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Respiratory protective devices — Methods of test and test equipment —

Part 14: Measurement of sound pressure level

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

Partie 14: Mesurage du niveau de pression sonore

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Foreword

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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 — Personal protective equipment*, Subcommittee SC 15, *Respiratory protective devices*.

This second edition cancels and replaces the first edition (ISO 16900-14:2015), which has been technically revised.

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

— New text and Figures 2 to 6 have been added to provide more details on the test components and methods.

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

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

This document is intended as a supplement to the respiratory protective devices (RPD) performance standards. 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 performance standards.

Respiratory protective devices — Methods of test and test equipment —

Part 14: Measurement of sound pressure level

1 Scope

This document specifies laboratory test methods for measuring the sound pressure level generated by the respiratory protective device (RPD) and by RPD warning devices, measured on a headform to which the RPD is fitted.

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 2768-2, *General tolerances — Part 2: Geometrical tolerances for features without individual tolerance indications*

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

IEC 61260-1, *Octave-band and fractional-octave-band filters — Part 1: Specifications*

IEC 61672-1, *Electroacoustics — Sound level meters — Part 1: Specifications*

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:

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

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

3.1
A-weighted equivalent continuous sound pressure level
$L_{p,\mathrm{A,eq}T}$
10 times the logarithm to the base 10 of the ratio of the time average of the square of the A-weighted sound pressure, p_A, during a stated time interval of duration T (starting at t_1 and ending at t_2), to the square of the reference value, p_0, expressed in decibels

$$L_{p,\mathrm{A,eq}T} = 10\log_{10}\left[\frac{\frac{1}{T}\int_{t_2}^{t_1} {p_\mathrm{A}}^2(t)\mathrm{d}t}{{p_0}^2}\right]\mathrm{dB} \quad (1)$$

where the reference value, p_0, is 20 µPa.

[SOURCE: ISO 9612:2009, 3.1, modified — "A-weighted time-averaged sound pressure level ($L_{p,A,T}$)" deleted.]

4 Prerequisites

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

a) the number of RPD specimens;

b) any prior conditioning or testing;

c) the RPD operating conditions;

d) the test duration;

e) 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 shall be evaluated. This estimate of uncertainty shall be stated when reporting test results, in order to enable the user of the test report to assess the reliability of the result in accordance with Annex A.

NOTE Uncertainty of measurement can be calculated in accordance with JCGM 100[3].

6 Method A — Measurement of the noise level

6.1 Principle

The RPD is operated on the RPD headform 3[1)] (medium size) as specified in ISO 16900-5, equipped with the special ear inserts shown in Figure 1. The RPD headform is attached to the RPD torso as specified in ISO 16900-5 and connected to a breathing machine or metabolic simulator. Microphones are placed in the special ear inserts, details of which are shown in Figure 2 to 4, to measure the A-weighted continuous equivalent sound pressure level generated by the RPD, exclusive of any warning device, at the right and left ears.

Measurements on both ears can be performed either in parallel or sequentially.

The RPD headform 3 shall be used regardless of the size of the respiratory interface and shall be attached to the RPD torso to avoid reflected noise.

6.2 Equipment

a) The RPD headform 3 with soft surface finish fixed to the RPD torso shall be used. The torso shall be covered with a cotton T shirt. A pressure microphone, 12 mm in diameter shall be fitted in each special ear insert in the position as shown in Figure 5. The surface of the microphone shall be positioned at the surface of the flat ear ±1 mm.

1) CAD file for the RPD headforms, available at ISO Livelink:

b) The measurement system shall meet the IEC 61672-1 Class 2 standard for sound level meters and shall be capable of measuring the A-weighted continuous equivalent sound pressure level in decibels.

c) A sound level calibrator meeting IEC 60942 Class 2.

d) A suitable adaptor (see Figure 6) for the microphone system and sound level meter.

e) A breathing machine or metabolic simulator as appropriate.

The test environment, including test enclosure should not include surfaces that can reflect sound from the specimen.

6.3 Procedure

a) The microphone(s) shall be mounted in the RPD headform at the position shown in Figure 5

b) The sound level meter and microphone system shall be calibrated using the specified sound level calibrator [see 6.2 c)]. The sound level calibrator including the adaptor shall be tightly fitted onto the microphone (See Figure 6). The sound level calibrator applies a sinusoidal tone to the microphone which is used by the sound level meter for calibration. The sound level calibrator and adaptor shall be removed after calibration.

c) The breathing machine or metabolic simulator shall be operated at the appropriate workrate for the class of the RPD.

d) The background noise level in the test room shall be measured, without the RPD fitted to the RPD headform, but with the breathing machine or metabolic simulator operating. The background noise level shall be a maximum of 70 dBA.

e) With the breathing machine or metabolic simulator switched off or disconnected, the RPD shall be fitted on the RPD headform and torso, making all the necessary adjustments to ensure a good fit with reference to the information supplied by the manufacturer.

f) Assisted filtering RPD shall be operated as specified by the manufacturer at the manufacturer's maximum flow conditions related to the workrate.

g) The breathing machine or metabolic simulator shall be switched back on or reconnected.

h) The $L_{p,\mathrm{A,eq}T}$ (A-weighted equivalent continuous sound pressure level) at both ear positions shall be measured. Measurements shall be made over the period of time as required by the performance standard during continuous operation of the RPD.