
**Respiratory protective devices —
Performance requirements —**

**Part 7:
Special application marine, mining,
welding, and abrasive blasting
- Filtering RPD and supplied
breathable gas RPD**

Appareils de protection respiratoire — Exigences de performances —

*Partie 7: Applications particulières pour environnements marins,
exploitation minière, soudage et projection d'abrasifs - APR alimentés
en gaz respirables 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*.

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 application other than fire services and escape and its elements and components.

Some test methods are described. For other test methods references are given to the ISO 16900 series standards of "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. 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.

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Respiratory protective devices — Performance requirements —

Part 7:

Special application marine, mining, welding, and abrasive blasting - Filtering RPD and supplied breathable gas RPD

1 Scope

This document specifies the requirements for supplied breathable gas respiratory protective device (RPD) and filtering RPD to be used for special application marine, mining, welding and abrasive blasting for use in the workplace to protect the wearer.

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 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 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 16900-10, *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 level*

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

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 23269-2:2011, *Ships and marine technology. Breathing apparatus for ships. Self-contained breathing apparatus for shipboard firefighters*

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

IEC 60068-2-64:2009, *Environmental testing — Part 2-64: Tests — Test Fh: Vibration, broadband random and guidance*

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

IEC 60079-11, *Explosive atmospheres — Part 11: Equipment protection by intrinsic safety “i”*

IEC 60079-32-1:2013, *Explosive atmospheres — Part 32-1: Electrostatic hazards — Guidance*

IEC 60079-32-2:2015, *Explosive atmospheres — Part 32-2: Electrostatic hazards — Tests*

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

IEC 60721-1:1990, *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*

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

EN 50303, *Group 1, category M1 equipment intended to remain functional in atmospheres endangered by firedamp and/or coal dust*

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 1981:2013, *Standard on Open-Circuit Self-Contained Breathing Apparatus (SCBA) for Emergency Services*

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**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.

3.2**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. to the wearer, 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.

3.3**component in ready for assembly state**

component with seals, plugs, packaging or other environmental protective means still in place

3.4**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.

Note 2 to entry: For escape devices this includes also the RPD in its carrying container unopened.

3.5**permeation**

process by which a chemical moves through a given material on a molecular level

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.

The following subclauses apply in addition to ISO 17420-2:2021, Clause 4:

4.2 Supplied breathable gas RPD

In addition, 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
Marine	MA2 (Marine firefighting)
	MA1 (Hazardous material)
Mining	MN3 (Mining firefighting and Rescue)
	MN2 (Underground mining explosive)
	MN1 (Underground mining non-explosive)
Abrasive blasting	AB
Welding	WE

Example for a special application supplied breathable gas RPD with protection class (PC5), work rate class (W3), RI class (cT), supplied breathable gas capacity class (S1800) and special application mining firefighting and rescue class (MN3)

Marking for the given example PC5 W3 cT S1800 MN3

4.3 Filtering RPD

In addition, 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
Mining	MN2 (Underground mining explosive)
	MN1 (Underground mining non-explosive)
Abrasive blasting	AB
Welding	WE

Example for a special application filtering RPD with Protection class (PC3), work rate class (W2), RI class (bT), particle filter performance class (F3) and special application underground mining non-explosive class (MN1).

Marking for the given example PC3 W2 bT F3 MN1

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 17420-1:2021, Clause 5 and ISO 17420-4:2021, Clause 5 apply.

6 Basic requirements for supplied breathable gas RPD or 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.

7 Special application for supplied breathable gas RPD for marine, mining, welding, abrasive blasting and filtering RPD for mining, welding, abrasive blasting

7.1 Special application – Requirement matrices

7.1.1 General

Supplied breathable gas RPD for marine, mining, welding, abrasive blasting shall each fulfil the requirements listed in their respective requirements [Table 3](#) to [Table 6](#).

Filtering RPD for mining, welding, abrasive blasting shall each fulfil the requirements listed in their respective requirements [Table 7](#) to [Table 9](#).

7.1.2 Supplied breathable gas RPD

7.1.2.1 Supplied breathable gas RPD – Marine

[Table 3](#) gives an overview about requirements and preconditioning of special application supplied breathable gas RPD — Marine.

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

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

In the first column the clause numbers of the requirements are given. In the third and fourth column the required pre-conditioning for different marine classes are listed.

In the second column the requirement is titled.

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

For the requirement [7.2.1.3](#) and class marine hazardous material (MA1) the following applies

At least one sample shall be preconditioned TH&VS&IE (Temperature and humidity, exposure to vibration and shock – marine and intermittent exposure).

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

Table 3 — Special application requirement overview – Supplied breathable gas RPD – Marine

Requirement	Title	Hazardous Materials MA1	Marine Fire-fighting MA2
		Protection class ≥PC5	Protection class ≥PC5
		Work rate class ≥W3	Work rate class ≥W3
		Pre-conditioning	
7.2.1.3	Temperature of operation – level 0	TH&VS&IE DR	TH&VS&IE DR
7.2.1.5	Temperature of operation – level 1	— ^a	AR/NP
7.2.1.6	Temperature of operation – level 2	— ^a	AR/NP
7.2.1.7	Temperature of operation – level 2 and flammability	— ^a	AR/NP
7.2.7.1	Contact with hot and cold surfaces - Supplied breathable gas RPD	AR/NP	AR/NP
7.2.8	Avoidance of frictional sparks	AR/NP	AR/NP
7.2.2	Fabric material flame resistance performance	AR/NP	— ^a
7.2.3.2	Radiant heat – level 1	AR/NP	AR/NP
7.2.3.3	Radiant heat – level 2	— ^a	AR/NP
^a — means that a test is not required for this combination of requirement and special application class. ^b X means exposure to dust has to be addressed by the FMEA (see 7.2.9.3). AR/NP as received (or in non pre-conditioned state). VS Exposure to vibration and shock – marine (7.3.2). TH&VS&IE Temperature and humidity according to ISO 17420-4:2021, 6.11.1.1.2, exposure to vibration and shock – marine (7.3.2) and enhanced resistance to corrosion- intermittent exposure (7.3.5). DR Exposure to impact from drop (7.3.6).			

Table 3 (continued)

Requirement	Title	Hazardous Materials MA1	Marine Fire-fighting MA2
		Protection class ≥PC5	Protection class ≥PC5
		Work rate class ≥W3	Work rate class ≥W3
		Pre-conditioning	
7.2.4	Resistance to hot particles	AR/NP	AR/NP
7.2.5.1	Chemical resistance – Supplied breathable gas RPD	AR/NP	AR/NP
7.2.5.2	Chemical resistance –Hazardous Materials	AR/NP	— ^a
7.2.6	Visor after chemical exposure	AR/NP	AR/NP
7.2.9.1	Connections	AR/NP	AR/NP
7.2.9.2	Abrasion resistance of visor	— ^a	AR/NP
7.2.9.3	Exposure to dust	X ^b	X ^b
7.2.12.1.1	Intrinsic safety and electromagnetic compatibility - General	AR/NP	AR/NP
7.2.12.1.3	Intrinsic safety and electromagnetic compatibility - Marine	AR/NP	AR/NP
7.2.13.1	Antistatic properties – General	AR/NP	AR/NP
7.2.13.3	Antistatic properties – Exposed RPD hoses	AR/NP	AR/NP
7.2.11.1	Practical performance - Passing through a square hatchway	AR/NP	AR/NP
7.2.11.2	Practical performance - Removing the RPD from the position as donned	AR/NP	AR/NP
7.2.11.5	Eye irritation (external)	AR/NP	AR/NP
7.2.11.6	Operation during submersion	AR/NP	AR/NP
7.2.11.8	Communication performance	AR/NP	AR/NP
7.2.10	Requirements for audible warning devices	VS&IE	VS&IE
^a — means that a test is not required for this combination of requirement and special application class. ^b X means exposure to dust has to be addressed by the FMEA (see 7.2.9.3). AR/NP as received (or in non pre-conditioned state). VS Exposure to vibration and shock – marine (7.3.2). TH&VS&IE Temperature and humidity according to ISO 17420-4:2021, 6.11.1.1.2, exposure to vibration and shock – marine (7.3.2) and enhanced resistance to corrosion- intermittent exposure (7.3.5). DR Exposure to impact from drop (7.3.6).			

7.1.2.2 Supplied breathable gas RPD – Mining

[Table 4](#) gives an overview about requirements and preconditioning of special application supplied breathable gas RPD – Mining.

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

[Table 4](#) shall be read as follows:

In the first column the requirements are given. In the third to fifth column in [Table 4](#) the required pre-conditioning for different mining classes are listed.

In the second column the requirement is titled.

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

For the requirement [7.2.1.3](#) and class mining non-explosive atmosphere (MN1) the following applies

At least one sample shall be preconditioned TH&VS&IE (Temperature and humidity, exposure to vibration and shock – marine and intermittent exposure).

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

At least one further sample shall be preconditioned PR (Exposure to changes in atmospheric pressure)

Table 4 — Special application requirement overview – Supplied breathable gas RPD – Mining

Requirement	Title	Mining non-explosive atmosphere MN1	Mining explosive atmosphere MN2	Mining Fire-fighting MN3
		Protection class $\geq PC1$	Protection class $\geq PC1$	Protection class $\geq PC5$
		Work rate class $\geq W2$	Work rate class $\geq W2$	Work rate class $\geq W3$
		Pre-conditioning		
7.2.1.3	Temperature of operation – level 0	TH&VS&IE	TH&VS&IE	TH&VS&IE
		DR	DR	DR
		PR	PR	PR
7.2.1.5	Temperature of operation – level 1	— ^a	— ^a	AR/NP
7.2.1.6	Temperature of operation – level 2	— ^a	— ^a	AR/NP
7.2.1.7	Temperature of operation – level 2 and flammability	— ^a	— ^a	AR/NP
7.2.7.1	Contact with hot and cold surfaces - Supplied breathable RPD	AR/NP	AR/NP	AR/NP
7.2.8	Avoidance of frictional sparks	— ^a	AR/NP	AR/NP
7.2.3.2	Radiant heat – level 1	— ^a	— ^a	AR/NP
7.2.3.3	Radiant heat – level 2	— ^a	— ^a	AR/NP
7.2.5.1	Chemical resistance – Supplied breathable gas RPD	— ^a	— ^a	AR/NP
7.2.9.1	Connections	— ^a	— ^a	AR/NP
7.2.9.2	Abrasion resistance of visor	AR/NP	AR/NP	AR/NP
7.2.9.3	Exposure to dust	X ^b	X ^b	X ^b
7.2.12.1.1	Intrinsic Safety and electromagnetic compatibility - General	— ^a	AR/NP	AR/NP
7.2.12.1.2	Intrinsic Safety and electromagnetic compatibility - Mining	— ^a	AR/NP	AR/NP
7.2.13.1	Antistatic properties - General	— ^a	AR/NP	AR/NP
^a — means that a test is not required for this combination of requirement and special application class. ^b X means exposure to dust has to be addressed by the FMEA (see 7.2.9.3). AR/NP as received (or in non pre-conditioned state). TH&VS&IE Temperature and humidity according to ISO 17420-4:2021, 6.11.1.1.2, exposure to vibration and shock – marine (7.3.2) and enhanced resistance to corrosion- intermittent exposure (7.3.5). DR Exposure to impact from drop (7.3.6). PR Exposure to changes in atmospheric pressure (7.3.4).				

Table 4 (continued)

Requirement	Title	Mining non-explosive atmosphere MN1	Mining explosive at- mosphere MN2	Mining Fire- fighting MN3
		Protection class ≥PC1	Protection class ≥PC1	Protection class ≥PC5
		Work rate class ≥W2	Work rate class ≥W2	Work rate class ≥W3
		Pre-conditioning		
7.2.13.2	Antistatic properties - Mining	— ^a	AR/NP	AR/NP
7.2.13.3	Antistatic properties - Exposed RPD hoses	— ^a	AR/NP	AR/NP
7.2.11.1	Practical performance - Passing through a square hatchway	— ^a	— ^a	AR/NP
7.2.11.2	Practical performance - Removing the RPD from the position as donned	— ^a	— ^a	AR/NP
7.2.11.5	Eye irritation (external)	AR/NP	AR/NP	AR/NP
7.2.11.6	Operating during submersion	— ^a	— ^a	AR/NP
7.2.11.8	Communication performance	— ^a	— ^a	AR/NP
7.2.11.7	Resistance to water splash	AR/NP	AR/NP	— ^a
7.2.10	Requirements for audible warning devices	— ^a	— ^a	VS&IE
^a — means that a test is not required for this combination of requirement and special application class. ^b X means exposure to dust has to be addressed by the FMEA (see 7.2.9.3). AR/NP as received (or in non pre-conditioned state). TH&VS&IE Temperature and humidity according to ISO 17420-4:2021, 6.11.1.1.2, exposure to vibration and shock - marine (7.3.2) and enhanced resistance to corrosion-intermittent exposure (7.3.5). DR Exposure to impact from drop (7.3.6). PR Exposure to changes in atmospheric pressure (7.3.4).				

7.1.2.3 Supplied breathable gas RPD - Welding

[Table 5](#) gives an overview about requirements and preconditioning of special application supplied breathable gas RPD — Welding.

Table 5 — Special application requirement overview - Supplied breathable gas RPD - Welding

Requirement	Title	Welding WE
		Protection class ≥PC1
		Work rate class ≥W1
		Pre-conditioning
7.2.7.1	Contact with hot and cold surfaces — Supplied breathable gas RPD	AR/NP
^a X means exposure to dust has to be addressed by the FMEA (see 7.2.9.3). AR/NP as received (or in non pre-conditioned state).		

Table 5 (continued)

Requirement	Title	Welding WE
		Protection class ≥PC1
		Work rate class ≥W1
		Pre-conditioning
7.2.4	Resistance to hot particles (embers/ sparks/ash)	AR/NP
7.2.9.3	Exposure to dust	X ^a
7.2.11.3	Field of vision for welding RPD	AR/NP
7.2.11.5	Eye irritation (external)	AR/NP
^a X means exposure to dust has to be addressed by the FMEA (see 7.2.9.3). AR/NP as received (or in non pre-conditioned state).		

7.1.2.4 Supplied breathable gas RPD – Abrasive blasting

[Table 6](#) gives an overview about requirements and preconditioning of special application supplied breathable gas RPD – Abrasive blasting.

Table 6 — Special application requirement overview – Supplied breathable gas RPD – Abrasive blasting

Requirement	Title	Abrasive Blasting AB
		Protection class ≥PC3
		Work rate class ≥W1
		Pre-conditioning
ISO 17420-4:2021, 6.2	RPD performance	AB
7.2.7.1	Contact with hot and cold surfaces - Supplied breathable gas RPD	AR/NP
7.2.9.1.3	Connections other than to RI	AR/NP
7.2.9.2	Abrasion resistance of visor	AR/NP
7.2.9.3	Exposure to dust	X ^a
7.2.11.4	Field of vision abrasive blasting RPD	AR/NP
7.2.11.5	Eye irritation (external)	AR/NP
7.2.11.7	Resistance to water splash	AR/NP
7.2.10	Requirements for audible warning devices	AR/NP
^a X means exposure to dust has to be addressed by the FMEA (see 7.2.9.3). AB pre-conditioned in accordance with ISO 14877:2002, 5.3.7 (see 7.3.7). AR/NP as received (or in non pre-conditioned state).		

7.1.3 Filtering RPD

7.1.3.1 Filtering RPD – Mining

[Table 7](#) gives an overview about requirements and preconditioning of special application filtering RPD – Mining.

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

For [7.2.1.2](#) within one line of the cell a different sample shall be used for each preconditioning.

Table 7 — Special application requirement overview – Filtering RPD – Mining

Requirement	Title	Mining non-explosive atmosphere MN1	Mining explosive atmosphere MN2
		Protection class ≥PC1	Protection class ≥PC1
		Work rate class ≥W2	Work rate class ≥W2
		Pre-conditioning	
ISO 17420-2:2021, 6.10.1.2	Particle filter	DR	DR
ISO 17420-2:2021, 6.10.1.3	Gas filter	DR	DR
7.2.1.4	Temperature of operation – level 0	AR/NP	AR/NP
		CR	CR
		PR	PR
		TH&VS	TH&VS
7.2.8	Avoidance of frictional sparks	— ^a	AR/NP
7.2.9.2	Abrasion resistance of visor	AR/NP	AR/NP
7.2.9.3	Exposure to dust	X ^b	X ^b
7.2.12.1.2	Intrinsic Safety and electromagnetic compatibility - Mining	— ^a	AR/NP
7.2.13.1	Antistatic properties - General	— ^a	AR/NP
7.2.13.2	Antistatic properties - Mining	— ^a	AR/NP
7.2.13.3	Antistatic properties – Exposed RPD hoses	— ^a	AR/NP
7.2.11.5	Eye irritation (external)	AR/NP	AR/NP
7.2.11.7	Resistance to water splash	AR/NP	AR/NP
7.2.7.2	Contact with and cold surfaces - Filtering RPD	AR/NP	AR/NP
^a — means that a test is not required for this combination of requirement and special application class. ^b X means exposure to dust has to be addressed by the FMEA (see 7.2.9.3). AR/NP as received (or in non pre-conditioned state). CR Enhanced resistance to corrosion – intermittent exposure (7.3.5). DR Exposure to impact from drop (7.3.6). PR Resistance to changes in atmospheric pressure (7.3.4). TH&VS&IE Temperature and humidity according to ISO 17420-2:2021, 6.9.2.2, exposure to vibration and shock – mining (7.3.3).			

7.1.3.2 Filtering RPD – Welding

[Table 8](#) gives an overview about requirements and preconditioning of special application filtering RPD – Welding

Table 8 — Special application requirement overview – Filtering RPD – Welding

Requirement	Title	Welding WE1
		Protection class ≥PC1
		Work rate class ≥W1
		Pre-conditioning
7.2.4	Resistance to hot particles (embers/ sparks/ash)	AR/NP
7.2.9.3	Exposure to dust	X ^a
7.2.11.3	Field of vision for welding	AR/NP
7.2.11.5	Eye irritation (external)	AR/NP
7.2.7.2	Contact with hot and cold surfaces - Filtering RPD	AR/NP
^a X means exposure to dust has to be addressed by the FMEA (see 7.2.9.3). AR/NP as received (or in non pre-conditioned state).		

7.1.3.3 Filtering RPD – Abrasive blasting

[Table 9](#) gives an overview about requirements and preconditioning of special application filtering RPD — Abrasive blasting

Table 9 — Special application requirement overview – Filtering RPD – Abrasive blasting

Requirement	Title	Abrasive Blasting AB
		Protection class ≥PC3
		Work rate class ≥W1
		Pre-conditioning
ISO 17420-2:2021, 6.3	RPD performance	AB
7.2.9.1.4	Connections other than to RI	AR/NP
7.2.9.2	Abrasion resistance of visor	AR/NP
7.2.9.3	Exposure to dust	X ^a
7.2.13.1	Antistatic properties - General	AR/NP
7.2.13.3	Antistatic properties – Exposed RPD hoses	AR/NP
7.2.11.4	Field of vision abrasive blasting RPD	AR/NP
7.2.11.5	Eye irritation (external)	AR/NP
7.2.7.2	Contact with hot surfaces generated by the RPD	AR/NP
^a X means exposure to dust has to be addressed by the FMEA (see 7.2.9.3). AR/NP as received (or in non pre-conditioned state). AB pre-conditioned in accordance with ISO 14877:2002, 5.3.7 (see 7.3.7).		

7.2 Requirements for special application RPD for marine, mining, welding and abrasive blasting

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](#), [7.2.1.6](#) and [7.2.1.7](#), warning and monitoring devices, if applicable, shall continue to function.

The pre-heating 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](#), 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 subclause supersedes ISO 17420-4:2021, 6.1.

RPD in ready for use state or the RPD component in ready for assembly state shall be pre-conditioning and tested as given in [Table 3](#) and [Table 4](#).

Sample(s) shall be equilibrated for a minimum of 4 h and tested at $\begin{pmatrix} -32 & +2 \\ & 0 \end{pmatrix}^{\circ}\text{C}$ and $\begin{pmatrix} 60 & 0 \\ & -2 \end{pmatrix}^{\circ}\text{C}$. 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, 6.3.

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 $\begin{pmatrix} -32 & +2 \\ & 0 \end{pmatrix}^{\circ}\text{C}$ and at 120 J.

7.2.1.4 Temperature of operation – level 0 – Filtering RPD

This subclause supersedes ISO 17420-2:2021, 6.2.

One RPD pre-conditioned in accordance with [7.3.1](#) shall be equilibrated for a minimum of 4 h and tested at $\begin{pmatrix} -32 & +2 \\ & 0 \end{pmatrix}^{\circ}\text{C}$. One RPD as received shall be equilibrated for a minimum of 4 h and tested at $\begin{pmatrix} 60 & 0 \\ & -2 \end{pmatrix}^{\circ}\text{C}$.

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 $\begin{pmatrix} 100 & 0 \\ & -2 \end{pmatrix}^{\circ}\text{C}$ whilst the RPD is ventilated with the settings of the test equipment at 35 l/min for 30 minutes or the service life of the RPD whatever is shorter and testing shall be started 2 min before the end of the exposure time or service life. The RPD shall 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 2 – 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 [7.2.1.7](#).

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

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

Temperature of operation level 2 is specified by a flame engulfment test after pre-conditioning at $(180 \pm 5)^{\circ}\text{C}$ for 5 min.

One RPD 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/min after the temperature exposure of $(180 \pm 5)^{\circ}\text{C}$ for 15 min at a ventilation rate of 40 l/min (20 cycles/min and 2 l/min 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.

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 insecure.

Check in accordance with [8.2](#).

The breathing resistance shall not exceed 1 200 Pa.

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

7.2.2 Resistance to flame of fabric materials – Supplied breathable gas RPD

This subclause supersedes ISO 17420-4:2021, 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 16900-10:2015, 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](#) or [7.2.3.3](#). 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 when checked in accordance with [8.2](#) and the RPD shall continue to meet the breathing resistance requirements specified in ISO 17420-4:2021, 6.3. Deformation of components does not constitute a failure.

For levels 1 and 2, 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 choose 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.

Testing shall be performed 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 according to ISO 17420-2:2021, Table 2 or ISO 17420-4:2021, Table 2 and following the requirements given in [7.2.3.1](#).

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 and 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 kW/m² for 5 min at the flow rate of 105 l/min and the setting of the test equipment according to ISO 17420-4:2021, Table 2 and following the requirements given in [7.2.3.1](#).

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 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.

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

When tested for resistance to hot particles, each non-metallic material exposed when the RPD, as received, is used, shall not ignite or drip. Whether or not a material is exposed it 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 – Supplied breathable gas RPD

7.2.5.1 Chemical resistance – 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 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 against the chemicals listed in [Table 10](#) 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 shall be measured in accordance with ISO 6529, with the following test conditions, for each of the listed chemicals in [Table 10](#).

The cumulative permeation mass at 30 min of exposure shall be measured in accordance with ISO 6529 for each of the listed chemicals in [Table 10](#) when tested at a liquid surface density exposure of 10 g/m² for liquid chemicals, and a vapour concentration of 10 000 ppm¹⁾ for gaseous chemicals or liquid chemicals with a high vapour pressure.

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

The liquid exposure condition shall be applied to those chemicals that have a vapour 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 vapour 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 8.3 and three hoses as received shall be tested against each chemical listed in Table 10.

Table 10 — 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) ^a	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) ^a	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 with methanol 10 % volume fraction).

7.2.6 Chemical resistance of visor only – 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 runoff to continue.

After exposure to the relevant 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.

7.2.7 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 subclause supersedes ISO 17420-4:2021, 6.7.

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.

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

7.2.7.2 Contact with hot surfaces – 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, with the exception of the wearer's hands if adjustment can be necessary.

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 metal components manufactured from Magnesium, Titanium, uncoated 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.

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 Mechanical Requirement

7.2.9.1 Connections – Supplied breathable gas RPD

7.2.9.1.1 Connections to RI – Supplied breathable gas RPD

ISO 17420-4:2021, 6.14.3.1 applies.

Table 11 supersedes ISO 17420-4:2021, 6.14.3.1, Table 9 and 10.

Table 11 — 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)

7.2.9.1.2 Connections to RI — Filtering RPD

ISO 17420-2:2021, 6.7.2 applies.

Table 12 supersedes ISO 17420-2:2021, 6.7.2, Table 6.

Table 12 — 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)

7.2.9.1.3 Connections other than to the RI – Supplied breathable gas RPD

ISO 17420-4:2021, 6.14.3.2 applies.

Two samples shall be tested.

[Table 11](#) in 7.2.9.1.1 supersedes ISO 17420-4:2021, 6.14.3.2, Table 9 and 10.

7.2.9.1.4 Connections other than to the RI – Filtering RPD

This subclause supersedes ISO 17420-2:2021, 6.7.3.

[Table 12](#) in 7.2.9.1.2 supersedes ISO 17420-2:2021, 6.7.2, Table 6.

7.2.9.2 Abrasion resistance of visor – Supplied breathable gas RPD and filtering RPD

One sample shall be tested.

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 1981:2013, 8.9.

7.2.9.3 Exposure to dust – Supplied breathable gas RPD and filtering RPD

RPD in ready for use state and component in ready for assembly state shall withstand the effects of dusty environment. This has to be addressed by the FMEA. See ISO 17420-2:2021, 6.8, or ISO 17420-4:2021, 6.10.

7.2.10 Requirements for audible warning devices – Supplied breathable gas RPD

Type Sxxxx RPD using high pressure compressed breathable gas shall be equipped with an audible warning device that indicates to the wearer that at least 200 l of breathable gas is remaining.

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 between 90 dB(A) and 110 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 between 90 dB(A) and 110 dB(A) shall be at least 15 s for a continuous and 60 s for an intermittent signal and thereafter shall continue to sound down to 1,0 MPa. After the initial time of 15 s or 60s less than 90 dB(A) is allowed.

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

7.2.11 Practical performance requirements – Supplied breathable gas RPD and filtering RPD

7.2.11.1 Passing through a square hatchway – Supplied breathable gas RPD

In addition to the requirements given in ISO 17420-4:2021, 5.8, RPD for some special application shall be tested without removing the RPD from the position as donned in relation to 7.2.11.2. The wearer with the doffed RPD shall pass through a horizontal square opening of 460 mm × 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.

7.2.11.2 Removing the RPD from the position as donned – Supplied breathable gas RPD

In addition to the general requirements given in ISO 17420-4:2021, 5.8, RPD Class SXXXX 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.

7.2.11.3 Field of vision for welding RPD – Supplied breathable gas RPD and filtering RPD

If the means of protection against non-ionizing radiation is integral with the RPD covered by this standard then the requirements of ISO 17420-1:2021, 5.2 are not applicable.

The field of vision shall be assessed by the ability to complete the practical performance test according to ISO 16900-7.

7.2.11.4 Field of vision for abrasive blasting RPD – Supplied breathable gas RPD and filtering RPD

If the means of protection against abrasive blasting is integral with the RPD covered by this standard then the requirements of ISO 17420-1:2021, 5.2 are not applicable.

The field of vision shall be assessed by the ability to complete the practical performance test according to ISO 16900-7.

7.2.11.5 Eye irritation (external) – Supplied breathable gas RPD and filtering RPD

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

This shall be demonstrated by a maximum TIL of 20 % when sampling from the ocular zone.

Exercises given in Table 13 shall be performed with crosswinds.

Table 13 — 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	

Table 13 (continued)

Air flow direction	Exercises	Test subject		
		1	2	3
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.

7.2.11.6 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 according to ISO 17420-4:2021, Table 2.

During the submersion the RPD shall be ventilated at 65 l/min, sinusoidal, at the setting according to ISO 17420-4:2021, Table 2 and 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 according to ISO 17420-4:2021, Table 2.

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](#).

7.2.11.7 Resistance to water splash – Supplied breathable gas RPD and filtering RPD

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

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

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

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

This subclause supersedes ISO 17420-1:2021, 5.9.3.

The RPD shall provide communication performance as specified in NFPA 1981: 2013, 7.10 by achieving a level of at least STI 0.55.

7.2.12 Requirements for RPD used in explosive atmospheres – Supplied breathable gas RPD and filtering RPD

7.2.12.1 Intrinsic safety and electromagnetic compatibility – Supplied breathable gas RPD and filtering RPD

7.2.12.1.1 Intrinsic safety and electromagnetic compatibility – General

If the RPD, in ready for use state or component in ready for assembly state, are equipped with an electric energy source or have electrically operating parts these components shall comply with IEC 60079-0 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.

The measurement accuracy shall be maintained when testing the device on electromagnetic compatibility in accordance with IEC 61000-6-2.

7.2.12.1.2 Intrinsic safety and electromagnetic compatibility – Mining

If the RPD, in ready for use state or component in ready for assembly state, are equipped with an electric energy source, exothermic source or has electrically operating parts these components shall comply with M1 EEx ia I, in accordance with IEC 60079-0 in combination with the EN 50303 respectively.

NOTE EN 50303 specifically addresses mining conditions such as gas and dust threats.

7.2.12.1.3 Intrinsic safety and electromagnetic compatibility – Marine

If the RPD, in ready for use state or component in ready for assembly state, are equipped with an electric energy source, exothermic source or has electrically operating parts these components shall comply with the class 2G EEx ib IIB T4 in accordance with IEC 60079-0.

7.2.13 Antistatic properties – Supplied breathable gas RPD and filtering RPD

7.2.13.1 Antistatic properties – General

Exposed parts, except RPD hoses, shall be tested in accordance with ISO 80079-36: 2016. Testing by charging with a DC high voltage power supply (ISO 80079-36:2016, D.4.2.3) can be excluded, as long as highly efficient charge generating mechanisms (fast separation processes, e.g. films moving over rollers, drive belts, loading arm operation and bulk hydrocarbon transfer) are unlikely to be present.

A warning shall be given in the information supplied by the manufacturer.

Exposed parts are those that can be touched, during use, by the exposed surface identification probe as specified in ISO 16900-5.

Exposed RPD hoses shall meet the requirement in [7.2.13.3](#)

7.2.13.2 Antistatic properties – Mining

Testing according to [7.2.13](#) shall be conducted for class M1, Group I requirements.

7.2.13.3 Antistatic properties – Exposed RPD hoses

Exposed RPD hoses shall have an insulation resistance that is greater than $10^3 \Omega$ and less than $10^8 \Omega$.

Exposed RPD hoses are those that can be touched, during use, by the exposed surface identification probe as specified in ISO 16900-5.

Testing shall be performed in accordance with ISO 8031.

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

7.3.1 General

This subclause 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 – Marine – Supplied breathable gas RPD

7.3.2.1 General

RPD in ready for use state and component in ready for assembly state shall be exposed to temperature and humidity according to ISO 17420-2:2021, 6.9.2.2 or ISO 17420-4:2021, 6.11.1.1.2. Thereafter the RPD shall be exposed to vibration in accordance with [7.3.2.2](#) and then to endurance in accordance with [7.3.2.3](#).

7.3.2.2 Resonance search vibration-marine

RPD shall be subjected to a vibration test according to ISO 23269-2:2011, 5.5. The samples shall be mounted to an electro-dynamic vibration testing machine and the following tests shall be conducted in three mutually perpendicular directions.

Sample(s) shall be fixed to the test rig to avoid relative movement during exposure. Parts with dampening characteristics, such as harness, shall not be used as a fixation means.

The samples shall be vibrated at a continuously changing frequency ranging from 5 Hz to 16 Hz, at a constant amplitude of 2 mm for a period of 10 min for each of three axis, three times in each direction (total hours of testing equal to 1,5 h). Then the samples shall be vibrated at frequencies from 16 Hz to 60 Hz, at a constant acceleration of 10 m/s² for a period of 10 min for each of three axis, three times in each direction (total hours of testing equal to 1,5 h). The frequencies and directions at which resonance occurred shall be recorded.

The samples shall then be subjected to [7.3.2.3](#).

7.3.2.3 Endurance vibration-marine

After the resonance search vibration test according to [7.3.2.2](#), RPD in ready for use state and component in ready for assembly state shall be subjected to a vibration test according to ISO 23269-2:2011, 5.5

Sample(s) shall be fixed to the test rig to avoid relative movement during exposure. Parts with dampening characteristics, such as harness, shall not be used as a fixation means.

The samples shall be vibrated for at least 1,5 h in each of three axis, three times each direction (total hours of testing equal to 4,5 h) at the most severe resonant frequency, identified in [7.3.2.2](#) if no resonance was observed, conduct the test at 16 Hz continuous at a single amplitude of 2 mm in each of three axis, three times each direction (total hours of testing equal to 4,5 h).

7.3.2.4 Exposure to shock-marine

RPD in ready for use state and component in ready for assembly state shall be subjected to a shock test according to IEC 60068-2-27:2010, Table A.2, 1st line, type 1 and [Figure 1](#) (half sine-pulse).

Sample(s) shall be fixed to the test rig to avoid relative movement during exposure. Parts with damping characteristics, such as harness, shall not be used as a fixation means.

Test parameters:

- Acceleration peak: 400 m/s²;
- Exposure time: 6 ms;
- Shock form: half-sine;
- Number of total shocks per RPD: 6 000 (1 000 per axis and direction).

7.3.3 Exposure to vibration and shock – Mining – Supplied breathable gas RPD and filtering RPD

7.3.3.1 General – 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 according to ISO 17420-2:2021, 6.9.2.2 or ISO 17420-4:2021, 6.10.1.1.2. Thereafter the RPD shall be exposed to vibration in accordance with 7.3.3.2 and then shock in accordance with 7.3.3.3.

7.3.3.2 Exposure to vibration – Mining – Supplied breathable gas RPD and filtering RPD

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 2MS (modified to start up from 10 Hz and ends at 500 Hz), for 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 60068-2-64:2009, test Fh: vibration: (random).

The sample(s) shall be fixed to the test rig to avoid relative movement during exposure. Parts with dampening characteristics, such as harness, shall not be used as a fixation means.

After vibration the RPD shall be exposed to shock according to 7.3.3.3.

7.3.3.3 Exposure to shock-mining – Supplied breathable gas RPD and filtering RPD

Each RPD in ready for use state and component in ready for assembly state shall be subjected to a shock test according to IEC 60068-2-27:2010, Table A.2, 5th line and Figure 1 (half sine-pulse) (transportable items which are repeatedly carried loose in any type of vehicle, rail, road or cross-country).

The sample(s) shall be fixed to the test rig to avoid relative movement during exposure. Parts with damping characteristics, such as harness, shall not be used as a fixation means.

Test parameters:

- Acceleration peak: 400 m/s².
- Exposure time: 6 ms.
- Shock form: half-sine.
- Numbers of shocks per RPD: 24 000 (4 000 per axis and direction).

7.3.4 Resistance to changes in atmospheric pressure – Supplied breathable gas RPD and filtering RPD

7.3.4.1 Exposure to positive pressure – Supplied breathable gas RPD and filtering RPD

RPD in ready for use state and component in ready for assembly state shall be exposed to a pressure sweep between environmental pressure and a positive pressure of + 20 kPa according to

IEC 60721-1:2002, Table 1, item 1.3.1, air pressure, with a pressure change of one second per cycle followed by the next cycle within maximum of 1 min, for a total of 300 cycles.

The supplied breathable gas RPD shall then be tested in accordance with ISO 17420-4:2021, 6.2 at $(22\pm 3)^\circ\text{C}$ and $(50\pm 25)\text{RH}$.

The filtering RPD shall then be tested in accordance with ISO 17420-2:2021, 6.3 at $(22\pm 3)^\circ\text{C}$ and $(50\pm 25)\text{RH}$.

7.3.4.2 Exposure to negative pressure – Supplied breathable gas RPD and filtering RPD

The RPD in ready for use state and component in ready for assembly state shall be exposed to a pressure sweep between environmental pressure and a negative pressure of - 40 kPa according to IEC 60721-1:2002, Table 1, item 1.3.1, air pressure, with a pressure change of 20 s per cycle followed by the next cycle within maximum of 1 min, for a total of 300 cycles.

The supplied breathable gas RPD shall then be tested in accordance with ISO 17420-4:2021, 6.2 at $(22\pm 3)^\circ\text{C}$ and $(50\pm 25)\text{RH}$.

The filtering RPD shall then be tested in accordance with ISO 17420-2:2021, 6.3 at $(22\pm 3)^\circ\text{C}$ and $(50\pm 25)\text{RH}$.

7.3.5 Enhanced resistance to corrosion – Intermittent exposure – Supplied breathable gas RPD and filtering RPD

This subclause supersedes ISO 17420-2:2021, 6.9.3.2 or ISO 17420-4:2021, 6.11.1.2.

If the RPD is marked for single shift use only it does not need to meet this requirement.

For filtering RPD filters shall not be part of the assessment after the pre-conditioning specified below. Non-preconditioned filters shall be used instead.

RPD in as worn state shall be exposed to a 5 % solution of neutral salt-water spray (NSS) in accordance with ISO 9227 for 8 h and then left for 16 h at $\left(20^{+5}_0\right)^\circ\text{C}$ with a relative humidity of 65 %. This procedure shall be carried out three times, within a 72 h period and the sample shall not be rinsed. The sample shall then be dried in warm or ambient air.

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

Check in accordance with 8.2 and record any observation.

7.3.6 Exposure to impact from drop

7.3.6.1 Supplied breathable gas RPD

One RPD in ready for use state with modified cylinders shall be dropped in the three orthogonal orientated axis from a height of $\left(1,0^{+0,1}_0\right)\text{m}$ onto a flat steel plate with a minimum thickness of 5 mm affixed to a concrete support.

All three exposures to impact from drop shall be performed with the same RPD. The exposure to impact from drop shall be performed in accordance with ISO 16900-6:2020, 6.7.

The cylinder tested shall be modified by filling with water to the same weight of a pressurized cylinder at the working pressure. To be able to check the tightness of the cylinder valve, this water filled cylinder shall be pressurized between 0,3 MPa and 1,0 MPa.