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Respiratory protective devices — Methods of test and test equipment —

Part 14: Measurement of sound level

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

Partie 14: Mesurage du niveau sonore

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Contents

Page

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).

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For an explanation on the meaning of ISO specific terms and expressions related to conformity assessment, as well as information about ISO's adherence to the WTO principles in the Technical Barriers to Trade (TBT) see the following URL: Foreword - Supplementary information.

The committee responsible for this document is 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 5: Breathing machine, metabolic simulator, RPD headforms and torso, tools and verification tools*

— *Part 6: Mechanical resistance/strength of components and connections*

— *Part 7: Practical performance tests methods*

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

— *Part 9: Determination of carbon dioxide content of the inhaled air*

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

— *Part 11: Determination of field of vision*

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

— *Part 13: RPD using regenerated breathable gas and special application mining escape RPD: Consolidated test for gas concentration, temperature, humidity, work of breathing, breathing resistance, elastance and duration*

— *Part 14: Measurement of sound level*

Introduction

This part of ISO 16900 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 part of ISO 16900 are necessary, these deviations will be specified in the performance standards.

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.

3.3.1 of the ISO/IEC Directives, Part 2 (sixth edition, 2011) defines a requirement as an "expression in the content of a document conveying criteria to be fulfilled if compliance with the document is to be claimed and from which no deviation is permitted."

3.3.2 of the ISO/IEC Directives, Part 2 (sixth edition, 2011) defines a recommendation as an "expression in the content of a document conveying that among several possibilities one is recommended as particularly suitable, without mentioning or excluding others, or that a certain course of action is preferred but not necessarily required, or that (in the negative form) a certain possibility or course of action is deprecated but not prohibited."

Respiratory protective devices — Methods of test and test equipment —

Part 14: Measurement of sound level

1 Scope

This part of ISO 16900 specifies a laboratory test method for determining the sound level generated by the complete respiratory protective device (RPD) and RPD warning sounds measured on a headform to which the RPD is fitted.

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*

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 apply.

3.1
A-weighted equivalent continuous sound pressure level
$L_{p,A,eqT}$
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

Note 1 to entry: $L_{p,A,eqT} = 10\lg\left[\dfrac{\frac{1}{T}\int_{t_2}^{t_1} p_A^2(t)dt}{p_0^2}\right]$ dB, where the reference value, p_0, is 20 µPa.

[SOURCE: ISO 9612:2009 [1], 3.1 modified]

4 Prerequisites

In order to implement this part of ISO 16900, at least the following parameters need to be specified in the relevant device standard:

a) the number of RPD specimens;

b) any prior conditioning or testing;

c) the RPD operating conditions;

d) test duration;

e) any deviations from the method(s).

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 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.

Where the assessment of the pass/fail criterion depends on a measurement, an uncertainty of measurement as specified in Annex A shall be reported.

6 Method A — Measurement of the noise level

6.1 Principle

The RPD is operated on a RPD headform and torso connected to a breathing machine. Microphones are placed to measure the A-weighted continuous equivalent sound pressure level generated by the device, exclusive of any warning device, at the right and left ears.

6.2 Equipment

a) The required RPD headform with soft surface finish shall be used. Additionally, RPD torso can be used where necessary. An omnidirectional microphone that has a profile of no more than 5 mm above the surface of the RPD headform when fitted in the test ear position inside the RPD shall be used, see Figure 1.

b) An instrument that meets the IEC 61672-1 Class 2 standard for sound level meters, capable of measuring the integrated A-weighted sound pressure level in decibels, indicated as dBA.

c) A suitable associated sound calibrator for the microphone system and sound level meter.

d) A breathing machine or metabolic simulator as appropriate.

The test environment should not include surfaces that may reflect sound from the specimen.

6.3 Procedure

a) The sound level meter and microphone system shall be calibrated using the associated sound calibrator.

b) The microphone shall be placed so that it faces outwards and lies flat on the external ear (pinnae) of the RPD headform at the position shown in Figure 1. This position corresponds to the centre of the external ear and level with the tragus. The microphones shall be held in place so that they do not move during the test. To avoid sound reflections caused by the measurement equipment, any microphone supporting elements, electrical leads, etc. within 30 mm of the measurement point shall occupy an area not exceeding 5 mm^2 in any plane above the surface of the RPD headform. It shall be ensured that any electrical leads are held in place flat to the surface of the RPD headform.

NOTE Putty or sticky–tack has been successfully used to stick the microphone to the RPD headform.

If part of the microphone is inset into the RPD headform, the sensing element of the microphone shall not be below the surface of the RPD headform and the opening shall be sealed against the side of the microphone.

c) 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 manufacturer's instructions for use. The RPD shall not make contact with the microphone assembly.

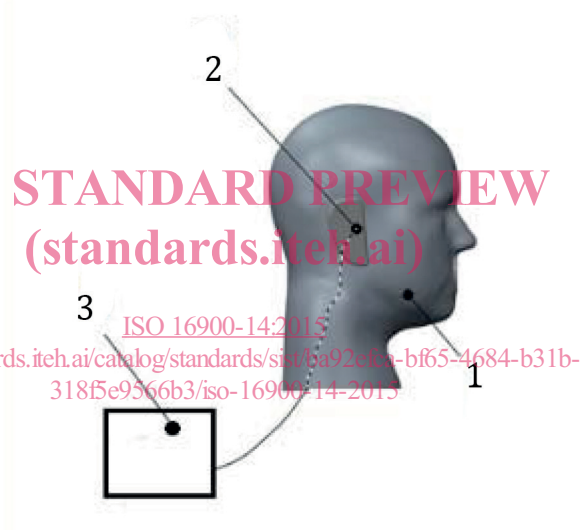
d) The RPD shall be operated as specified by the manufacturer at the manufacturer's maximum flow conditions.

e) Operate the breathing machine or metabolic simulator at the appropriate workrate for the class of the RPD.

f) The $L_{p,A,eqT}$ (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.

g) The background noise level in the test room, measured without the RPD fitted to the RPD headform, but with the breathing machine operating (when used), shall be a maximum of 70 dBA.

h) The measurements shall be repeated three times, refitting the RPD on the RPD headform and torso in between each measurement.



Key

1 required RPD headform
2 microphone position in flattened pinnea
3 sound measurement device

Figure 1 — Typical arrangement of the sound level measurement

6.4 Test report for method A

The test report shall include information regarding those parameters specified in Clause 4, together with the background sound pressure level and the maximum measured $L_{p,A,eqT}$ value. The uncertainty of measurement shall be reported.

7 Method B — Measurement of warning sound level

7.1 Principle

The RPD is operated on a RPD headform and torso connected to a breathing machine. Microphones are placed to measure the sound spectrum generated by the RPD warning device at the right and left ears.