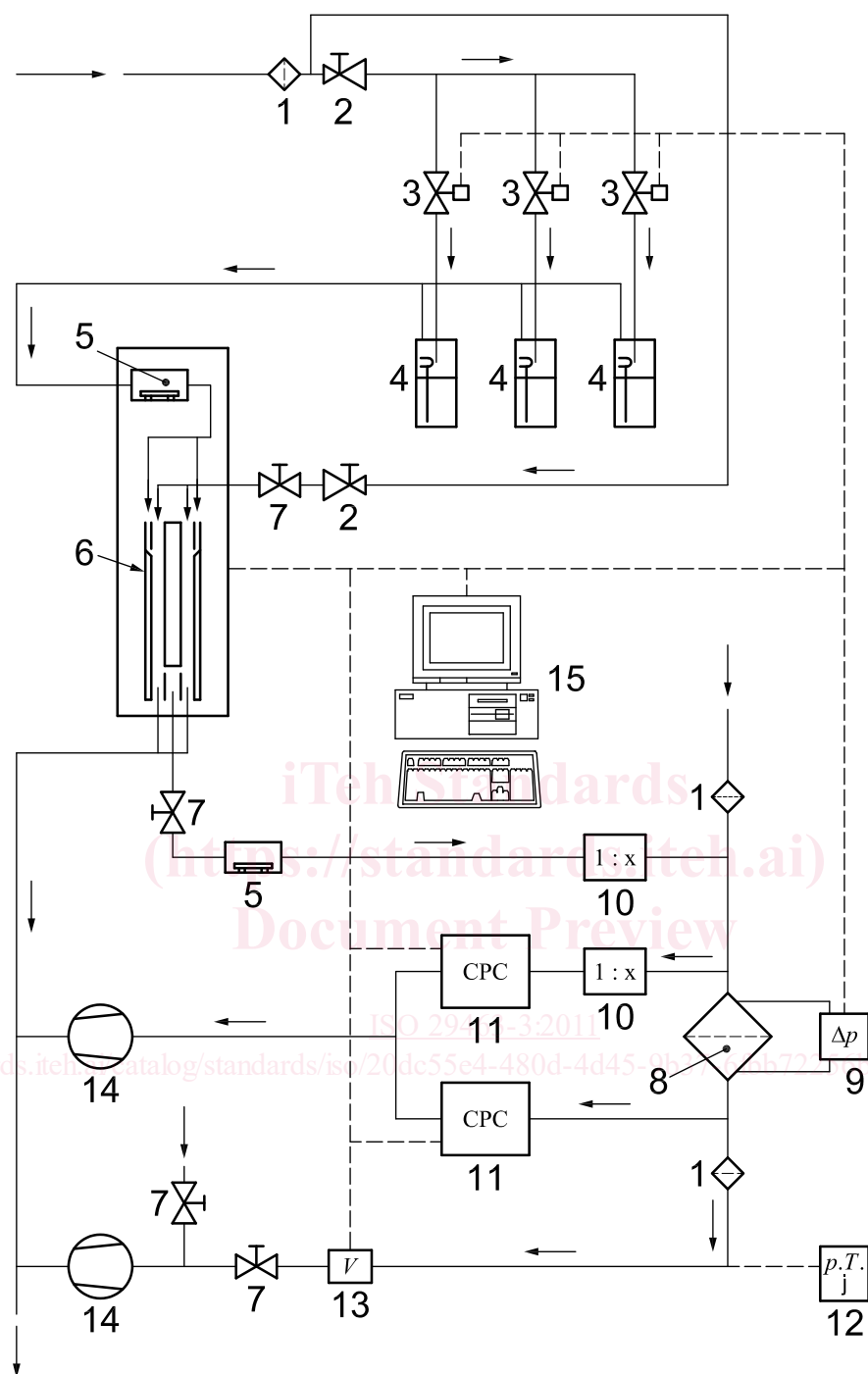
All samples shall be clearly and permanently marked with the following details:

- a) designation of the filter medium;
- b) upstream side of the filter medium.

7 Test apparatus

The test apparatus being used and the arrangement of the components and measuring equipment are shown in Figure 1.

The basic details for the aerosol generation and the aerosol neutralization, together with the details of suitable types of apparatus, are given in ISO 29463-2.



Key

- | | |
|----------------------------------|---|
| 1 filter | 9 differential pressure gauge |
| 2 pressure valve | 10 dilution system |
| 3 solenoid valve | 11 condensation particle counter |
| 4 jet nebulizer | 12 measuring equipment for absolute pressure, temperature and relative humidity |
| 5 neutralizer | 13 volume flow rate meter |
| 6 differential mobility analyser | 14 vacuum pump |
| 7 needle valve | 15 computer for control and data storage |
| 8 test filter mounting assembly | |

Figure 1 — Set-up for testing with mono-disperse test aerosols