
**Respiratory protective devices —
Performance requirements —**

**Part 5:
Special application fire and rescue
services - Supplied breathable gas
RPD and filtering RPD**

Appareils de protection respiratoire — Exigences de performances —

*Partie 5: Applications particulières pour lutte contre les feux et
opérations de sauvetage - APR alimentés en gaz respirable et APR
filtrants*



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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).

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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* in close cooperation with Subcommittee SC 14, *Firefighters' personal equipment*.

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 requirements for RPD used for special applications fire and rescue services and its elements and components.

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.

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

To apply this standard properly consider the following:

- ISO 17420-1 specifies the general requirements for supplied breathable gas RPD and filtering RPD and cannot be used as a standard for "certification" alone. Therefore, compliance with the requirements and tests of ISO 17420-2 or ISO 17420-4 is required in addition.

The structure of the standards is as follows:

ISO 17420-1 specifies the general requirements for RPD.

ISO 17420-2 and ISO 17420-4 gives requirements for filtering or supplied breathable gas RPD and give information if any of the general requirements in Part 1 needs an addition.

EXAMPLE for ISO 17420-4 5.8.1 General

ISO 17420-1:2021, 5.8.1 applies with the following in addition:

ISO 17420-5 to ISO 17420-9 gives requirements for filtering or supplied breathable gas RPD — Special application and some of the requirements will supersede requirements specified in ISO 17420-2 or ISO 17420-4.

EXAMPLE for ISO 17420-5 [7.2.1.3](#) Temperature of operation – level 0 — Supplied breathable gas RPD

This clause supersedes ISO 17420-4:2021, 6.1.

For more information see also the introduction in the other parts of the ISO 17420 series.

Respiratory protective devices — Performance requirements —

Part 5:

Special application fire and rescue services - Supplied breathable gas RPD and filtering RPD

1 Scope

This document specifies the minimum requirements for supplied breathable gas RPD and filtering RPD to be used for special application fire and rescue services.

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 6529:2013, *Protective clothing — Protection against chemicals — Determination of resistance of protective clothing materials to permeation by liquids and gases*

ISO 8031, *Rubber and plastics hoses and hose assemblies — Determination of electrical resistance and conductivity*

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

ISO 10297, *Gas cylinders — Cylinder valves — Specification and type testing*

ISO 13506-1, *Protective clothing against heat and flame — Part 1: Test method for complete garments — Measurement of transferred energy using an instrumented manikin*

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 16900-5, *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, *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 16900-10, *Respiratory protective devices — Methods of test and test equipment — Part 10: Resistance to ignition, flame, radiant heat and heat*

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, *Respiratory protective devices — Methods of test and test equipment — Part 14: Measurement of sound pressure level*

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

ISO/TS 16975-1:2016, *Respiratory protective devices — Selection, use and maintenance — Part 1: Establishing and implementing a respiratory protective device programme*

ISO 17420-1:2021, *Respiratory protective devices — Performance requirements — Part 1: General*

ISO 17420-2:2021, *Respiratory protective devices — Performance requirements — Part 2: Requirements for filtering RPD*

ISO 17420-4:2021, *Respiratory protective devices — Performance requirements — Part 4: Requirements for supplied breathable gas RPD*

ISO 80079-36:2016, *Explosive atmospheres — Part 36: Non-electrical equipment for explosive atmospheres — Basic method and requirements*

IEC 60068-2-27:2010, *Environmental testing — Part 2-27: Tests — Test Ea and guidance: Shock*

IEC 60068-2-64, *Environmental testing — Part 2-64: Tests — Test Fh: Vibration, broadband random and guidance*

IEC 60079-0, *Explosive atmospheres — Part 0: Equipment — General requirements*

IEC 60529:2013, *Degrees of protection provided by enclosures (IP Code)*

IEC 60721-1:2002, *Classification of environmental conditions — Part 1: Environmental parameters and their severities*

IEC 60721-3-2:2018, *Classification of environmental conditions — Part 3-2: Classification of groups of environmental parameters and their severities — Transportation and Handling*

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

EN 15333-1:2008, *Respiratory equipment - Open-circuit umbilical supplied compressed gas diving apparatus - Part 1: Demand apparatus*

ASTM D1003:2013, *Standard Test Method for Haze and Luminous Transmittance of Transparent Plastics*

ASTM D6413, *Standard Test Method for Flame Resistance of Textiles (Vertical Test)*

NFPA 1981:2019, *Standard on Open-Circuit Self-Contained Breathing Apparatus (SCBA) for Emergency Services*

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**RPD in as worn state**

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

Note 1 to entry: All of the various components (e.g. for an SCBA: cylinder, respiratory interface, demand valve, harness etc.) have been completely assembled and then connected (RI connected to the demand valve) together in accordance with the information supplied by the manufacturer.

3.1.3**component in ready for assembly state**

component with seal, plug, packaging or other environmental protective means, still in place

3.1.4**RPD in ready for use state**

RPD ready to be donned as described by the manufacturer

Note 1 to entry: In line with the information supplied by the manufacturer for donning the RPD, further actions can be necessary.

3.2 Abbreviated terms

RI	Respiratory Interface
RPD	Respiratory protective devices

4 Classification overview

ISO 17420-2:2021, Clause 4 or ISO 17420-4:2021, Clause 4 applies.

4.1 General

ISO 17420-1:2021, 4.1 applies.

4.2 Supplied breathable gas RPD

This subclause applies in addition to ISO 17420-4:2021, Clause 4.

Additionally supplied breathable gas RPD may be classified for one or more special applications, as given in [Table 1](#).

Table 1 — Special application classification supplied breathable gas RPD

Special application	Classes
Fire and rescue services	FF5 (Firefighting type R2) ^a FF4 (Firefighting type R1) ^a FF3 (Hazardous material) FF2 (Rescue) FF1 (Wildland firefighting)
^a Selection of the RPD shall be based on a risk assessment, which includes compatibility of the selected RPD being worn with other items of PPE, taking into consideration operational practices, environmental conditions, local building regulations or standards and other technical standards. See e.g. ISO/TS 16075-1, ISO 17420-1:2021, 5.4 and ISO 11999-2. FF4 (type R1) and FF5 (type R2) items of RPD have differing performance characteristics. For example, type R1 provides material thermal performance tested at 180 °C maximum and is commonly used for defensive firefighting and is generally not intended to be used for internal attack firefighting. Type R2 provides a material thermal performance tested at 260 °C maximum and is commonly used for internal attack firefighting.	

Example for a supplied breathable gas RPD for special application firefighting type R1 with protection class (PC5), work rate class (W3), RI class (cT), supplied breathable gas capacity class (S1800) and special application class (FF4)

Marking for the given example PC5 W3 cT S1800 FF4

4.3 Filtering RPD

This subclause applies in addition to ISO 17420-2:2021, Clause 4.

Additionally filtering RPD may be classified for one or more special applications, as given in [Table 2](#).

Table 2 — Special application classification of filtering RPD

Special application	Classes
Fire and rescue services	FF2 (Rescue) FF1 (Wildland firefighting)

Example for a filtering RPD for special application wildland firefighting with protection class (PC3), work rate class (W2), RI class (bT), particle filter performance class (F3) and special application class (FF1).

Marking for the given example PC3 W2 bT F3 FF1

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

ISO 17420-1:2021, Clause 5 and ISO 17420-2:2021, Clause 5 or ISO 17420-4:2021, Clause 5 applies.

6 Basic requirements for supplied breathable gas RPD and filtering RPD

All requirements of ISO 17420-2:2021, Clause 6 or ISO 17420-4:2021, Clause 6 apply unless superseded by this document and indicated in the relevant clauses.

NOTE 1 Optional features are also given in ISO 17420-2 or ISO 17420-4.

NOTE 2 Where requirements are superseded by those in [Clause 7](#) of this document, the test schedules given in ISO 17420-2:2021 Annex C or ISO 17420-4:2021, Annex C can be used as a guideline for testing.

7 Special application for fire and rescue services filtering and supplied breathable gas RPD

7.1 Special application for fire and rescue services RPD – Requirement matrices

7.1.1 General

Supplied breathable gas fire and rescue services RPD shall fulfil all requirements specified in [Table 3](#).

Filtering fire and rescue services RPD shall fulfil all requirements specified in [Table 4](#).

7.1.2 Supplied breathable gas fire and rescue services RPD

[Table 3](#) gives an overview about requirements and preconditioning of supplied breathable gas fire and rescue services RPD.

[Table 3](#) shall be read as follows:

In the first column the requirements are specified. In the third to seventh column the required pre-conditioning for different fire and rescue services classes are specified.

For each pre-conditioning within one line of the cell different sample(s) shall be used. At least one RPD shall be tested after each required pre-conditioning.

For the requirement [7.2.1.3](#) and class hazardous materials (FF3) the following applies.

At least one sample shall be pre-conditioned VS & CE (Exposure to vibration and shock – firefighting and enhanced resistance to corrosion – constant exposure).

At least one further sample shall be pre-conditioned DR (Exposure to impact from drop).

Table 3 — Special application requirement overview – Supplied breathable gas fire and rescue services RPD

Requirement	Title	Wildland firefighting	Rescue	Hazardous materials	Firefighting	
		FF1	FF2	FF3	FF4 ^a	FF5 ^a
		Protection class ≥PC3	Protection class ≥PC3	Protection class ≥PC4	Protection class ≥PC5	Protection class ≥PC5
		Work rate class ≥W2	Work rate class ≥W2	Work rate class ≥W2	Work rate class ≥W3	Work rate class =W4
		Pre-conditioning				
7.2.1.3	Temperature of operation – level 0	VS&CE DR	VS&CE DR	VS&CE DR	VS&CE DR	VS&CE DR
7.2.1.5	Temperature of operation – level 1	AR/NP	AR/NP	AR/NP	AR/NP	AR/NP
7.2.1.7	Temperature of operation – level 2- type R1	— ^b	— ^b	— ^b	AR/NP	— ^b
7.2.1.8	Temperature of operation – level 3- type R2	— ^b	— ^b	— ^b	— ^b	AR/NP
7.2.1.9	Temperature of operation at level 2 and flammability	— ^b	— ^b	— ^b	AR/NP	AR/NP
7.2.1.10	Temperature of operation at level 3 and flammability	— ^b	— ^b	— ^b	— ^b	AR/NP

Table 3 (continued)

Requirement	Title	Wildland firefighting	Rescue	Hazardous materials	Firefighting	
		FF1	FF2	FF3	FF4 ^a	FF5 ^a
		Protection class ≥PC3	Protection class ≥PC3	Protection class ≥PC4	Protection class ≥PC5	Protection class ≥PC5
		Work rate class ≥W2	Work rate class ≥W2	Work rate class ≥W2	Work rate class ≥W3	Work rate class ≥W4
		Pre-conditioning				
7.2.1.11	Thermal shock	— ^b	AR/NP	AR/NP	AR/NP	AR/NP
7.2.2.2	Fabric material flame resistance performance	AR/NP	AR/NP	AR/NP	— ^b	— ^b
7.2.3.2	Radiant heat – level 1	AR/NP	AR/NP	AR/NP	AR/NP	AR/NP
7.2.3.3	Radiant heat – level 2	— ^b	— ^b	— ^b	AR/NP	AR/NP
7.2.3.4	Radiant heat – level 3	— ^b	— ^b	— ^b	— ^b	AR/NP
7.2.4	Resistance to hot particles	AR/NP	AR/NP	AR/NP	AR/NP	AR/NP
7.2.5.1	Chemical resistance of materials	— ^b	AR/NP	AR/NP	AR/NP	AR/NP
7.2.6	Hazardous materials	— ^b	— ^b	AR/NP	O	O
7.2.7.1	Contact with hot and cold surfaces	AR/NP	AR/NP	AR/NP	AR/NP	AR/NP
7.2.8	Avoidance of frictional sparks	— ^b	AR/NP	AR/NP	AR/NP	AR/NP
7.2.9	Visor after chemical exposure	— ^b	AR/NP	AR/NP	AR/NP	AR/NP
7.2.10.1	Connections	— ^b	AR/NP	AR/NP	AR/NP	AR/NP
7.2.10.3	Abrasion resistance of visor	— ^b	— ^b	AR/NP	AR/NP	AR/NP
7.2.11	Requirements for audible warning devices	— ^b	— ^b	AR/NP	AR/NP	AR/NP
7.2.12	Practical performance - RPD	— ^b	AR/NP	AR/NP	AR/NP	AR/NP
7.2.13	Eye irritation (external)	AR/NP	AR/NP	AR/NP	AR/NP	AR/NP
7.2.14	Operating during submersion	AR/NP	AR/NP	AR/NP	AR/NP	AR/NP
7.2.16	Communication performance (speaking and hearing)	— ^b	— ^b	AR/NP	AR/NP	AR/NP
7.2.17.1	Use in explosive atmospheres	— ^b	AR/NP	AR/NP	AR/NP	AR/NP
7.2.17.2	Electromagnetic compatibility	— ^b	AR/NP	AR/NP	AR/NP	AR/NP
7.2.19	Exposure to dust	— ^b	— ^b	— ^b	X ^c	X ^c

Table 3 (continued)

Requirement	Title	Wildland firefighting	Rescue	Hazardous materials	Firefighting	
		FF1	FF2	FF3	FF4 ^a	FF5 ^a
		Protection class ≥PC3	Protection class ≥PC3	Protection class ≥PC4	Protection class ≥PC5	Protection class ≥PC5
		Work rate class ≥W2	Work rate class ≥W2	Work rate class ≥W2	Work rate class ≥W3	Work rate class =W4
		Pre-conditioning				

^a Selection of the RPD shall be based on a risk assessment, which includes compatibility of the selected RPD being worn with other items of PPE, taking into consideration operational practices, environmental conditions, local building regulations or standards and other technical standards. See e.g. ISO 17420-1:2021, 5.4 and ISO 11999-2. FF4 (type R1) and FF5 (type R2) items of RPD have differing performance characteristics.

For example, type R1 provides material thermal performance tested at 180 °C maximum and is commonly used for defensive firefighting and is generally not intended to be used for internal attack firefighting. Type R2 provides a material thermal performance tested at 260 °C maximum and is commonly used for internal attack firefighting.

^b — means that a test is not required for this combination of requirement and special application class.

^c X means exposure to dust has to be addressed by the FMEA (see 7.2.19).

AR/NP as received or in non pre-conditioned.

VS & CE Exposure to vibration and shock (see 7.3.2) and enhanced resistance to corrosion –constant exposure (see 7.3.5).

DR Exposure to impact from drop (see 7.3.4).

O Optional feature.

7.1.3 Filtering fire and rescue services RPD

Table 4 gives an overview about requirements and pre-conditioning of filtering fire and rescue services RPD.

At least one RPD shall be tested after each required pre-conditioning. Pre-conditionings shall not be combined.

Table 4 shall be read as follows:

In the first column the requirements are specified. In the third and fourth column the required pre-conditioning for different fire and rescue services classes are specified.

For each pre-conditioning within one cell different sample(s) shall be used.

EXAMPLE For the requirement 7.2.1.4 and class rescue (FF2) the following applies.

At least one sample shall be pre-conditioned VS (Exposure to vibration and shock – fire and rescue services).

Table 4 — Special application requirement overview – Filtering RPD – Fire and rescue services

Requirement	Title	Wildland Fire-fighting FF1	Rescue FF2
		Protection class ≥PC3	Protection class ≥PC3
		Work rate class ≥W2	Work rate class ≥W2
ISO 17420-2:2021, 6.10.1.2	Particle filter	DRO	DRO
ISO 17420-2:2021, 6.10.1.3	Gas filter ^a	EA	EA
7.2.1.4	Temperature of operation – level 0	DRO	DRO
7.2.1.6	Temperature of operation – level 1 ^a	EA	EA
7.2.8	Avoidance of frictional sparks	DRO	DRO
7.2.2.1	Six burner dynamic ^a	EA	EA
7.2.3.2	Radiant heat – level 1 ^a	VS	VS
7.2.4	Resistance to hot particles (embers, sparks, ash) ^a	AR/NP	AR/NP
7.2.5.2	Chemical resistance of materials	— ^b	AR/NP
7.2.7.2	Contact with hot surfaces generated by the RPD	AR/NP	AR/NP
7.2.10.2	Connections	— ^b	AR/NP
7.2.10.3	Abrasion resistance of visor	AR/NP	AR/NP
7.2.17.1	Use in explosive atmospheres	AR/NP	AR/NP
7.2.17.2	Electromagnetic compatibility	AR/NP	AR/NP
7.2.13	Eye irritation (external)	AR/NP	AR/NP
7.2.16	Communication performance (speaking and hearing)	AR/NP	AR/NP
7.2.15	Resistance to water splash	— ^b	— ^b
7.2.18.2.1	Filter capacity and filter performance for the test gas CO ^a	AR/NP	AR/NP
7.2.18.2.2	Filter capacity for the test gases other than CO and particle filter efficiency ^a	— ^b	— ^b
7.2.19	Exposure to dust	AR/NP	AR/NP
^a If claimed for FF 1 (wildland firefighting). ^b — means that a test is not required for this combination of requirement and special application class. ^c X means exposure to dust has to be addressed by the FMEA (see 7.2.19). AR/NP as received or in non pre-conditioned state. DRO Exposure to impact from drop (see 7.3.3). VS Exposure to vibration and shock (see 7.3.2). EA Exposure to exhaled air, if applicable (see ISO 17420-2:2021 6.9.3.1).		X ^c	X ^c

7.2 Requirements for special application fire and rescue services RPD

7.2.1 Thermal Requirements

7.2.1.1 Temperature of operation – Supplied breathable gas RPD

After exposure to the relevant temperature levels outlined in [7.2.1.3](#), [7.2.1.5](#), [7.2.1.7](#), [7.2.1.8](#), [7.2.1.9](#), [7.2.1.10](#) and [7.2.1.11](#) warning and monitoring devices, if applicable, shall continue to function.

The preheating shall be homogenous around the RPD.

Deformation or superficial damage of components does not constitute a failure.

Check in accordance with [8.2](#).

7.2.1.2 Temperature of operation – Filtering RPD

After exposure to the relevant temperature levels outlined in [7.2.1.4](#) and [7.2.1.6](#), warning and monitoring devices, if applicable, shall continue to function.

Deformation or superficial damage of components does not constitute a failure.

Check in accordance with [8.2](#).

7.2.1.3 Temperature of operation – level 0 – Supplied breathable gas RPD

This clause supersedes clause ISO 17420-4:2021, 6.1.

RPD in ready for use state or the RPD component in ready for assembly state shall be exposed to the pre-conditioning in accordance with [7.3.2](#) and [7.3.5](#) and the relevant subclauses as given in [Table 3](#).

One RPD shall be equilibrated for a minimum of 4 h and tested at $\begin{pmatrix} -32 & +2 \\ & 0 \end{pmatrix}^{\circ}\text{C}$.

One RPD shall be equilibrated for a minimum of 4 h and tested at $\begin{pmatrix} 60 & 0 \\ & -2 \end{pmatrix}^{\circ}\text{C}$.

The RPD shall continue to meet the work of breathing/breathing resistance requirements at the work rate regime for the RPD class, as specified in ISO 17420-4:2021, 6.2.

Testing shall be performed in accordance with ISO 16900-12.

For RPD having cylinder valve(s), the valve(s) shall meet the requirements of ISO 10297 at the temperature of operation of $\begin{pmatrix} -32 & +2 \\ & 0 \end{pmatrix}^{\circ}\text{C}$ and an impact of 120 J.

7.2.1.4 Temperature of operation – level 0 – Assisted filtering RPD

The influence of temperature of flow rate shall be determined in accordance with ISO 17420-2:2021, 6.2

but using the temperatures of $\begin{pmatrix} -32 & +2 \\ & 0 \end{pmatrix}^{\circ}\text{C}$ and $\begin{pmatrix} 60 & 0 \\ & -2 \end{pmatrix}^{\circ}\text{C}$.

RPD shall continue to meet the work of breathing/breathing resistance requirements at the test regime for the RPD work rate class, as specified in ISO 17420-2:2021, 6.3.1 or 6.3.2.

Testing shall be performed in accordance with ISO 16900-12.

7.2.1.5 Temperature of operation – level 1 – Supplied breathable gas RPD

One RPD in as worn state shall be exposed to $\begin{pmatrix} 0 \\ 100 \\ -2 \end{pmatrix}^{\circ}\text{C}$ whilst the RPD is ventilated with the settings of the test equipment at 35 l/min for 30 min or the service life of the RPD, whatever is shorter. Testing shall be started 2 min before the end of the exposure time or service life. The RPD shall continue to meet the work of breathing/breathing resistance requirements at 35 l/min setting of the test equipment, as specified in ISO 17420-4:2021, 6.2.

Testing shall be performed in accordance with ISO 16900-12.

7.2.1.6 Temperature of operation – level 1 – Assisted filtering RPD

To determine the influence of temperature the RPD shall be tested for flow after each of the following:

One RPD in as worn state shall be exposed to $\begin{pmatrix} 0 \\ 100 \\ -2 \end{pmatrix}^{\circ}\text{C}$ for 30 min. Testing shall be started within 3 min after the exposure at ambient laboratory temperature.

Taking into account the influencing parameters as specified in ISO 17420-2:2021, 6.1, the measured minimum and the measured maximum flow rate shall be determined in accordance with ISO 16900-8.

The RPD shall continue to meet the work of breathing/breathing resistance requirements as specified in ISO 17420-2:2021, 6.3.2.

Testing shall be performed in accordance with and ISO 16900-12.

7.2.1.7 Temperature of operation – level 2- FF4 (type R1) – Supplied breathable gas RPD

One RPD in as worn state shall be tested as received at $(180 \pm 5)^{\circ}\text{C}$ for 5 min.

Testing shall be performed as part of [7.2.1.9](#).

7.2.1.8 Temperature of operation – level 3-FF5 (type R2) – Supplied breathable gas RPD

One RPD in as worn state shall be tested as received at $(260 \pm 5)^{\circ}\text{C}$ for 5 min.

Testing shall be performed as part of [7.2.1.10](#).

7.2.1.9 Temperature of operation – level 2 and flammability – Supplied breathable gas RPD

Temperature of operation level 3 is specified by a flame engulfment test after pre-conditioning at $(180 \pm 5)^{\circ}\text{C}$.

One RPD, as received and in as worn state shall be subjected to $(950 \pm 50)^{\circ}\text{C}$ for 10 s at 105 l/min (42 cycles/min and 2,5 l/cycle) after the temperature exposure of $(180 \pm 5)^{\circ}\text{C}$ for 5 min at a ventilation rate of 40 l/min (20 cycles/min and 2 l/cycle) in accordance with the flame engulfment test specified in ISO 16900-10.

The change of the ventilation rate from 40 l/min to 105 l/min shall be completed prior to the start of the flame exposure. The transition period between one flow rate and the next flow rate shall be no more than 60 s whilst the RPD remains in the operational mode.

No after-flame shall continue for more than 2,2 s after the test flame extinguishes.

Additionally, no component that secures the apparatus to the user's body or that secures the cylinder to the apparatus shall separate or be displaced to such an extent that would cause the RPD to become detached from the wearer's body or the cylinder to become unsecured.

Check in accordance with 8.2.

The breathing resistance shall not exceed 1 200 Pa at both flow rates.

Testing shall be performed in accordance with ISO 16900-10.

7.2.1.10 Temperature of operation – level 3 and flammability – Supplied breathable gas RPD

Temperature of operation level 4 is specified by a flame engulfment test after pre-conditioning at $(260 \pm 5) ^\circ\text{C}$.

One RPD, as received and in as worn state shall be subjected to $(950 \pm 50) ^\circ\text{C}$ for 10 s at 105 l/min after the temperature exposure of $(260 \pm 5) ^\circ\text{C}$ for 5 min at a ventilation rate of 40 l/min $(20 \text{ l/min} \times 2)$ in accordance with the flame engulfment test ISO 16900-10.

The change of the ventilation rate from 40 l/min to 105 l/min shall be completed prior to the start of the flame exposure. The transition period between one flow rate and the next flow rate shall be no more than 60 s whilst the RPD remains in the operational mode.

Additionally, no component that secures the apparatus to the user's body or that secures the cylinder to the apparatus shall separate or be displaced to such an extent that would cause the RPD to become detached from the wearer's body or the cylinder to become unsecured.

Check in accordance with 8.2.

The breathing resistance shall not exceed 1 200 Pa at both flow rates.

Testing shall be performed in accordance with ISO 16900-10.

7.2.1.11 Thermal shock – Supplied breathable gas RPD

One RPD in ready for use state shall be equilibrated for a minimum of 4 h at $\begin{pmatrix} -32 & +2 \\ & 0 \end{pmatrix} ^\circ\text{C}$ and tested within 10 min at $(60 \pm 5) ^\circ\text{C}$.

One RPD in ready for use state shall be equilibrated for a minimum of 4 h at $\begin{pmatrix} 0 \\ 60 & -2 \end{pmatrix} ^\circ\text{C}$ and tested within 10 min at $(-32 \pm 5) ^\circ\text{C}$.

The RPD shall continue to meet the work of breathing/breathing resistance requirements specified in ISO 17420-4:2021, 6.3 at the work rate regime for the RPD class, as specified in ISO 17420-4:2021, 6.2.

7.2.2 Resistance to flame

7.2.2.1 Six burner dynamic – Filtering RPD

This clause supersedes ISO 17420-1:2021, 5.3 for the RI only.

One RI as received shall be tested for flame and heat resistance as specified in ISO 16900-10. Prior to testing, all components and accessories, which are claimed by the manufacturer as part of the RPD, shall be assembled with the RI. The components and accessories shall be in as received state. There shall be no dripping at all, and the assembly under test shall not continue to burn for more than 5 s.

Deformation/decomposition is allowed, as long as it does not drip or burn through or present any other hazard to the wearer.

The tip of each burner shall be set at 250 mm from the closest point upon which that flame will impinge, following the contour of the RI and component contour.

The RPD or the RI does not need to fulfil any other requirement of this standard after this test.

Check in accordance with [8.2](#).

After exposure to flame the RPD or RI shall not leak at a rate of more than one bubble per second.

Testing shall be performed in accordance with [8.3](#).

7.2.2.2 Fabric material flame resistance performance – Supplied breathable gas RPD

This clause supersedes ISO 17420-1:2021, 5.3 for fabric materials only.

Three test samples shall be conditioned by five cycles of washing and drying in accordance with the procedures specified in the information supplied by the RPD manufacturer.

If washing is not intended in accordance with the information supplied by the RPD manufacturer, three samples shall be tested as received.

All fabric material of RPD used to secure the RPD to the wearer shall be tested as designed for its function for flame resistance as specified in ISO 16900-10, in accordance with ASTM D6413 and shall not

- exceed an average char length of 100 mm,
- exceed an after flame time of 2,0 s,
- drip.

7.2.3 Radiant heat

7.2.3.1 General

One RPD shall be tested as received in as worn state for resistance to radiant heat specified in [7.2.3.2](#), [7.2.3.3](#) or [7.2.3.4](#). When exposed to the relevant conditions given in [7.2.3.2](#) or [7.2.3.3](#), while ventilated and subsequently returned to ambient conditions, no component of the RPD shall melt through or burn through as checked in accordance with ISO 17420-1:2021, 6.2 and the RPD shall continue to meet the breathing resistance requirements specified in ISO 17420-2:2021, 6.2.

Deformation of components does not constitute a failure.

For levels 1 and 2 exposures, one RPD shall be tested on a head and torso with a radiant heat panel in the front and, after the RPD has cooled down to ambient temperature, from the back.

The donning of the RPD shall be performed in accordance with the information supplied by the manufacturer. If more than one position is possible chose that which exposes functional parts to the heat flux the most.

Heat-Flux shall be measured at the point of the RPD closest to the radiant heat panel.

Level 3 exposure is assessed in the instrumented manikin test, in accordance with ISO 13506-1 and ISO 16900-10.

Test in accordance with ISO 13506-1 and ISO 16900-10.

7.2.3.2 Radiant heat – level 1 – Supplied breathable gas RPD and filtering RPD

One RPD shall be exposed to a radiant heat of 1,25 kW/m² for 30 min at the flow rate of 35 l/min (dynamic sinusoidal) and the setting of the test equipment in accordance with ISO 17420-4:2021 Table 2 and following the requirements given in [7.2.3](#).

Breathing resistance (peak pressure) shall be measured during the exposure. The breathing resistance (peak pressure) shall not exceed 1 200 Pa. For supplied breathable gas RPD and assisted filtering RPD with work rate class ≥ 3 the inhalation breathing resistance (peak pressure) shall be greater than zero.

Testing shall be performed in accordance with ISO 16900-2 and ISO 16900-10.

7.2.3.3 Radiant heat – level 2 – Supplied breathable gas RPD

One RPD shall be exposed to a radiant heat of $8,0 \text{ kW/m}^2$ for 5 min at the flow rate of 105 l/min (setting of the test equipment in accordance with ISO 17420-4:2021, Table 2) and following the requirements given in 7.2.3.

Breathing resistance (peak pressure) shall be measured prior to and during exposure. At the end of the exposure the breathing resistance (peak pressure) shall not exceed 1 200 Pa. For RPD work rate class ≥ 3 the inhalation breathing resistance (peak pressure) shall be greater than zero.

Testing shall be performed in accordance with ISO 16900-2 and ISO 16900-10.

7.2.3.4 Radiant heat – level 3 – Supplied breathable gas RPD

One RPD in as worn state (not ventilated) fitted to the test manikin shall be exposed to a radiant heat level of 84 kW/m^2 as simulated by ISO 13506-1 for 8 s.

Breathing resistance (peak pressure) shall be measured after the exposure at the flow rate of 105 l/min and the setting of the test equipment in accordance with ISO 17420-4:2021 Table 2. The breathing resistance shall not exceed 1 300 Pa.

Testing shall be performed in accordance with ISO 16900-10 and exposure in accordance with ISO 13506-1.

7.2.4 Resistance to hot particles (embers/sparks/ash) – Supplied breathable gas RPD and filtering RPD

The RPD shall be tested as received. Non-metallic material exposed, when the RPD is in as worn state, shall be tested for resistance to hot particles and shall not ignite or drip. Whether or not a material is exposed shall be determined by use of the exposed surface identification probe specified in ISO 16900-5.

Testing shall be performed in accordance with ISO 16900-10.

Check in accordance with 8.2.

7.2.5 Chemical resistance of materials

7.2.5.1 Supplied breathable gas RPD

When exposed to the following liquids a) to d) the relevant retention components of the RPD shall not separate when tested in accordance with ISO 16900-6.

The relevant retention components are the components that secure the RPD to the wearer, or fabric means that secure the cylinder to the supplied breathable gas RPD and shall be tested as received.

The relevant RPD retention components shall be submerged for 10 s into each of the liquids listed, followed by a resting time of 45 min allowing the runoff to continue.

After exposure to the liquid a) to c) and resting, the relevant RPD components shall be rinsed with water. Following exposure to liquid d) the sample is not rinsed.

For each of the following liquids a new sample shall be used.

- a) 40 % mass fraction, sodium hydroxide (NaOH);

- b) 37 % mass fraction, hydrochloric acid (HCl);
- c) 37 % mass fraction, sulphuric acid (H₂SO₄);
- d) >95 % mass fraction, ortho-xylene (C₆H₄(CH₃)₂).

Testing shall be performed at ambient laboratory temperatures (16 °C to 32 °C).

After the resting time of 45 min the relevant RPD retention component or the fabric means that secure the cylinder to the supplied breathable gas RPD shall then be subjected to a pull force of 200 N axial to the normal use position. The pull force shall be applied progressively within 5 s to 7 s and thereafter maintained for 10 s.

Testing shall be performed in accordance with ISO 16900-6.

The harness of the RI is excluded from this requirement.

7.2.5.2 Filtering RPD

When exposed to the liquids in a) to d) the relevant retention components of the RPD shall not separate when tested in accordance with ISO 16900-6.

The relevant retention components that secure the RPD to the wearer shall be tested as received.

The relevant RPD retention components shall be submerged for 10 s into each of the liquids listed, followed by a resting time of 45 min allowing the runoff to continue.

After exposure to the liquid a) to c) and resting, the relevant RPD components shall be rinsed with water. Following exposure to liquid d) the sample is not rinsed.

For each of the following liquids a new sample shall be used.

- a) 40 % mass fraction, sodium hydroxide (NaOH);
- b) 37 % mass fraction, hydrochloric acid (HCl);
- c) 37 % mass fraction, sulphuric acid (H₂SO₄);
- d) >95 % mass fraction, ortho-xylene (C₆H₄(CH₃)₂).

Tests shall be performed at ambient laboratory temperatures (16 °C to 32 °C).

After the resting time of 45 min the relevant RPD fabric component shall then be subjected to a pull force of 200 N axial to the normal use position. The pull force shall be applied progressively within 5 s to 7 s and thereafter maintained for 10 s.

Testing shall be performed in accordance with ISO 16900-6.

The harness of the RI is excluded from this requirement.

7.2.6 Hazardous materials – Supplied breathable gas RPD

Permeation shall be tested on RPD components made of materials which by available data are regarded to be sensitive to the chemicals given in [Table 5](#) and which form the barrier between the breathable gas and the environment.

The RPD components to be tested are RI material, visor, valves, hoses and others, if applicable. Material test samples, other than hoses, shall be taken from the RPD component, if possible, or shall have the same minimum thickness as the RPD component which forms the barrier between the breathable gas and the environment.

Testing except for hoses shall be performed in accordance with ISO 6529:2013, 10.5 or 10.6.

The cumulative permeation mass at 30 min of exposure shall be measured in accordance with ISO 6529:2013 for each of the listed chemicals in Table 5 when tested at a liquid surface density exposure of 10 g/m² for liquid chemicals, and a vapor concentration of 10 000 ppm¹⁾ for gaseous chemicals or liquid chemicals with a high vapor pressure. The liquid exposure condition shall be applied to those chemicals that have a vapor pressure of less than 1,333 kPa at 20 °C. The liquid shall be applied uniformly by placing a sufficient number of droplets of chemicals on the exposed surface of the test material set with the permeation test cell. The droplet volume is to be between 1 µl and 100 µl as determined by the test laboratory to be most convenient for their dispensing equipment. The gaseous exposure conditions shall be applied to chemicals with a vapor pressure of equal to or greater than 1,333 kPa at 20 °C.

The average cumulative permeation mass for each specimen for each chemical shall be reported in µg/cm² in accordance with ISO 6529:2013, Clause 11, along with any observations for degradation of the material as the result of the chemical exposure (such as surface changes, swelling, or discoloration).

Each tested RPD hose shall have a cumulative permeation mass no greater than 6,0 µg/cm².

Testing for hoses shall be performed in accordance with 8.4 and three hoses as received shall be tested against each chemical given in Table 5.

Table 5 — Chemicals used for permeation tests

Name	Formula	CAS number	Physical state
Ammonia, anhydrous (99,99 % volume fraction) ^a	NH ₃	7664-41-7	gas
Chlorine (99,5 % volume fraction)	Cl ₂	7782-50-5	gas
Diethylamine	NH(C ₂ H ₅) ₂	109-89-7	gas
Formaldehyde ^b	CH ₂ O	50-00-0	liquid
Hydrogen chloride	HCl	7647-01-0	gas
Nitric acid (40 % mass fraction)	HN ₃	7697-37-2	liquid
Toluene	C ₆ H ₅ -CH ₃	108-88-3	liquid
^a Values in brackets are minimum values of purity of chemicals used.			
^b Test as formalin solution (formaldehyde with 37 % volume fraction in water and methanol with 10 % volume fraction).			

7.2.7 Contact with hot and cold surfaces generated by the RPD

7.2.7.1 Contact with hot and cold surfaces – Supplied breathable gas RPD

This clause supersedes ISO 17420-4:2021, 6.7.

Any uncoated metal surface of the RPD that may come in contact with the dressed wearer's body during normal use shall not exceed 65 °C or be less than -10 °C. Other material surfaces of the RPD that may come in contact with the dressed wearer's body during normal use shall not exceed 70 °C.

Surfaces that may come in contact with the wearer's hands for the purpose of adjustment of the RPD shall not exceed 60 °C.

The RPD surface temperatures shall be measured when tested in accordance with ISO 17420-4:2021, 6.2 and the temperatures shall be recorded in order to determine presence of hot or cold surfaces.

A warning concerning the potential for hot and/or cold surface temperatures shall be given in the information supplied by the manufacturer.

Check in accordance with 8.2.

1) 10 000 ppm corresponds to a volume fraction of 1 % of the challenge gas in 1 m³ of air.

7.2.7.2 Contact with hot surfaces generated by the RPD – Filtering RPD

There shall be no contact of hot surfaces exceeding 65 °C for uncoated metal surfaces and 70 °C for other surface material, of RPD with the skin of the wearer during normal use.

Straps and components of the RPD that may be adjusted by the wearer when the RPD is hot, may be exempted from the temperature test above.

If both of the these conditions are met the operator would be wearing thermal protective gloves under normal use conditions.

A warning concerning the potential for hot surface temperatures shall be given in the information supplied by the RPD manufacturer.

Surface temperature shall be determined during the filter capacity test in accordance with ISO 17420-2:2021, 6.10.1.3.2.

Check in accordance with [8.2](#).

7.2.8 Avoidance of frictional sparks – Supplied breathable gas RPD and filtering RPD

RPD shall not have exposed unprotected metal components manufactured from Magnesium, Titanium, Aluminium, or of their alloys, containing these metals which, on impact with rusted iron or steel, are likely to produce sparks capable of igniting flammable gas/air mixtures. Protective surface finishes include, but are not limited to, thermal spray, anodizing, powder coating, hard coating, and liquid paint. Exposed components are those that can be touched, during use, by the exposed surface identification probe as specified in ISO 16900-5.

Check in accordance with [8.2](#).

7.2.9 Visor after chemical exposure – Supplied breathable gas RPD and filtering RPD

One RPD visor in the as received state shall be submerged such that only the outside of the visor is in contact with the selected liquid(s). This submersion shall be for a duration of 10 s into each of the four selected liquid(s) listed below followed by a resting time of 45 min allowing the the liquid to runoff the RPD.

After exposure to the liquid a) to c) and resting, the visor shall be rinsed with water. Following exposure to liquid d) the visor is not rinsed. For each of the following liquids a new visor shall be used.

- a) 40 % mass fraction, sodium hydroxide (NaOH).
- b) 37 % mass fraction, hydrochloric acid (HCl).
- c) 37 % mass fraction, sulfuric acid (H₂SO₄).
- d) >95 % mass fraction, ortho-xylene (C₆H₄(CH₃)₂).

Tests shall be performed at ambient laboratory temperatures (16 °C to 32 °C).

After the resting time of 45 min the visor shall be checked for degradation to the extent that there are no visible hole(s) and shall not exhibit an average delta haze greater than 14 % averaged over four individual measurements on each visor.

Each visor shall be tested in accordance with ASTM D1003:2013, procedure A.

Check in accordance with [8.2](#).

7.2.10 Mechanical requirement

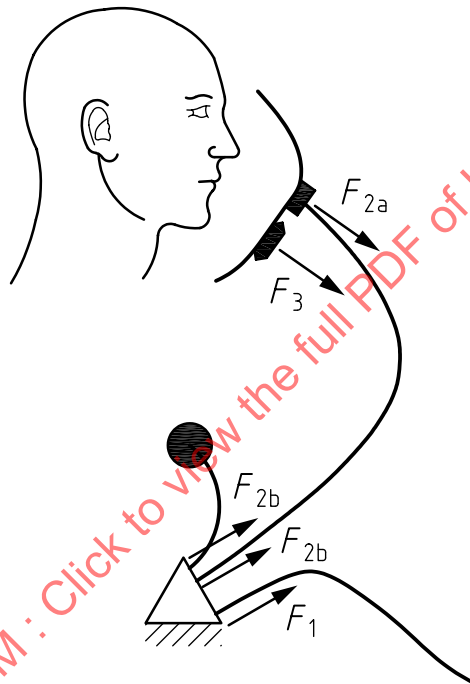
7.2.10.1 Connections – Supplied breathable gas RPD

ISO 17420-4:2021, 6.14.3.1 and 6.14.3.2 apply.

Table 6 supersedes ISO 17420-4:2021, 6.14.3.1, Tables 9 and 10.

Table 6 — Pull forces – Special application

Pull force area/Direction (Vectors)	F_1	F_{2a}	F_{2b}	F_3
	N			
Special application	(1 000 ± 50)	(500 ± 25)	(500 ± 25)	(50 ± 2,5)



Key

- F_1 pull force direction for connection between manifold and supply hose
 F_{2a} pull force direction for connection between RI and pressurized hose
 F_{2b} pull force direction for connection between manifold/pressure indicator and pressurized hose
 F_3 pull force direction for connection between RI and accessories

Figure 1 — Pull force arrangement

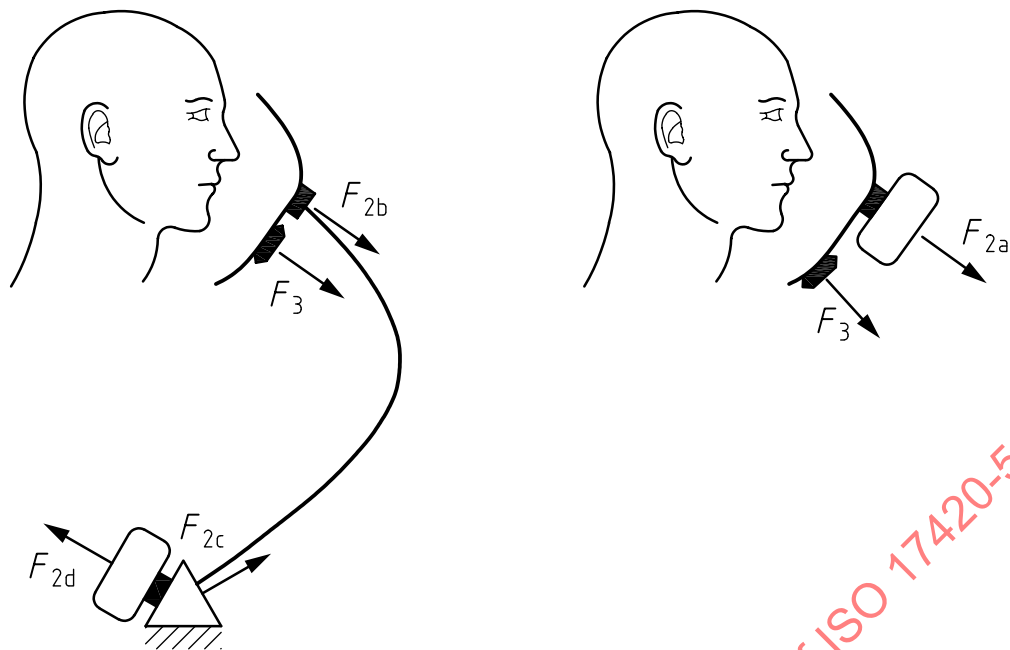
7.2.10.2 Connections — Filtering RPD

ISO 17420-2:2021, 6.7.2 and 6.7.3 apply.

Table 7 supersedes ISO 17420-2:2021, 6.7.2, Table 6.

Table 7 — Pull forces – Special application

Pull force area/Direction (Vectors)	F_{2a}	F_{2b}	F_{2c}/F_{2d}	F_3
	N			
Special application	(50 ± 2,5)	(500 ± 25)	(500 ± 25)	(50 ± 2,5)



Key

- F_{2a} pull force direction for connection between RI and filter
- F_{2b} pull force direction for connection between RI and breathing hose
- F_{2c} pull force direction for connection between manifold and breathing hose
- F_{2d} pull force direction for connection between manifold and filter
- F_3 pull force direction for connection between RI and accessories

Figure 2 — Pull force arrangement

7.2.10.3 Abrasion resistance of visor

The RPD visor in the as received state shall not exhibit a delta haze greater than 14 % when tested for resistance to abrasion in accordance with NFPA 1981:2019, 8.9.

One sample shall be tested.

7.2.11 Requirements for audible warning devices – Supplied breathable gas RPD

The warning device shall activate at a pressure of (55 ± 5) bar or at such higher pressure as will ensure that at least 200 l of breathable gas remain within the gas cylinder.

If the warning device consumes the breathable gas supply to activate the warning, any such gas consumed shall be in excess of the required 200 l of breathable gas.

The warning shall continue until at least 1,0 MPa of breathable gas is remaining.

One sample shall be tested.

The sound pressure level shall be at least 90 dB(A) measured at the ear of the head form, defined in ISO 16900-5 nearest to the device when donned on a torso in the frequency range between 2 000 Hz and 4 000 Hz.

The signal may be continuous or intermittent. When activated, the duration of the warning shall be at least 15 s for a continuous and 60 s for an intermittent signal. Thereafter shall continue to sound down to 1,0 MPa. After the initial time of 15 s or 60 s less than 90 dB(A) is allowed.

Testing shall be performed in accordance with ISO 16900-14.

7.2.12 Practical performance requirements

7.2.12.1 Passing through a square hatchway

In addition to the requirements given in ISO 17420-4:2021, 5.8, RPD for some special applications shall be tested by removing the RPD from the position as donned in relation to 7.2.12.2. The wearer with the doffed RPD shall pass through a horizontal square opening of 460 mm x 460 mm such that the legs clear the opening and then pass back through the opening to the ground, until the head is clear of the opening.

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

7.2.12.2 Removing the RPD from the position as donned

In addition to the general requirements given in ISO 17420-4:2021, 5.8, Supplied breathable gas RPD shall be designed to maintain the supply of breathable gas through the RI, while removing the RPD during active use from the wearing position without interrupting the supply of the breathable gas to the wearer.

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

7.2.13 Eye irritation (external)

RPD with RI covering the wearers' eyes but with ocular zone not being purged by inhalation air shall provide eye protection against eye-irritating substances.

This shall be demonstrated by a maximum total inward leakage (TIL) of 20 % when sampling from the ocular area.

Exercises given in Table 8 shall be performed with crosswinds.

Table 8 — Cross wind testing — Exercises of ISO 16900-1:2019, Table B.1

Air flow direction	Exercises	Test subject		
		1	2	3
Front	6)	x		
	7)	x		
	8)	x		
Side	6)		x	
	7)		x	
	8)		x	
Rear	6)			x
	7)			x
	8)			x

Testing shall be performed with three test subjects.

Testing shall be performed in accordance with ISO 16900-1:2019, 11.3.

7.2.14 Operation during submersion – Supplied breathable gas RPD

One RPD shall be tested.

The RPD shall continue to operate while being submerged in water at a temperature of $(22 \pm 3) ^\circ\text{C}$ for 1 min in each of the six orientations in accordance with EN 15333-1:2008, 6.5.8, at a depth of 1 m measured from the surface to the top of the breastbone of the torso.

Prior to submersion the RPD shall meet the breathing resistance (peak pressures) requirement at the maximum flow rate for its class for a minimum of two minutes and at the settings in accordance with ISO 17420-4:2021, Table 2.

During the submersion test, the RPD shall be ventilated at 65 l/min, sinusoidal, and with at the setting specified in ISO 17420-4:2021, Table 2. Breathing resistance shall not be assessed.

After removal from the water and waiting for 10 s, the RPD shall meet the breathing resistance (peak pressures) requirement at the maximum flow rate for its class for a minimum of two minutes and at the settings specified in ISO 17420-4:2021, Table 2.

Each orientation shall be tested separately.

The presence of water in the RI after the test does not constitute a reason for failure, and if any water is present, it shall be removed prior to measurement of breathing resistance.

Any warning device, monitor, or integrated checking device shall operate according to the manufacturer's instruction after the submersion.

Check in accordance with [8.2](#).

7.2.15 Resistance to water splash – Filtering RPD

RPD in as worn state shall be subject to a water splash test in accordance with IEC 60529:2013, 14.2.4, Method b.

The RI sealing area shall be blocked off to prevent ingress of water.

After the RPD has undergone the water splash test, the requirements of ISO 17420-2:2021, 6.3 or ISO 17420-4:2021, 6.2, shall be met at $(23 \pm 2) ^\circ\text{C}$.

7.2.16 Communication performance (speaking and hearing) – Supplied breathable gas RPD and filtering RPD

This clause supersedes ISO 17420-1:2021, 5.8.3.

The RPD shall provide communication performance as specified in NFPA 1981:2019, 7.10 by achieving a level of at least STI 0.55.

7.2.17 Requirements for RPD used in explosive atmospheres and electromagnetic compatibility – Supplied breathable gas RPD and filtering RPD

7.2.17.1 Use in explosive atmospheres

RPD, in ready for use state or components in ready for assembly state, shall comply with the appropriate requirements according to EN 60079-0 for electronic components at the temperature of operation as specified in [7.2.1.3](#) for supplied breathable gas RPD or [7.2.1.4](#) for filtering RPD, and ISO 80079-36 for non-electronic components (antistatic properties).

Only if the RPD is intended to be used in environments where highly efficient charge generating mechanisms (fast separation processes, e.g. films moving over rollers, drive belts, loading arm operation and bulk hydrocarbon transfer) are present, then testing with a DC high voltage power supply (ISO 80079-36:2016, D.4.2.3) shall be included in the testing.

Testing of hoses shall be performed in accordance with ISO 8031.

2 RPD shall fulfill the following protection level.

For gases: Class IIB (e.g. ethylene, ethylene oxide), ignition temperature $200 ^\circ\text{C}$ (T3) and suitable for zone 1 (Gb):

IIB T3 Gb

NOTE Based on a risk assessment it might be necessary to choose higher protection levels, e.g. to include diethyl ether and acetaldehyde requiring a lower ignition temperature class, i.e. 135 °C (T4).

For dust: Class IIIC (suitable for combustible flyings, non-conductive dust and conductive dust), maximum surface temperature of RPD 200 °C and suitable for zone 21 (Db):

IIIC T 200 °C Db

7.2.17.2 Electromagnetic compatibility

If the information supplied by the manufacturer states that the RPD is electromagnetically compatible (EMC), the RPD shall comply with the IEC 61000-6-2 EMC Publications or other equivalent national programs.

7.2.18 RPD class FF1

7.2.18.1 General

RPD class FF1 shall meet the requirements of ISO 17420-2 except the filter requirements and shall have a minimum protection class of PC3 and a minimum work rate class of W2.

RPD class FF1 shall fulfil the requirements filter capacity and performance as given in [Table 9](#) and [Table 10](#).

7.2.18.2 Filter capacity and performance for RPD class FF1

7.2.18.2.1 Filter capacity and filter performance for the test gas CO

[Table 9](#) gives values for filter capacity and performance for test gas CO.

Table 9 — Filter capacity and performance for test gas CO

Test	Test gas concentration ml/m ³	Flow rate (dynamic) ^a l/min (with a tolerance of ±2 %)	Temperature °C	Relative humidity %	Breakthrough concentration ml/m ³	Minimum breakthrough time min
capacity	200	35	(25 ± 1)	(95 ± 3)	25 ^b	480
performance	200	65	(25 ± 1)	(95 ± 3)	25	3
capacity	1 200	35	(25 ± 1)	(95 ± 3)	200 ^b and 200 ml dose	480
performance	1 200	65	(25 ± 1)	(95 ± 3)	200	3
migration	200	35	(25 ± 1)	(95 ± 3)	25	480 (See ISO 17420- 2:2021, 6.10.1.3.3)
^a Testing as complete filtering RPD.						
^b Time weighted average over any 5 min interval (moving average).						

7.2.18.2.2 Filter capacity for the test gases other than CO and particle filter efficiency

[Table 10](#) gives values for filter capacity for test gases other than CO.

Table 10 — Filter capacity for test gases other than CO

Test	Test gas concentration ml/m ³	Flow rate (constant) l/min (with a tolerance of $\pm 2\%$)	Temperature °C	Relative humidity %	Breakthrough concentration ml/m ³	Minimum breakthrough time min
Cyclohexane	300	30	(22 $\pm$ 1)	(25 $\pm$ 3) and (70 $\pm$ 3)	10	40
Sulfur dioxide	50				5	60
Nitrogen dioxide	25				1 (NO ₂) or 25 (NO)	60
Formaldehyde	50				1	60
Acrolein	10				0,1	40

Particle filter(s) shall have a minimum of class F2 and shall not be designated for single shift use only.

Testing shall be performed in accordance with ISO 17420-2:2021, 6.10.1.2.3 or 6.10.1.2.4.

Filter(s) designated for single shift use only shall be tested in accordance with ISO 17420-2:2021, 6.10.1.3.3 for test gases nitrogen dioxide, formaldehyde and acrolein only.

7.2.19 Exposure to dust

RPD in ready for use state and component in ready for assembly state shall withstand the effects of dusty environments. See ISO 17420-2:2021, 6.8, or ISO 17420-4:2021, 6.10.

This has to be addressed by the FMEA.

7.3 Pre-conditioning of supplied breathable gas RPD and filtering RPD

7.3.1 General

This clause supersedes ISO 17420-2:2021, 6.9.1 or ISO 17420-4:2021, 6.11.1.

Depending on the special application class the following pre-conditionings have to be applied to the appropriate RPD prior to the performance requirements of ISO 17420-2:2021, 6.3, or ISO 17420-4:2021, 6.2.

7.3.2 Exposure to vibration and shock – Supplied breathable gas RPD and filtering RPD

RPD in ready for use state and component in ready for assembly state shall be exposed to temperature and humidity in accordance with ISO 17420-2:2021, 6.9.2.2 or ISO 17420-4:2021, 6.11.1.1.2.

Thereafter at ambient temperature the RPD shall be subjected to a vibration test in accordance with IEC 60721-1:2002, Table 1, 6.1.2, Figure 2 model spectrum type G (modified to start up from 10 Hz and ends at 500 Hz), and IEC 60721-3-2:2018, Clause 5, Table 5 mechanical environmental conditions class 2M5 (modified to start up from 10 Hz and ends at 500 Hz), stationary vibration, random as shown in ISO 17420-4:2021, Table 8.

Testing time for random vibration shall be 180 min per axis.

Testing shall be performed in accordance with IEC 60068-2-64, test Fh: vibration: (random).

The RPD in ready for use state and component in ready for assembly state shall be fixed to the test rig to avoid relative movement during exposure. Parts with dampening characteristics, such as body harness, shall not be used as a fixation means.