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Respiratory protective devices — Performance requirements —

Part 2: Requirements for filtering RPD

Appareils de protection respiratoire — Exigences de performances — Partie 2: Dispositifs de filtration

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Foreword

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

A list of all parts in the ISO 17420 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 describes basic requirements for filtering respiratory protective devices (RPD) and its elements and components.

Requirements for RPD used in environments for special applications are given in the relevant parts of the ISO 17420 series.

Some test methods are described. For other test methods references are given to the ISO 16900 series "Methods of test and test equipment" or other test methods not developed by ISO/TC 94/SC 15.

Annex A gives information about reliability.

Annex B features an example of a FMEA (Failure Mode and Effects Analysis).

Annex C gives the test schedules including any pre-conditioning and number of samples.

Annex D provides information for normalisation of test results.

The sequence of testing follows the principle to minimize the necessary number of samples by carrying out destructive tests at the end. It also includes for safety reason that tests with test subjects are only carried out after the test samples have shown their safe performance in other tests.

Respiratory protective devices — Performance requirements —

Part 2:
Requirements for filtering RPD

1 Scope

This document specifies requirements for the performance and testing of filtering respiratory protective devices (RPD) in accordance with their classification and for use in the workplace to protect the wearer from hazardous atmospheres and/or environments.

Requirements for RPD elements and components are also specified in this document.

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 9227, *Corrosion tests in artificial atmospheres — Salt spray tests*

ISO 16900-1:2019, *Respiratory protective devices — Methods of test and test equipment — Part 1: Determination of inward leakage*

ISO 16900-2, *Respiratory protective devices — Methods of test and test equipment — Part 2: Determination of breathing resistance*

ISO 16900-3, *Respiratory protective devices — Methods of test and test equipment — Part 3: Determination of particle filter penetration*

ISO 16900-4:2011, *Respiratory protective devices — Methods of test and test equipment — Part 4: Determination of gas filter capacity and migration, desorption and carbon monoxide dynamic testing*

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 16900-6:—, *Respiratory protective devices — Methods of test and test equipment — Part 6: Mechanical resistance/strength of components and connections*

ISO 16900-7:2020, *Respiratory protective devices — Methods of test and test equipment — Part 7: Practical performance test methods*

ISO 16900-8, *Respiratory protective devices — Methods of test and test equipment — Part 8: Measurement of RPD air flow rates of assisted filtering RPD*

ISO 16900-9, *Respiratory protective devices — Methods of test and test equipment — Part 9: Determination of carbon dioxide content of the inhaled gas*

ISO 16900-12, *Respiratory protective devices — Methods of test and test equipment — Part 12: Determination of volume-averaged work of breathing and peak respiratory pressures*

ISO 16900-14:2020, *Respiratory protective devices — Methods of test and test equipment — Part 14: Measurement of sound level*

ISO 16972, *Respiratory protective devices — Vocabulary and graphical symbols*

ISO/TS 16973, *Respiratory protective devices -- Classification for respiratory protective device (RPD), excluding RPD for underwater application*

ISO 17420-1:—, *Respiratory protective devices — Performance requirements — Part 1: General*

ISO 17420-3, *Respiratory protective devices — Performance requirements — Part 3: Thread connection*

IEC 61000-6-2, *Electromagnetic compatibility (EMC) — Part 6-2: Generic standards — Immunity standard for industrial environments*

3 Terms, definitions, abbreviations and symbols

3.1 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/

3.1.1
non pre-conditioned state
without pre-conditioning but possibly modified to carry out tests or already used in non-destructive tests

Note 1 to entry: This includes e.g. cleaning and disinfection.

3.1.2
as worn state
RPD where all components are connected and assembled in the way that it is intended to be used and worn (e.g. worn by the wearer, adapted to a RPD headform or RPD headform and torso or suitable holder)

Note 1 to entry: All of the various components [e.g. for an assisted filtering device: blower unit, battery, respiratory interface (RI), filters, etc.] have been completely assembled and then connected (RI connected to the hose of the blower unit) together in accordance with the information supplied by the manufacturer.

3.1.3
ready for assembly state
RPD or components with seals, plugs or other environmental protective means, still in place ready to be assembled and/or donned

Note 1 to entry: RPD or components can remain sealed and plugged until donning if so stated in the information supplied by the manufacturer.

3.1.4
integrated RPD
RPD designed so that components in the breathable gas supply chain are nonseparable

3.1.5
measured maximum flow rate
volumetric flow rate of an assisted filtering RPD, determined in a laboratory test, when the RPD is in the condition which results in the highest air flow rate, where this condition takes into account the influences of temperatures, settings of RPD, pre-conditionings, use of accessories and any other related factors

[SOURCE: ISO 16900-8:2014, 3.6]

3.1.6
migration
diffusion of the gas or vapour molecules within the sorbent after the filter is partially loaded

3.1.7
standardized connector
device that allows an optional connection between a filter and a respiratory interface

Note 1 to entry: Filter connector meeting the requirements of ISO 17420-3.

3.1.8
replacement part
identical to the one originally supplied with the RPD by the manufacturer, and declared interchangeable by the manufacturer

3.1.9
normalised condition
test condition adjusted to 1013 hPa and body temperature (37 °C or 310 K) saturated with water vapour, which is 63 hPa, used for the normalization of test results

Note 1 to entry: Further information is given in Annex D.

3.2 Abbreviated terms

FMEA	Failure Mode and Effects Analysis
V_T	Tidal volume
WoB	Work of Breathing
BTPS	body temperature pressure saturated

3.3 Symbols

3.3.1

Product information; information point (ISO 7000-2760).

Indication for the RI that it is a part of a RPD system with multiple configurations.

3.3.2

Operator's manual; operating instructions (ISO 7000-1641).

Booklet: "See information supplied by the RPD manufacturer"

3.3.3

Do not re-use (ISO 7000-1051).

Crossed out 2: “For single shift use only”

3.3.4

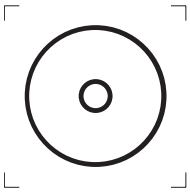
yyyy/mm

Use by date (ISO 7000-2607)

Hourglass: "End of shelf life"

Key: yyyy year, mm month

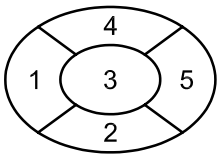
3.3.5



Roller; cylinder (ISO 7000-0566)

Target: "Standardized connector"

3.3.6



RPD headform number allocation for size designation

4 Classification overview

ISO 17420-1:—, 4.1 applies with the following addition:

The classification of a filtering RPD is determined by the appropriate combination of the following classes: (protection class) (work rate class) (RI class) (particle filterclass and/or gas filter type and class).

Additionally filtering RPD may be classified for one or more special applications, as given in ISO 17420-5 to ISO 17420-9.

Table 1 — Gas filter type and class

Type	Class(es)	Type description
OV	1, 2, 3 or 4	Organic vapours
OG	1	Organic gases (low boiling, i.e. below 65 °C)
AC	1, 2, 3 or 4	Acidic compounds
BC	1, 2, 3 or 4	Basic compounds
NOX	1, 2 or 3	Nitrogen oxides
HG	1, 2 or 3	Mercury (Hg)
OZ	1	Ozone (O_3)
HCN	1, 2, 3 or 4	Hydrogen Cyanide (HCN)
AH	1	Arsine (AsH_3)

Table 1 *(continued)*

Type	Class(es)	Type description
HF	1, 2 or 3	Hydrogen fluoride (HF)
CD	1	Chlorine dioxide (ClO_2)
ETO	1, 2 or 3	Ethylene oxide ($(CH_2)_2O$)
FM	1, 2 or 3	Formaldehyde (CH_2O)
MB	1, 2 or 3	Methyl bromide (CH_3Br)
CO	Three classes based on time (20 min, 60 min or 180 min)	Carbon monoxide (CO)
PH	1 or 2	Phosphine (PH_3)

The designation of a filtering RPD is determined by an appropriate combination of the classes given in ISO 17420-1:—, Table 1 and Table 1 of this document.

Example for a basic RPD with protection class (PC3), work rate class (W2), RI class (bT), particle filter class (F3) and gas filter type and class (OV2).

Marking for the given example PC3 W2 bT F3 OV2

Multi-functional filtering RPD have separate classifications for each function, i.e. one classification for the unassisted mode and one classification for the assisted mode.

5 General requirements for RPD

5.1 General

ISO 17420-1:—, 5.1, applies.

5.2 Field of vision

ISO 17420-1:—, 5.2, applies.

5.3 Resistance to flame – Single burner dynamic

ISO 17420-1:—, 5.3, applies.

5.4 Compatibility with additional equipment

ISO 17420-1:—, 5.4, applies.

5.5 Monitor performance

ISO 17420-1:—, 5.5, applies with the following addition:

The monitor system shall not interfere with the operation of the RPD.

5.6 Warning device(s), checking device(s) and control means

5.6.1 Performance of warning device(s), if applicable

RPD shall be checked after sequential pre-conditioning in accordance with 6.9.2.

RPD powered by an energy source shall be equipped with a low energy warning device to warn the wearer at least 5 min prior to the performance of the RPD falling below the manufacturer's minimum design conditions. From the activation of the warning the RPD shall be tested in accordance with 6.3.2 for a period of 5 min but with a fixed setting of 35 l/min, see Table 2.

Check in accordance with 7.2 and Clause 9.

For assisted filtering RPD a warning device shall warn the wearer when the performance of the RPD is outside of the manufacturer's design conditions.

Testing shall be performed in accordance with 6.3.2 and, if applicable, in accordance with ISO 16900-8.

During use, warning devices shall not switch off automatically and shall not be capable of being switched off by the wearer while the cause of the warning remains other than to correct the warning condition.

Check in accordance with 7.2.

Any warning shall be detectable without any intervention by the wearer. Any warning shall be detectable by the wearer within 15 s.

Testing shall be performed in accordance with ISO 16900-7:2020, Annex A, activity 11).

Any warnings which require different reactions by the wearer shall be distinguishable from one another.

Check in accordance with 7.2.

5.6.2 Performance of checking device

ISO 17420-1:—, 5.6.2, applies.

5.6.3 Control means (if applicable)

Manual control means installed on a RPD shall be clearly identifiable and, if more than one, distinguishable from one another by the wearer during use.

If there is a control means for setting different PC classes it shall not be possible to change the PC class during use without indication to the wearer.

Adjustable control means shall be tested in accordance with 6.3.

Testing shall be performed in accordance with ISO 16900-7.

5.7 Protection class determination

5.7.1 General

ISO 17420-1:—, 5.7.1, applies.

5.7.2 Total inward leakage (TIL)

ISO 17420-1:—, 5.7.2, applies.

The following applies in addition to ISO 17420-1:—, 5.7:

5.7.3 Total inward leakage requirement for RPD not using a standardized connector

RPD, except those with RIs class a, shall be tested for total inward leakage in accordance with ISO 17420-1:—, 5.7.2.

NOTE 1 For RI using standardized connector see 6.11.3.3.

NOTE 2 For RI class a see ISO 17420-1:—, 5.7.2.