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Respiratory protective devices — Methods of test and test equipment —

Part 2: Determination of breathing resistance

Appareils de protection respiratoire — Méthodes d'essai et équipement d'essai —

Partie 2: Détermination de la résistance respiratoire

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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 on 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 the following URL: www.iso.org/iso/foreword.html.

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

This second edition cancels and replaces the first edition (ISO 16900-2:2009), which has been technically revised.

The main changes compared to the previous edition are as follows:

— relevant respiratory protective device (RPD) headform or torso have been used and previously specified headform and concentric breathing tube assembly have been deleted;

— Annex B has been deleted;

— air volume flow rate has been corrected to the standardized condition of 1 013 hPa and 20 °C.

A list of all parts in the ISO 16900 series can be found on the ISO website.

Introduction

This document is intended as a supplement to the relevant performance standards for respiratory protective devices (RPDs). Test methods are specified for complete devices or parts of devices. If deviations from the test method given in this document are necessary, these deviations will be specified in the relevant performance standard.

The following definitions apply in understanding how to implement an ISO International Standard and other normative ISO deliverables (TS, PAS, IWA):

— “shall” indicates a requirement;

— “should” indicates a recommendation;

— “may” is used to indicate that something is permitted;

— “can” is used to indicate that something is possible, for example, that an organization or individual is able to do something.

Respiratory protective devices — Methods of test and test equipment —

Part 2: Determination of breathing resistance

1 Scope

This document specifies the method(s) of test for breathing resistance for

— respiratory protective devices (RPDs),

— filters for RPDs, and

— respiratory interfaces (RI).

2 Normative references

The following documents are referred to in the text in such a way that some or all of their content constitutes requirements 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 16900-5, *Respiratory protective devices — Methods of test and test equipment — Part 5: Breathing machine, metabolic simulator, RPD headforms and torso, tools and verification tools*

ISO 16900-10, *Respiratory protective devices — Methods of test and test equipment — Part 10: Resistance to ignition, flame, radiant heat and heat*

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

3 Terms and definitions

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

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

— IEC Electropedia: available at http://www.electropedia.org/

— ISO Online browsing platform: available at https://www.iso.org/obp

3.1
static breathing resistance
differential pressure caused by an RPD when the breathing gas is passed through the device at a constant flow

3.2
dynamic breathing resistance
differential pressure caused by an RPD when the breathing gas is moved by a breathing machine, adjusted to a specified minute ventilation including breathing frequency, waveform and tidal volume

4 Prerequisites

In order to implement this document, at least the following parameters shall be specified in the performance standard:

— the number of specimens;

— the selection and type(s) of support such as RPD headform/RPD torso;

— the state in which the RI or RPD shall be tested;

— any prior conditioning or testing;

— flow rate (static test method);

— flow rate (minute ventilation), including breathing frequency, tidal volume and waveform (dynamic) test method;

— any deviations from the method(s).

5 General test requirements

Unless otherwise specified, the values stated in this document 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 conditions for testing shall be between 16 °C and 32 °C and (50 ± 30) % RH. Any temperature limits specified shall be subject to an accuracy of ±1 °C.

For each of the required measurements performed in accordance with this document, a corresponding estimate of the uncertainty of measurement should be evaluated. This estimate of uncertainty should be applied and stated when reporting test results, in order to enable the user of the test report to assess the reliability of the result (see Annex A).

All flow rate values shall be corrected to 1 013 hPa and 20 °C.

NOTE Uncertainty of measurement can be calculated in accordance with JCGM 100[1].

6 Method 1: Static breathing resistance for filters and respiratory interfaces (RI)

6.1 General

The filter or RI is mounted on a support and air is drawn through the device at a constant flow rate.

NOTE 1 The convention of reporting breathing resistance is that if, during the inhalation resistance test, the pressure inside an RI or downstream of a filter relative to atmosphere is negative, the result is prefixed with a "–". If the relative pressure inside an RI is positive, the result is prefixed with a "+".

NOTE 2 The pressure drop across a filter is reported without any prefix.

6.2 Equipment

6.2.1 Pressure gauge, calibrated in the appropriate range relevant to the performance standard.

6.2.2 Flowmeter(s), calibrated in the appropriate volumetric flow rate range and corrected for the ambient temperature and ambient atmospheric pressure during use.

6.2.3 Ambient temperature and ambient atmospheric pressure measuring equipment.

6.2.4 Regulated blower/compressed air source and/or a variable suction device.

6.2.5 Support for the device (e.g. filter holder or relevant RPD headform).

NOTE 1 The filter holder can be provided by the RPD manufacturer.

NOTE 2 It is important that the support for the device does not reduce the effective working area of the filter or RPD.

6.3 Procedure

6.3.1 Procedure for filters for respiratory protective devices

Air is drawn through the filter and filter holder system (see Figure 1). The pressure drop between ambient and a pressure port fitted at a suitable point between the filter holder and the connection to the suction device is measured.

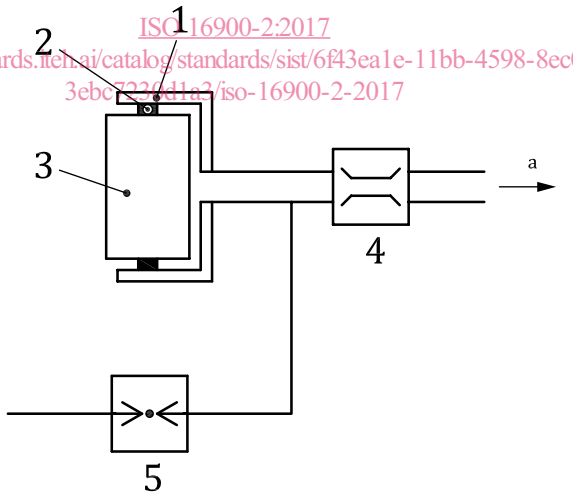
Ensure that the filter is in the state designated by the performance standard.

Mount the filter in a leak-tight manner as indicated in Figure 1. Draw the appropriate airflow, as specified in the performance standard, through the filter holder system. Measure and record the pressure drop, Δp_S.

Remove the filter. Draw the same airflow through the filter holder system. Measure and record the pressure drop, Δp_H.

Calculate and report the breathing resistance of the filter, Δp_F, according to Formula (1) at the specified flow rate.

$$\Delta p_F = \Delta p_S - \Delta p_H \quad (1)$$



Key

1 filter holder
2 sealing mechanism
3 filter
4 flow meter
5 pressure gauge
a Regulated suction.

Figure 1 — Typical arrangement for measurement of breathing resistance of filters