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Respiratory protective devices — Methods of test and test equipment —

Part 3: Determination of particle filter penetration

Appareils de protection respiratoire — Méthodes d'essai et équipement d'essai —
Partie 3: Détermination de la pénétration d'un filtre à particules

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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.

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 16900-3 was prepared by Technical Committee ISO/TC 94, *Personal safety — Protective clothing and equipment*, Subcommittee SC 15, *Respiratory protective devices*.

ISO 16900 consists of the following parts, under the general title *Respiratory protective devices — Methods of test and test equipment*:

— *Part 1: Determination of inward leakage*

— *Part 2: Determination of breathing resistance*

— *Part 3: Determination of particle filter penetration*

— *Part 4: Determination of gas filter capacity and migration, desorption and carbon monoxide dynamic testing*

— *Part 11: Determination of field of vision*

The following parts are under preparation:

— *Part 5: Breathing machine/metabolic simulator/RPD headforms/torso, tools and transfer standards*

— *Part 8: Measurement of RPD air flow rates*

— *Part 10: Resistance to ignition, flame, radiant heat and heat*

— *Part 12: Determination of volume averaged work of breathing and peak respiratory pressures*

Introduction

This part of ISO 16900 is intended as a supplement to the respiratory protective devices (RPD) performance standard ISO 17420 (all parts). Test methods are specified for complete devices or parts of devices that are intended to comply with ISO 17420. If deviations from the test method given in this part of ISO 16900 are necessary, these deviations will be specified in ISO 17420.

Respiratory protective devices — Methods of test and test equipment —

Part 3: Determination of particle filter penetration

1 Scope

This part of ISO 16900 specifies the test methods for particle filter penetration of separate or integral filters for respiratory protective devices.

2 Normative references

The following documents, in whole or in part, are normatively referenced in this document and are indispensable for its application. For dated references, only the edition cited applies. For undated references, the latest edition of the referenced document (including any amendments) applies.

ISO 16972, *Respiratory protective devices — Terms, definitions, graphical symbols and units of measurement*

ISO 21748, *Guidance for the use of repeatability, reproducibility and trueness estimates in measurement uncertainty estimation*

3 Terms and definitions

For the purposes of this document, the terms and definitions given in ISO 16972 apply.

4 Prerequisites

The performance standard shall indicate the conditions of the test. This includes the following:

a) number of specimens;

b) sequence of preconditioning;

c) challenge aerosol flow rate(s) through the filter under test.

5 General test requirements

Unless otherwise specified, the values stated in this part of ISO 16900 are expressed as nominal values. Except for temperature limits, values which are not stated as maxima or minima shall be subject to a tolerance of ±5 %. Unless otherwise specified, the ambient temperature for testing shall be between 16°C and 32°C and (50 ± 30) % relative humidity. Any temperature limits specified shall be subject to an accuracy of ±1 °C.

6 Principle

A challenge aerosol of known characteristics is generated and passed through the filter under test. The concentration of aerosol downstream of the filter divided by the aerosol concentration upstream of the filter as measured on the same type of detector, multiplied by a factor of 100, is the percentage penetration of the filter under test.

The two reference aerosols are sodium chloride and paraffin oil. The sodium chloride is a solid aerosol and the paraffin oil is a liquid aerosol.

7 Apparatus

7.1 General

The test apparatus consists of four modules:

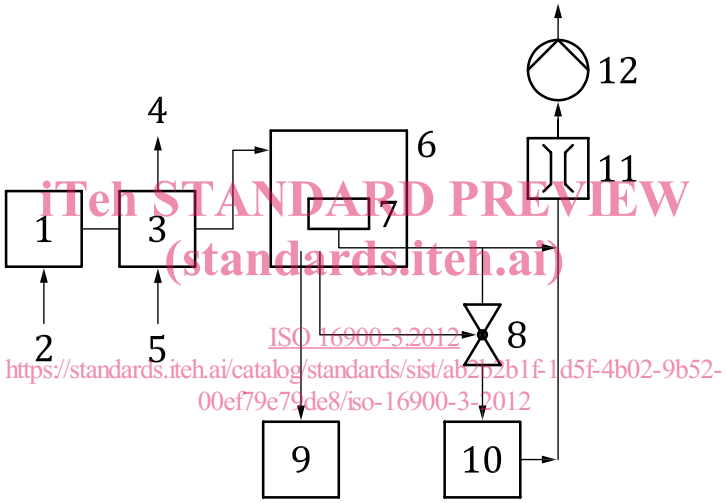
a) aerosol generator;

b) flow control;

c) filter test chamber;

d) aerosol detector.

A schematic drawing of an example for a test apparatus is shown in Figure 1.



Key

1 aerosol generator
2 compressed air supply
3 flow control module
4 air bleed (test flows less than the output of the generator)
5 make-up air (test flows greater than the output of the generator)
6 filter test chamber
7 filter under test
8 two-way sample selection valve
9 second aerosol detection photometer (optional)
10 aerosol detection photometer
11 flow meter
12 suction pump

Figure 1 — Schematic example of test apparatus

7.2 Aerosol generator

7.2.1 General

Sodium chloride (NaCl) aerosol shall be neutralized by the injection of both positive and negative ions into the drying or dilution air flow so that the charge distribution is brought to the state of equilibrium, commonly known as the Boltzmann distribution. Paraffin aerosol shall not be neutralized since this increases variability in the test results.

NOTE The ions should be generated by electrical means and adjusted so that there is no overall charge bias on the aerosol.

7.2.2 Sodium chloride test method

7.2.2.1 The test aerosol is generated by atomising by compressed air a solution of sodium chloride in demineralized water. The atomized solution is mixed with dry air to cause the water to evaporate. The resultant aerosol shall have the following properties:

a) the number median of particle size distribution is between 0,06 µm and 0,10 µm electromobility diameter, with a geometric standard deviation between 1,4 and 1,8;

b) the aerosol concentration is within the range 8 mg/m^3 to 35 mg/m^3;

c) the variation of the concentration is not greater than ±10 % during the test;

d) the relative humidity is 40 % or less at (22 ± 3) °C.

The aerosol mass concentration, particle size distribution and humidity shall be measured within the filter test chamber.

NOTE It is recommended that an electrical mobility method be used to determine the particle size distribution. Additional information on electrical mobility measurements may be found in ISO 15900.

7.2.2.2 The NaCl solution shall be completely replaced and not replenished in order to maintain the correct solution concentration.

7.2.3 Paraffin oil test method

7.2.3.1 The test aerosol is generated by atomising by compressed air the liquid paraffin oil. The paraffin oil characteristics at 20 °C shall be:

a) CAS number: 8012-95-1;

b) density: 0,818 g/cm^3 to 0,875 g/cm^3;

c) dynamic viscosity: 0,025 Pa·s to 0,080 Pa·s; [kinematic viscosity: < 35 mm^2/s (at 40 °C: 13,5 mm^2/s to 16,5 mm^2/s)].

7.2.3.2 Laboratories shall consider the following:

a) paraffin oil in the test rig shall be replaced with fresh oil every three months irrespective of use, or more frequently if exposed continuously to heating and compressed air;

b) where the generator requires the oil to be heated, it is recommended not to heat the oil above 60 °C.

7.2.3.3 The paraffin aerosol shall have the following properties: