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

Appareils de protection respiratoire — Termes, définitions, symboles graphiques et unités de mesure

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Foreword

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ISO 16972 was prepared by Technical Committee ISO/TC 94, *Personal safety — Protective clothing and equipment*, Subcommittee SC 15, *Respiratory protective devices*.

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

1 Scope

This International Standard is applicable to respiratory protective devices. It defines commonly used terms and specifies units of measurement to achieve a uniform interpretation and to prevent ambiguous use. It indicates graphical symbols that may be required to be placed on respiratory protective devices (RPD) or parts of RPD or instruction manuals, in order to instruct the person(s) using the RPD about its operation.

2 Normative references

The following referenced documents are indispensable for the application 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 7000:2004, *Graphical symbols for use on equipment — Index and synopsis*

IEC 80416-1[1)], *Basic principles for graphical symbols for use on equipment — Part 1: Creation of graphical symbols for registration*

ISO 80416-2[2)], *Basic principles for graphical symbols for use on equipment — Part 2: Form and use of arrows*

3 Terms and definitions

For the purposes of this document, the following terms and definitions apply.

NOTE The terms are listed in alphabetical order. Terms which refer to current RPD are not listed in these definitions because they are design related and are described in Annex A. Bold type used within a definition identifies terms defined elsewhere in this list of preferred terms.

3.1
abrasion resistance
ability of an **RPD** and/or its components to withstand degradation from abrasive effects (e.g. scratch, scrape, scuff)

3.2
abrasive blasting respiratory protective device
device designed to protect the wearer from inhalation of, impact of, and abrasion by materials used or generated in abrasive blasting

3.3
accessory
item, or items, that are attached to the **RPD** that are not necessary for the RPD to meet the requirements of the ISO RPD performance standard and do not compromise its protection

3.4
adequacy assessment
selection method identifying **RPD** able to reduce the wearer's hazard exposure to acceptable levels

3.5
aerodynamic diameter
diameter of a unit density sphere having the same settling velocity as the particle in question

3.6
aerosol
suspension of solid, liquid or solid and liquid particles in a gaseous medium

3.7
aerosol penetration
ability of particles to pass through a particle filtering material

3.8
air flow resistance
pressure difference between upstream and downstream locations caused by the flow of air through parts and components of RPD such as, an exhalation valve, inhalation valve, filter(s), and tube, etc.

1) Cancels and replaces ISO 3461-1:1988.

2) Cancels and replaces ISO 4196:1984.

3.9
air-purifying respiratory protective device
device in which ambient air is passed through an air-purifying element(s) that remove(s) the contaminant(s)

NOTE Air is passed through the air-purifying element by means of the breathing action or by a blower.

3.10
ambient air bypass
means to enable the wearer to breathe the **ambient atmosphere** before entering and after leaving a hazardous atmosphere

3.11
ambient air system
device used to deliver ambient air at a low pressure directly to an atmosphere supplying **RPD** (manually or power assisted)

3.12
ambient atmosphere
air surrounding the **RPD** wearer

3.13
ambient concentration
concentration of a compound in the air surrounding the **RPD** wearer

3.14
ambient laboratory conditions
atmosphere where the temperature is between 16 °C and 32 °C and the relative humidity is between 20 % and 80 %

3.15
atmospheric contaminant
potentially harmful substance that is present in unacceptably high concentration in the ambient air, and to which workers may be exposed in their working environment

3.16
atmospheric dew point
temperature at which moisture begins to condense from a gas as the gas is cooled at standard atmospheric pressure. (1 013,25 hPa)

3.17
biological monitoring
analysis of exhaled air, a biological fluid (e g., urine, blood, perspiration), or a body tissue (e g., hair, nails) to assess the extent to which an individual has been exposed to a contaminant/hazard

3.18
body harness
means to enable a wearer to wear certain components of an **RPD** on the body

3.19
breakthrough concentration
concentration of test gas in effluent air at which a **gas filter** undergoing a gas filter capacity test is deemed exhausted

3.20
breakthrough curve
graph for gas filter(s) showing the relationship between effluent concentration of the test substance versus time of **gas filter**(s)

3.21
breakthrough time
time from the start of a **gas filter** capacity test to the time when the **breakthrough concentration** has been reached in effluent air under the defined conditions

3.22
breakthrough time curve
graph showing the relationship between **test concentration** and **breakthrough time** for **gas filter**(s)

3.23
breathable gas
mixtures of gases that are suitable for respiration without adverse effects to health

3.24
breathable gas cylinder
integral part of the **RPD** that contains the **breathable gas** supply

3.25
breathable gas quality
composition of a breathable gas as defined in relevant standards

3.26
breath cycle
time period comprised of one inhalation and one exhalation sequence

3.27
breathing bag
component of an **RPD** which compensates for variations in the **breathable gas** supply or demand and provides for peak inhalation flow requirements

3.28
breathing gas regeneration
process whereby an RPD absorbs carbon dioxide in exhaled gas and delivers oxygen, controls water vapour and temperature of gas to be rebreathed

3.29
breathing machine
ventilation machine that simulates respiratory ventilation by using waveforms, which can be sinusoidal or representative of the inhalation and exhalation cycle

NOTE See also **metabolic simulator**.

3.30
breathing peak resistance
maximum differential pressure of an **RPD** during inhalation (inhalation peak resistance) or exhalation (exhalation peak resistance)

3.31
breathing resistance
pressure differential between upstream and downstream location caused by an **RPD** to the flow of breathable gas during inhalation (inhalation resistance) or exhalation (exhalation resistance)

3.32
BTPS
body temperature pressure saturated standard condition for the expression of ventilation parameters

EXAMPLE Body temperature (37 °C),atmospheric pressure (1 013,25 hPa) and saturated air (vapour pressure = 62,66 hPa).

3.33
buddy breathing
practice that enables a second person to simultaneously share the same **breathable gas** supply as that of the wearer of such **RPD** while both persons are attempting to move to a safe location

3.34
bypass valve
component part of an **RPD**, which is furnished as an emergency manual valve to supply necessary **breathable gas** when the ordinary supply path is out of order

3.35
CO_2 concentration limits
maximum allowed concentration of carbon dioxide within inhaled **breathable gas**

3.36
char length
length of brittle residue found when a fabric or material is exposed to thermal energy

3.37
checking device
characteristic of **RPD** to enable the wearer to verify, before use or periodically during use, that the manufacturer's minimum design conditions are met

3.38
cleaning/disinfection resistance
ability of the device to withstand cleaning and disinfection processes defined by the manufacturer

3.39
clogging
accumulation of particles on a filter with a consequent increase in its resistance to flow

3.40
combination filter
filter intended to remove dispersed solid and/or liquid particles and specified gases and vapours from the flow of air passing through it

3.41
combined RPD
RPD which are capable to operate in either filtering or breathable gas supply mode

3.42
communication performance
ability of wearer to communicate face to face with others at a given distance

3.43
compatibility
ability of **RPD** to be used in conjunction with other PPE

3.44
competent person
person with suitable and sufficient experience and with practical and theoretical knowledge of the elements of an **RPD programme** for which (s)he is responsible

3.45
confined space
area with limited access, as described in national regulations, which requires special considerations for entry

3.46
continuous flow valve
control valve which provides the wearer of a breathable gas-supplying **RPD** with **breathable gas** and allows the wearer to regulate a continuous air flow within prescribed limits

3.47
count median diameter
CMD
particle size of a particle distribution for which one-half the total number of particles are larger and one-half are smaller

3.48
dead space
space in which exhaled gas has not been purged and is subject to being rebreathed

3.49
demountable parts
parts of the device that are designed to be disconnected and reconnected by hand, without using tools

3.50
design duration
length of time specified by the manufacturer for a device in which the design conditions (e.g. flow rate) are met

3.51
dew point
temperature of air at a specified pressure when condensation of water will occur

3.52
doffing
process of removing or taking off the **RPD** effectively

3.53
donning
process of putting on the **RPD** effectively

3.54
drip
to run or fall in drops or blobs

3.55
dummy head
fixture simulating human heads, used in testing **RPD**.

3.56
durability
capability of the device to withstand all usage stress factors without degradation of performance or integrity

3.57
dust
aerosol consisting of mechanically produced solid particles derived from the breaking up of larger particles ranging from submicroscopic to macroscopic

NOTE See also **fume** and **smoke**.

3.58
emergency breathing component
component of the **RPD** that comes into operation when the normally operating mode of the device is not functioning

NOTE It provides an adequate level of protection for a period to enable the device wearer to exit the work area, unassisted, to a place of safety.

3.59
electromagnetic compatibility
EMC
ability of a device, unit of equipment or system to function satisfactorily in its electromagnetic environment without introducing intolerable electromagnetic disturbances to anything in that environment

3.60
end of battery life
lowest capacity level of a battery which still allows a proper continuous function of the RPD

3.61
end of life cycle indicator
system that indicates the end of the overall life of an RPD

3.62
end-of-service-life indicator
ESLI
system that warns the wearer of a **gas filtering RPD** of the approach of the end of adequate respiratory protection

3.63
environment
potential hazardous area in which the **RPD** is to be used

3.64
ergonomic factors/parameters
all aspects of the RPD that are intended to maximize the wearer's ability to perform their tasks while minimizing wearer fatigue and discomfort

3.65
escape RPD
respiratory protective device to be used only when escaping (emergency egress) from a dangerous **environment**

3.66
exhalation valve
non-return valve which allows the release of exhaled and excess **breathable gas** from the **RPD**

3.67
explosive atmosphere
mixtures of substances with air, under atmospheric conditions, in the form of gases, vapours, mists or dusts in which, after ignition has occurred, combustion spreads to the entire unburned mixture

3.68
exposed parts
any part of the **RPD** which may come in contact with the ambient atmosphere during foreseeable conditions of use

3.69
eye irritation (external)
redness, itching or tearing of the eyes caused by gases, vapours, particles and liquids

3.70
eye irritation (internal)
redness, itching or tearing of the eyes caused by the **RPD** itself

3.71
fabric component
any single, or combination of, natural or synthetic material(s) that are pliable and that are made by weaving, felting, forming, or knitting

3.72
face seal leakage
leakage between the face and the **respiratory interface**

3.73
field of vision
area of sight while wearing an **RPD**

3.74
filter holder
component which is attached to either a respiratory interface or other part of the device and into which a filter, either encapsulated or unencapsulated, is inserted

3.75
filtering device
RPD in which air passes through filter(s) before being inhaled

NOTE The device can be unassisted, power assisted or powered.

3.76
fit test
use of a challenge agent and specific protocol to qualitatively or quantitatively determine an individual's ability to obtain an adequate seal with a specific make, model, and size of an **RPD**

3.77
flow rate
air supply
volume (mass) of **breathable gas** passing through the device in a given time

3.78
fogging
reduction of the field of vision and visual acuity caused by condensation of humidity inside the **visor**

3.79
fume
solid aerosols formed when the material from a volatilised solid condenses in air

3.80
gas
fluid that is in a gaseous state at **standard temperature and pressure** that expands to occupy the space or enclosure in which it is confined

3.81
gas filter
filter intended to remove specific gases and vapours from the atmosphere passing through it

3.82
gas filter capacity
volume or mass of a gaseous contaminant that a **gas filter** can adsorb, absorb or catalyze the breakdown of

3.83
gas filter change schedule
time interval after which a used **gas filter** is replaced with a new one

3.84
gas filtering RPD
device consisting of a **respiratory interface** with a filter which removes certain gases or vapours from the air to be inhaled by the **wearer** for a limited period

3.85
hazardous atmosphere
any atmosphere that is **oxygen-deficient**, exceeds an **occupational exposure limit**, presents a fire/explosion hazard, and/or contains an airborne toxic or disease-producing contaminant in concentrations deemed to be hazardous

3.86
hazard ratio
estimated/measured airborne concentration of a substance divided by the **occupational exposure limit**

NOTE This ratio is calculated for each gas, vapour, and/or particulate component, or for a mixture when the components have additive effects, that pose a respiratory hazard.

3.87
head harness
means of holding a **respiratory interface** in place on the head

3.88
heads up display
HUD
visual monitor or warning in the line of sight of the **RPD** wearer

3.89
high pressure
equal to or greater than 1 MPa (10 000 mbar) absolute pressure

3.90
hose
hollow flexible conduit to carry **breathable gas** designated as **low, medium** or **high pressure**

3.91
hydration facility
design feature of **RPD** to allow the **wearer** to drink without **doffing** of **RPD**

3.92
hydrostatic test
calibrated expansion pressure test of the structural integrity of cylinders

3.93
hypoxia
any condition in which there is an inadequate supply of oxygen in the tissues

3.94
immediately dangerous to life or health
IDLH
atmosphere that poses an immediate threat to life, would cause irreversible adverse health effects, or would impair an individual's ability to escape from a dangerous atmosphere

3.95
impact resistance
ability of RPD to withstand mechanical shock and dynamic stress from environment

3.96
inhalation valve
valve which opens during inhalation and closes during exhalation

3.97
inhaled air
air breathed in by the wearer

3.98
integral filter
filter which is not separable from the rest of the **respiratory interface**

3.99
interactive flow rate
actual **RPD** breathing gas flow per time as a result of the wearer's demand

3.100
intrinsic safety
various designations that ensure the RPD is not a source of ignition in explosive atmospheres

3.101
intrinsically safe (IS) RPD
respiratory protective device that has been certified as not providing a source of ignition in an explosive atmosphere

3.102
inward leakage
leakage of the ambient atmosphere into the **respiratory interface from** all sources excluding filter(s) where present, when measured in the laboratory in the specific test atmosphere

NOTE It is expressed as a ratio of contaminant concentration inside an **RPD** and ambient atmosphere, as follows:

$$\text{Inward leakage (\%)} = C_i/C_o \times 100$$

where

C_i is the concentration of challenge agent inside the respiratory interface;

C_o is the concentration of challenge agent outside inside the respiratory interface.

3.103
laboratory gas filter capacity
mass/volume of a specific test agent that will be removed or retained by certain mechanisms (e.g. physisorption, chemisorption, catalytical conversion, etc.) under specified conditions of temperature, relative humidity, challenge test gas concentration and the flow rate

NOTE The mass/volume is determined by measuring the breakthrough time at a defined breakthrough concentration.

3.104
leak-tightness
ability to withstand a loss of pressure inside an **RPD** over a given time as determined by a laboratory test

3.105
life cycle
time between date of manufacturing of the device to the date when device has to be withdrawn from service

3.106
liquefied-breathing gas
oxygen or air stored in liquid form and supplied to the wearer in a gaseous form

3.107
loose fitting respiratory interface
respiratory interface which does not rely on forming a complete seal to the wearer's skin

3.108
low boiling organic compound
organic compound having a boiling point $\leqslant$ 65 °C at atmospheric pressure

3.109
low pressure
pressure up to 100 hPa (mbar) above atmospheric pressure (gauge)

3.110
manufacturer's minimum design condition
lowest level of operating condition of the device as stated by the manufacturer at which the complete device will still meet the requirements for the designated class

3.111
manufacturer's minimum design flow rate
MMDF
minimum air flow rate, as stated by the manufacturer, at which the relevant requirements are met

3.112
marking
information included on the device to indicate specific **RPD** characteristics

3.113
mass median aerodynamic diameter
MMAD
point in an aerodynamic particle size distribution where half of the mass lies in particles with a diameter less than the MMAD and half in particles with diameters greater than the MMAD

3.114
material's compatibility with skin
characteristic of material resulting in insignificant irritation to the wearers' skin when in direct contact

3.115
maximum flow condition
those factors appropriate to the design specified by the manufacturer which give rise to the highest flow rate

3.116
maximum use concentration
MUC
maximum atmospheric concentration of a hazardous substance from which the **RPD** wearer can be expected to be protected when wearing an **RPD**, and is determined by the protection level of the **respiratory protective device** or class of respiratory protective devices and the **occupational exposure limit** of the hazardous substance

NOTE The maximum use concentration usually can be determined mathematically by multiplying the protection level specified for a respiratory protective device by the occupational exposure limit used for the hazardous substance.

3.117
mechanical shock
dynamic force on the device during a fall from a given height as determined by a laboratory test

3.118
mechanical strength of visor
ability of the device to withstand mechanical stress to the barrier in front of the eyes

3.119
medium pressure
pressure between 100 hPa (mbar) above atmospheric pressure to 1 MPa (10 000 mbar) pressure gauge

3.120
metabolic simulator
programmable automatic **breathing machine** that can simulate the characteristics of both human breathing (variable tidal volume and respiratory rate, humidity, temperature) and metabolic functions (variable oxygen consumption and carbon dioxide production)

3.121
minimum flow condition
those factors appropriate to the design specified by the manufacturer which give rise to the lowest flow rate

3.122
minimum required protection factor
MRPF
level of protection required, derived from the **adequacy assessment** procedure

3.123
minute ventilation
total volume of air exchanged in the lungs during one minute, V_E in l/min **BTPS**

3.124
minute volume
quantity of air exhaled in one minute

3.125
mist
liquid droplets generated by condensation of vapour back to the liquid state or by breaking up a liquid into a dispersed state

3.126
mode of operation
primary means of supplying the wearer with breathable gas, i.e., particle filtering, gas and vapour filtering, or breathable gas supplying

3.127
monitor
component of an **RPD** to enable the wearer to continuously assess that the manufacturer's minimum design air flow rate or manufacturer's minimum design conditions are met

3.128
multi-functional RPD
RPD which are capable of operating within its mode of operation by using different operating methods; e.g. power assist filtering devices, power on/off, compressed **breathable gas** system with compressed breathable gas device

3.129
multi-type combination filter
combination filter which meets the requirements of more than one type of gas and particle filter

3.130
multi-type gas filter
gas filter which meets the requirements of more than one type of gas filter

3.131
negative pressure
pressure inside the respiratory interface, hose, etc. that is lower than that of the ambient atmosphere

NOTE It is expressed in pascals (Pa).

3.132
nominal working duration
working time of a device, used for the classification determined in laboratory tests with a flow rate specified in an International Standard

3.133
occupational exposure limit
OEL
maximum concentration of airborne contaminants deemed to be acceptable, as defined by the authority having jurisdiction

3.134
operating pressure
pressure(s) developed within the **RPD** during service

3.135
oxygen compatibility
capability of **RPD** to allow direct contact with pressurised oxygen without risk of fire or explosion by being oil and grease free

3.136
oxygen consumption
amount of oxygen consumed by the human tissues for aerobic energy production, VO_2 in l/min **STPD**

3.137
oxygen deficient
condition based on an oxygen concentration or partial pressure below which a person may be adversely affected

NOTE Each authority having jurisdiction may establish an alternative definition or specific limit.

3.138
oxygen-enriched air
air containing oxygen at higher concentrations than that of atmospheric air at sea level

3.139
particle
generic term used to describe solid or liquid substances in the finely divided state and refers to particulate aerosols

EXAMPLE Dusts, mists, smoke, fumes, fibres, and fog as well as micro-organisms.

3.140
particle filter
filter which is intended to remove airborne particles

3.141
particle filter efficiency
degree to which a filter removes **aerosols** from the **ambient atmosphere**

3.142
particle filter respiratory protective device
particle filter RPD
device consisting of a **respiratory interface** with a **particle filter** that removes finely divided **particles** from the air to be inhaled by the **wearer**

NOTE The filter medium may be replaceable or be an integral part of the construction.

3.143
peak inspiratory flow rate
highest instantaneous flow rate during the inhalation phase of a breath cycle in l/s **BTPS**

NOTE Litres per second (l/s) is the preferred unit as the flow takes place only during a short fraction of the breath cycle.

3.144
permeation
process by which a chemical moves through an **RPD** material on a molecular level (diffusion)

3.145
physical work capacity
ability of a person to engage in muscular work

3.146
positive pressure
pressure inside the **respiratory interface**, hose, etc. higher than that of the **ambient atmosphere**

3.147
practical performance
evaluation of **RPD** during simulation of typical work or escape activities in a laboratory

3.148
protection level
degree of respiratory protection allocated to an RPD for the purposes of selection and use that is expected to be provided to wearers when used within an effective RPD program as described in ISO 16975

3.149
pressure dew point
temperature at which moisture begins to condense from a gas under pressure, as the gas is cooled at this pressure

3.150
psychological impact on wearer
positive and negative influences on the wearer's state of mind by wearing the RPD or by its appearance and/or design

3.151
qualitative fit factor
QLFF
minimum assured (C_o/C_i)
qualitative estimate of the minimum fit of a particular **tight-fitting respiratory protective device** to a specific individual when a **qualitative fit test** is passed, i.e., the test agent is not detected by the subject's senses

3.152
qualitative fit test
QLFT
pass/fail test method that relies on the subject's sensory response to detect a challenge agent in order to assess the adequacy of **RPD** fit

3.153
quantitative fit factor
QNFF
QNFF = (C_o/C_i)
measure of the fit of a particular **tight-fitting** respiratory interface to a specific individual

NOTE It represents only **respiratory interface** to face leakage. Leakage from other sources (e g., air-purifying elements) must be essentially zero. The **QNFF** is measured with specialized instrumentation.

3.154
quantitative fit test
QNFT
test method that uses an instrument to assess (quantify) the amount of face seal leakage into the **respiratory protective device** in order to assess the adequacy of its fit