BRITISH STANDARD

BS EN
14529:2005

Respiratory protective devices — Self-contained open-circuit compressed air breathing apparatus with half mask designed to include a positive pressure lung governed demand valve for escape purposes only

The European Standard EN 14529:2005 has the status of a British Standard

ICS 13.340.30

BSI
British Standards

National foreword

This British Standard is the official English language version of EN 14529:2005.

The UK participation in its preparation was entrusted by Technical Committee PH/4, Respiratory protection, to Subcommittee PH/4/13, Breathing apparatus, which has the responsibility to:

— aid enquirers to understand the text;

— present to the responsible international/European committee any enquiries on the interpretation, or proposals for change, and keep UK interests informed;

— monitor related international and European developments and promulgate them in the UK.

A list of organizations represented on this subcommittee can be obtained on request to its secretary.

Cross-references

The British Standards which implement international or European publications referred to in this document may be found in the *BSI Catalogue* under the section entitled "International Standards Correspondence Index", or by using the "Search" facility of the *BSI Electronic Catalogue* or of British Standards Online.

This publication does not purport to include all the necessary provisions of a contract. Users are responsible for its correct application.

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Summary of pages

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WARNING

The UK, as a member of CEN, is obliged to publish EN 14529:2005 as a British Standard. However, attention is drawn to the fact that during the development of this European Standard, the UK consistently voted against its approval as a European Standard.

The reason for this disapproval is as follows. The Scope of EN 14529:2005 states that this standard ". . . specifies minimum requirements for self-contained open-circuit compressed air breathing apparatus with half mask designed to include a positive pressure lung governed demand valve for escape purposes only.

"Such equipment is intended for use in work situations where the risk on overpressurisation of the pressure vessels with their valves due to hot environmental conditions is low.

"This European Standard does not apply to apparatus for work and rescue or to diving apparatus."

During discussion of this standard by BSI Committee PH/4/13, which mirrors the work of CEN Committee TC79/SC6, the UK committee expressed the opinion that the self-contained open-circuit compressed air breathing apparatus with half mask covered in this standard is not a safe combination to be used in those emergency situations where wearers may be exposed to other conditions (such as exposure in confined spaces to, or leaks of, noxious or toxic substances) that will, on the basis of a risk assessment in accordance with The Control of Substances Hazardous to Health Regulations 2002, require the combination to meet higher minimum performance requirements for the protection of the wearer.

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EUROPEAN STANDARD

NORME EUROPÉENNE

EUROPÄISCHE NORM

EN 14529

August 2005

ICS 13.340.30

English Version

Respiratory protective devices - Self-contained open-circuit compressed air breathing apparatus with half mask designed to include a positive pressure lung governed demand valve for escape purposes only

Appareils de protection respiratoire - Appareils de protection respiratoire autonomes à circuit ouvert, à air comprimé avec demi-masque et soupape à la demande à commande à la première inspiration, à pression positive, pour l'évacuation uniquement

Atemschutzgeräte - Behältergeräte mit Druckluft (Pressluftatmer) mit Halbmaske in der Ausführung mit einem Überdrucklungenautomaten nur für Fluchtzwecke

This European Standard was approved by CEN on 1 July 2005.

CEN members are bound to comply with the CEN/CENELEC Internal Regulations which stipulate the conditions for giving this European Standard the status of a national standard without any alteration. Up-to-date lists and bibliographical references concerning such national standards may be obtained on application to the Central Secretariat or to any CEN member.

This European Standard exists in three official versions (English, French, German). A version in any other language made by translation under the responsibility of a CEN member into its own language and notified to the Central Secretariat has the same status as the official versions.

CEN members are the national standards bodies of Austria, Belgium, Cyprus, Czech Republic, Denmark, Estonia, Finland, France, Germany, Greece, Hungary, Iceland, Ireland, Italy, Latvia, Lithuania, Luxembourg, Malta, Netherlands, Norway, Poland, Portugal, Slovakia, Slovenia, Spain, Sweden, Switzerland and United Kingdom.

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EUROPÄISCHES KOMITEE FÜR NORMUNG

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Ref. No. EN 14529:2005: E

Contents

Foreword

This European Standard (EN 14529:2005) has been prepared by Technical Committee CEN/TC 79 “Respiratory protective devices”, the secretariat of which is held by DIN.

This European Standard shall be given the status of a national standard, either by publication of an identical text or by endorsement, at the latest by April 2006, and conflicting national standards shall be withdrawn at the latest by April 2006.

This European Standard has been prepared under a mandate given to CEN/CENELEC by the European Commission and the European Free Trade Association, and supports essential requirements of EU Directive(s) 89/686/EEC and 97/23/EEC.

For relationship with EU Directive(s), see informative Annexes ZA and ZB, which are integral parts of this European Standard.

According to the CEN/CENELEC Internal Regulations, the national standards organizations of the following countries are bound to implement this European Standard: Austria, Belgium, Cyprus, Czech Republic, Denmark, Estonia, Finland, France, Germany, Greece, Hungary, Iceland, Ireland, Italy, Latvia, Lithuania, Luxembourg, Malta, Netherlands, Norway, Poland, Portugal, Slovakia, Slovenia, Spain, Sweden, Switzerland and United Kingdom.

Introduction

A given respiratory protective device can only be approved when the individual components satisfy the requirements of the test specification which may be a complete European Standard or part of a European Standard and practical performance tests have been carried out successfully on complete apparatus where specified in the appropriate European Standard. If for any reason a complete apparatus is not tested then simulation of the apparatus is permitted provided the respiratory characteristics and weight distribution are similar to those of the complete apparatus.

1 Scope

This European Standard specifies minimum requirements for self-contained open-circuit compressed air breathing apparatus with half mask designed to include a positive pressure lung governed demand valve for escape purposes only.

Such equipment is intended for use in work situations where the risk on overpressurisation of the pressure vessels with their valves due to hot environmental conditions is low.

This European Standard does not apply to apparatus for work and rescue or to diving apparatus.

Laboratory and practical performance tests are included for the assessment of compliance with the requirements.

2 Normative references

The following referenced documents are indispensable for the application of this European Standard. For dated references, only the edition cited applies. For undated references, the latest edition of the referenced document (including any amendments) applies.

EN 132:1998, *Respiratory protective devices – Definitions of terms and pictograms*

EN 134:1998, *Respiratory protective devices - Nomenclature of components*

EN 140:1998, *Respiratory protective devices – Half mask and quarter masks – Requirements, testing, marking*

EN 148-1, *Respiratory protective devices - Threads for facepieces - Part 1: Standard thread connection*

EN 148-2, *Respiratory protective devices - Threads for facepieces - Part 2: Centre thread connection*

EN 148-3, *Respiratory protective devices - Threads for facepieces - Part 3: Thread connection for M 45 x 3*

EN 1964-1, *Transportable gas cylinders — Specification for the design and construction of refillable transportable seamless steel gas cylinders of water capacities from 0,5 litre up to and including 150 litres — Part 1: Cylinders made of seamless steel with an R_m value of less than 1100 MPa*

EN 1964-2, *Transportable gas cylinders — Specification for the design and construction of refillable transportable seamless steel gas cylinders of water capacities from 0,5 litre up to and including 150 litres — Part 2: Cylinders made of seamless steel with an R_m value of 1100 MPa and above*

EN 1964-3, *Transportable gas cylinders — Specification for the design and construction of refillable transportable seamless steel gas cylinders of water capacity from 0,5 litre up to and including 150 litres — Part 3: Cylinders made of seamless stainless steel with an R_m value of less than 1100 MPa*

EN 1975, *Transportable gas cylinders - Specification for the design and construction of refillable transportable seamless aluminium and aluminium alloy gas cylinders of capacity from 0, 5 litre up to 150 litre*

EN 12021, *Respiratory protective devices - Compressed air for breathing apparatus*

EN 12245, *Transportable gas cylinders - Fully wrapped composite cylinders*

EN 13274-2:2001, *Respiratory protective devices - Methods of test - Part 2: Practical performance tests*

EN 13274-3:2001, *Respiratory protective devices - Methods of test - Part 3: Determination of breathing resistance*

EN 13274-4:2001, *Respiratory protective devices - Methods of test - Part 4: Flame tests*

EN 13274-5, *Respiratory protective devices - Methods of test - Part 5: Climatic conditions*

3 Terms and definitions

For the purposes of this European Standard, the terms and definitions given in EN 132:1998 and the nomenclature given in EN 134:1998 apply.

4 Description

Lung governed demand compressed air escape apparatus are designed and constructed to enable the wearer to breathe air on demand from a pressure vessel(s) either via a pressure reducer and a lung governed demand valve or a lung governed demand valve connected to the half mask. The exhaled air passes without re-circulation from the half mask via the exhalation valve to the ambient atmosphere.

This apparatus typically comprises pressure vessel(s), body harness, lung governed demand valve, pressure indicator(s), warning device (optional), connecting hoses and tubes and a half mask.

5 Classification

Lung governed demand compressed air escape apparatus are classified according to the rated working duration (see 6.23.1) which is defined by performing a breathing machine test in accordance with 7.6.4 with a minute volume of 35 l/min (20 cycles/min, 1,75 l/stroke).

Rated working duration is defined in steps of 5 minutes, starting with 5 minutes as a minimum, up to a maximum of 30 min rated working duration, since the necessary escape time is considered to be the classification.

NOTE It should be recognised that the effective duration may vary according to the breathing rate.

6 Requirements

6.1 General

In all tests all test samples shall meet the requirements.

Wherever a test clause is referenced, all sub-clauses of the test clause shall apply, unless otherwise stated.

6.2 Ergonomics

The requirements of this European Standard are intended to take account of the interaction between the wearer, the apparatus, and where possible the working environment in which the apparatus is likely to be used. The device shall satisfy 6.3, 6.8 and 6.9.

6.3 Design

The diameter of pressurised parts downstream of the shut-off valve(s) shall not exceed 32 mm.

The apparatus shall be designed so as not to interfere with work activities when carried in accordance with the manufacturers instructions.

The apparatus shall be so designed that there are no protruding parts or sharp edges likely to be caught on projections in narrow passages or that may hurt the wearer.

The apparatus shall be designed to ensure its full function in any orientation.

The ready for use state of the apparatus shall identify the pressure in the pressure vessel(s) prior to use and during storage. In the ready for use state the half mask shall be securely attached to the apparatus. In the case of a permanent installation of the apparatus in a storage container the pressure vessel seal shall be opened automatically upon removal from the storage container. In all cases, once opened, the pressure vessel seal shall be locked in the open position against inadvertent closing.

If the escape apparatus is fitted with a connection for a working breathing apparatus, (e.g. airline apparatus), the connection shall be leak tight.

The use of a supplementary supply shall not be permitted.

The apparatus shall not include a second medium pressure connector or an ambient air bypass.

Testing shall be done in accordance with 7.3 and 7.8.

6.4 Materials

The carrying container and the locking device, where present, shall be adequately protected against corrosion. The materials used shall be able to withstand temperatures and mechanical stress expected whilst being carried on the man as well as on machines and vehicles.

Testing shall be done in accordance with 7.3, and 7.8 after pre-conditioning according to 7.4.

Exposed parts, i.e. those which may be subjected to impact during use of the apparatus shall not be made of aluminium, magnesium, titanium or their alloys.

To prevent electrostatic charges on non-metal carrying containers, the surface resistance shall not exceed 10^9 Ω. Where the apparatus is required to be anti-static during escape materials used shall be anti-static as far as it is practicable.

Testing shall be done in accordance with 7.6.6.

Materials which come into direct contact with the wearer's skin and the breathable gas shall not be known to be likely to cause irritation or any other adverse effect to health.

The finish of any part of the apparatus likely to be in contact with the wearer shall be free from sharp edges and burrs.

Testing shall be done in accordance with 7.3 and 7.8.

6.5 Cleaning and disinfecting

All materials shall be visibly unimpaired after cleaning and disinfection by the agents and procedures specified by the manufacturer.

Testing shall be done in accordance with 7.3 and 7.8.

6.6 Mass

Where the apparatus is intended to be carried on the wearer for not more than 1 h, the mass of the complete apparatus including carrying container shall not exceed 7,5 kg.

Where the apparatus is intended to be carried on the wearer for more than 1 h, the mass of the complete apparatus including carrying container shall not exceed 5 kg.

The mass of the apparatus, excluding any container, when stored ready for use shall not exceed 7,5 kg.

Testing shall be done in accordance with 7.1 and 7.3.

6.7 Connections

6.7.1 General

The design and construction of the apparatus shall permit its components to be readily separated for cleaning, inspecting and testing. Demountable connections to achieve this shall be readily connected and secured where possible by hand.

Any means for sealing used shall be retained in position when the connection(s) is (are) disconnected during normal use and maintenance.

Where a compressed airline breathing apparatus incorporating a half mask is used in conjunction with an escape breathing apparatus with a half mask as specified by this European Standard, all connections that may have to be disconnected by the wearer whilst wearing the apparatus shall be located so as to be readily accessible to the wearer and designed so as to be easily disconnected without assistance.

Testing shall be done in accordance with 7.3 and 7.8.

6.7.2 Connection between apparatus and half mask

NOTE The connection between the apparatus and the half mask may be achieved by a permanent, special or thread type connector.

If a thread type connector is used it shall not be possible to connect it with the EN 148-1 and EN 148-3 threads.

The thread according to EN 148-2 shall not be used with the equipment covered by this European Standard.

Testing shall be done in accordance with 7.3.

After pre-conditioning in accordance with 7.4 and return to temperatures between 17°C and 23°C the connectors between apparatus and the half mask shall be examined and the performance requirements of the threads shall be satisfied.

For all equipment connectors a pull test as described in 6.11 and 7.8 of EN 140:1998 shall be applied and no separation shall occur and the performance requirements of the threads shall be satisfied.

Testing shall be done in accordance with 7.3.

6.8 Harness

The apparatus shall have a harness or other means of carrying so that the wearer’s hands are left free, when the apparatus is in use.

Any harness shall be designed to allow quick, easy and correct donning of the apparatus without assistance.

Testing shall be done in accordance with 7.3 and 7.8.

6.9 Handling

The apparatus shall be capable of being donned and put into operation simply and without undue exertion under difficult conditions e.g. in the dark and in spaces with restricted areas.

If the apparatus is fitted with a special lock, the design shall be such that it cannot be opened inadvertently. This design criteria shall be checked as part of and prior to testing in accordance with 7.8.

If the apparatus has been opened, this shall be obvious by visual inspection.

Testing shall be done in accordance with 7.3 and 7.8.

6.10 Leak tightness

The ready for use apparatus shall be leak tight so that the pressure change does not exceed 0,3 mbar in 1 min.

Testing shall be done in accordance with 7.6.3.

6.11 Half mask

The half mask shall fulfil the performance requirements of EN 140 when tested as a complete apparatus, except the breathing resistance requirement according to 6.15 of EN 140:1998.

6.12 Temperature performance and flammability resistance

6.12.1 General

After pre-conditioning according to 7.4 and return to (20 ± 3) °C pressure vessels shall be charged to the manufacturer's maximum recommended filling pressure. The apparatus shall meet the requirements of 6.10 and 6.23, the carrying container shall have no deficiencies that impair its functionability, the materials used shall not show substantial detoriations (severe deformations, cracks etc.) and the connectors between apparatus and half mask shall be examined.

For standardised threads a thread gauge shall be used to check dimensions.

For all equipment connectors a pull test as described in 6.11.2 and 7.8 of EN 140:1998 shall be applied and no separations shall occur.

After the test the equipment connector shall be dimensionally correct.

Testing shall be done in accordance with 7.3.

6.12.2 Temperature performance

6.12.2.1 General

The apparatus shall operate trouble-free over the temperature range -15 °C to 60 °C.

Apparatus specifically designed for temperatures beyond these limits shall be tested and marked accordingly. The apparatus shall meet the breathing resistance requirements given in 6.12.2.2 and 6.12.2.3 at the extremes of the temperature given.

6.12.2.2 Breathing resistance at low temperature

A positive pressure shall be maintained in the half mask.

The exhalation resistance shall not exceed 10 mbar.

Testing shall be done in accordance with 7.6.1.

6.12.2.3 Breathing resistance at high temperature

A positive pressure shall be maintained in the cavity of the half mask.

The exhalation resistance shall not exceed 10 mbar.

Testing shall be done in accordance with 7.6.2.

6.12.3 Flammability

All parts which are likely to be exposed to flame during actual use shall prove to be "self-extinguishing", i.e. the material shall not be of highly flammable nature and when tested the parts shall not continue to burn for more than 5 s after removal from the flame.

After completing the flammability test the apparatus shall meet the requirements given in 6.10.

Testing shall be done in accordance with 7.6.3 and 7.6.7.

6.13 Protection against particulate matter

The component parts of the apparatus supplying compressed air shall be reliably protected against the penetration of particulate matter that may be contained in the compressed air.

Testing shall be done in accordance with 7.3.

6.14 High and medium pressure parts

Metallic high pressure tubes, valves and couplings shall be tested to prove that they are capable of withstanding a pressure of 50 % above the maximum filling pressure of the pressure vessel without damage.

Non-metallic high pressure parts shall be tested to prove that they are capable of withstanding a pressure twice the maximum filling pressure of the pressure vessel without damage.

All medium pressure tubes downstream of the pressure reducer shall be capable of withstanding twice their maximum attainable working pressure without damage.

Testing shall be done in accordance with 7.1 and 7.3.

6.15 High, medium and low pressure connections

High, medium and low pressure connectors shall not be interchangeable.

Testing shall be done in accordance with 7.3.

6.16 Pressure vessel(s)

The pressure vessel shall be approved with respect to EN 1964 parts 1 to 3, EN 1975 and EN 12245.

Only pressure vessels of equal maximum filling pressure shall be connected to an apparatus with more than one pressure vessel.

Testing shall be done in accordance with 7.3 and 7.8.

It shall not be possible to connect pressure vessels with a higher maximum filling pressure (e.g. 300 bar) to an apparatus which is designed only for a lower maximum filling pressure (e.g. 200 bar).

Testing shall be done in accordance with 7.3.

6.17 Pressure vessel seal

There shall be only one pressure vessel seal or other technical provisions to open the total air stored. The pressure vessel seal or its equivalent shall be opened easily by hand or automatically when starting the apparatus.

Where a spindle valve is used it shall be so designed that the valve spindle cannot be completely unscrewed from the assembly during normal operation of the pressure vessel seal valve.

The opening device shall be designed so that it cannot be closed inadvertently.

Testing shall be done in accordance with 7.3 and 7.8.

6.18 Pressure reducer

If the apparatus is designed with a pressure reducer, any adjustable medium pressure stage shall be reliably secured against accidental alteration and adequately sealed so that any unauthorised adjustment can be detected.

Testing shall be done in accordance with 7.3.

6.19 Pressure relief valve

6.19.1 General

A pressure relief valve shall be provided if the down stream parts of the apparatus cannot take full pressure vessel pressure.

6.19.2 Apparatus with a pressure relief valve

The pressure relief valve shall be designed to pass an air flow of 400 l/min at a medium pressure not exceeding 30 bar.

With the pressure relief valve operational, the inhalation and exhalation breathing resistance shall not exceed 25 mbar.

Testing shall be done in accordance with 7.7.1 and 7.7.2.

6.19.3 Apparatus without a pressure relief valve

Where a pressure relief valve is not provided, the breathing resistance requirements of 6.19.2 shall be met.

Testing shall be done in accordance with 7.7.1 and 7.7.3.

6.20 Pressure indicator

The apparatus shall be equipped with a reliable pressure indicator which will indicate the maximum filling pressure of the pressure vessel(s) ready for use.

The pressure indicator shall be designed to withstand a pressure of at least 50 bar above the maximum filling pressure of the pressure vessel.

The pressure indicator shall function independently of the action of the pressure vessel seal at all times.

A pressure indicator shall be provided with a blow-out release which protects the wearer against injuries. If the window is incorporated in the pressure indicator, it shall be of non-splintering clear material.

A restrictor shall be provided so that if the indicator is damaged, the outflow of air at 200 bar pressure shall not exceed a rate of 25 l/min. If the nominal pressure is less the requirement shall be met at the nominal pressure.

Testing shall be done in accordance with 7.1, 7.3 and 7.8.

6.21 Flexible hoses and tubes

6.21.1 Breathing hose

Breathing hoses shall be flexible and non-kinking. The breathing hoses shall permit free head movement and shall not restrict or close off the air supply under chin or arm pressure during practical performance tests.

Testing shall be done in accordance with 7.8.

The connections shall withstand axially a tensile force of 50 N.

Testing shall be done in accordance with 7.5.2.

6.21.2 Medium pressure connecting tube

Tubes to the demand valve (connections included) shall withstand for 15 min twice the operating pressure of the pressure relief valve or at least 30 bar which ever is the higher.

The connections of the medium pressure connecting tube shall withstand an axial tensile force of 50 N.

Testing shall be done in accordance with 7.3 and 7.5.2.

6.22 Mechanical strength

After pre-conditioning in accordance with 7.4 the apparatus shall still be leak tight, provide protection and meet the performance requirements of 6.23.

Testing shall be done in accordance with 7.1, 7.4, 7.6.3, 7.6.4, 7.6.5, 7.9.1 and 7.9.2.

6.23 Performance requirements

6.23.1 Rated working duration

The apparatus shall cover the minimum duration laid down for its classification as specified in Clause 5. The test is terminated when the inhalation resistance goes negative.

Testing shall be done in accordance with 7.6.4.

6.23.2 Inhalation resistance

The half mask cavity pressure shall remain positive at all pressure vessel pressures from full to 20 bar.

Testing shall be done in accordance with 7.9.1.

6.23.3 Exhalation resistance

The exhalation resistance shall not exceed 10 mbar.

Testing shall be done in accordance with 7.9.2.

6.23.4 Static pressure

The opening pressure of the exhalation valve shall be at least 0,3 mbar more than the maximum static pressure of the demand valve at all pressure vessel pressures between maximum filling pressure and 20 bar.

Reduce the flow until zero- flow and measure the remaining pressure which is called static pressure.

Testing shall be done in accordance with 7.1 and 7.6.5.

6.24 Protection against environment

During storage it shall be possible to store the apparatus in a storage and/or carrying container with means for mounting such that it is protected from dust and climate. It shall be possible to identify the ready for use state required in 6.3 and also any unauthorised opening.

Testing shall be done in accordance with 7.3.

6.25 Practical performance

The complete apparatus shall also undergo practical performance tests under realistic conditions. These general practical performance tests serve the purpose to check the apparatus for imperfections that cannot be determined by the tests described elsewhere in this European Standard.

If during any activity, by any test subject the test subject fails to finalise the selected activity due to the apparatus being not fit for the purpose for which it has been designed, the apparatus shall be deemed to have failed.

After completion of the activities the test subjects are asked to answer the questions in 6.6 of EN 13274-2:2001. These answers will be used by the test house to determine if the apparatus passes or fails. This will enable other test houses to duplicate the tests and the results thereof.

Testing shall be done in accordance with 7.3 and 7.8.

7 Testing

7.1 General

If no special measuring devices or measuring methods are specified commonly used methods and devices shall be applied.

Before performing tests involving human subjects account shall be taken of any national regulations concerning the medical history, examination or supervision of the test subjects.

7.2 Nominal values and tolerances

Unless otherwise specified, the values stated in this European Standard are expressed as nominal values. Except for temperature limits, values which are not stated as maxima or minima shall be subject to a tolerance of ± 5 %. Unless otherwise specified, the ambient temperature for testing shall be in the range between 16 °C and 32 °C and the temperature limits shall be subject to an accuracy of ± 1 °C.

7.3 Visual inspection

The visual inspection shall be made by the test house prior to laboratory or practical performance tests. This may entail a certain amount of dismantling in accordance with the manufacturer’s instructions for maintenance. The visual inspection shall include the assessment of the device marking and information supplied by the manufacturer and any safety data sheets (if applicable) or declarations relevant to the materials used in its construction.

7.4 Pre-Conditioning

The apparatus shall be conditioned by the following cycle in accordance with EN 13274-5:

a) (70 ± 3) °C/dry atmosphere/(72 ± 3) h;

b) (70 ± 3) °C/wet atmosphere/(72 ± 3) h;

c) (-30 ± 3) °C/dry atmosphere/(24 ± 1) h.

WARNING — The pressure vessel shall be charged to not more than 50 % of the manufacturer's maximum recommended filling pressure during conditioning.

After pre-conditioning and return to (20 ± 3) °C pressure vessels shall be charged to the manufacturer's maximum recommended filling pressure. The apparatus shall meet the requirements of 6.10 and 6.23, the carrying container shall have no deficiencies that impair its functionability, the materials used shall not show substantial deteriorations (severe deformations, cracks etc.). and the connectors between apparatus and half mask shall be examined.

7.5 Mechanical strength

7.5.1 Vibration

The test apparatus shown schematically in Figure 1, consists of a steel case (K) which is fixed on a vertically moving piston (S), capable of being lifted up 20 mm by a rotating cam (N) and dropping down onto a steel plate (P) under its own mass as the cam rotates. The mass of the steel case shall be more than 10 kg.

The apparatus shall be tested as received including carrying container and sealing.

The apparatus shall be placed in the case (K) so that they do not touch each other during the test allowing 6 mm horizontal movement and free vertical movement.

The test rig shall be operated at the rate of approximately 100 rotations per minute for a total of 500 rotations.

7.5.2 Tensile force

The test specimen including connecting components is subjected to the tensile force for (10 ± 1) s.

7.6 Resistance to temperature

7.6.1 Breathing resistance at low temperature

When testing the apparatus for performance at low temperatures the complete apparatus shall be exposed to a temperature of (-15 ± 3) °C for (20 ± 1) h. Within 5 min after removal the apparatus shall be tested at room temperature in accordance with EN 13274-3:2001, method 2, setting E.

7.6.2 Breathing resistance at high temperature

When testing the apparatus (fully charged) for performance at high temperature the complete apparatus shall be exposed to a temperature of (60 ± 2) °C for (4 ± 1) h. In case of wrapped composite pressure vessels the time shall be at least 12 h. Within 5 min after removal the apparatus shall be tested on a breathing machine which is at room temperature in accordance with EN 13274-3:2001, method 2, setting E.

7.6.3 Leak tightness of the ready for use apparatus

The leak test of the ready for use apparatus takes place before and after tests for resistance to temperature and flammability when tested with dry air. The apparatus is tested with the pressure vessel(s) closed and with the demand valve connected to a device which will create a positive pressure of 7,5 mbar and also to a

manometer. This leak test shall be conducted independently from temperature and flammability tests. During the positive pressure test the exhalation valve shall be sealed.

NOTE The test at a negative pressure may be conducted prior to filling empty pressure vessel on apparatus not fitted with an on/off pressure vessel seal but otherwise ready for use.

7.6.4 Rated working duration

The rated working duration is determined during a breathing machine test at 35 l/min (20 cycles/min, 1,75 l/stroke).

7.6.5 Static pressure

The opening pressure of the exhalation valve shall be measured with a constant flow of 10 l/min. Reduce the flow until zero flow and measure the remaining pressure which is called static pressure.

7.6.6 Insulation resistance of non-metallic carrying containers

The resistance is tested on the carrying container if size permits, or on a test piece comprising a rectangular plate with dimensions in accordance with Figure 2 on which two parallel electrodes are painted on the surface, using a conducting paint with a solvent which has no significant effect on the insulation resistance.

The test piece shall have an intact surface and shall be cleaned with distilled water, then with isopropyl alcohol (or any other solvent that can be mixed with water and will not affect the material of the test piece), then once more with distilled water before being dried. Untouched by bare hands, it shall then be conditioned for 24 h at a temperature of (23 ± 2) °C and (50 ± 5) % relative humidity.

The test shall be carried out under the same ambient conditions.

The direct voltage applied for one minute between the electrodes shall be equal to (500 ± 10) V.

During the test, the voltage shall be sufficiently steady so that the charging current due to voltage fluctuation will be negligible compared with the current flowing through the test piece. In certain cases this requires the use of batteries or accumulators.

The insulation resistance is the quotient of the direct voltage applied at the electrodes to the total current flowing between them when the voltage has been applied for 1 min.

Suitable test methods are shown in Annex A.

7.6.7 Flammability

The breathing hoses, medium pressure tubes and lung governed demand valve shall be tested in accordance with EN 13274-4:2001, method 3.

7.7 Pressure reducer

7.7.1 General

The apparatus including the half mask is fitted to a dummy head which is connected to a breathing machine. The breathing machine is adjusted to 25 cycles/min and 2 l/stroke (see Figure 3).

7.7.2 Apparatus with a pressure relief valve

With the breathing machine not operating, a suitable flow measuring device is connected to the outlet of the relief valve and air is supplied to the medium pressure side of the pressure reducer. The air supply pressure is gradually increased until a flow of 400 l/min passes through the relief valve. Whilst under these conditions, the

breathing machine is started and the breathing resistance is measured at the appropriate pressure sampling point.

7.7.3 Apparatus without a pressure relief valve

The outlet of the demand valve is connected to a suitable flow measuring device. Air is supplied to the medium pressure side of the pressure reducer and the air supply pressure is gradually increased. The medium pressure required to create a continuous flow of 400 l/min through the relief valve is recorded.

Under these conditions, a breathing machine test is conducted on the complete apparatus including the half mask and the breathing resistance is measured at the appropriate sampling point.

7.8 Practical performance

7.8.1 General

Practical performance tests shall be performed with two apparatus as received and two test subjects in accordance with EN 13274-2.

7.8.2 Escape tests

7.8.2.1 General

The test shall be conducted in a training gallery. During escape tests the test subjects perform at different work levels.

Prior to the escape tests the test subjects shall be instructed using the instructions for use on the correct procedure of opening, donning and of the operation of the apparatus. The test subjects shall carry out the opening and donning procedure in the dark without assistance.

The exercises shall be carried out at an ambient temperature between 20 °C and 30 °C.

The ambient atmosphere shall be free of smoke. The air flow shall be negligible.

During the test, the test subject is to be accompanied by an assistant.

Prior to escape tests the temperature and relative humidity of the atmosphere shall be noted at various points of the escape route.

During tests the following shall be recorded:

Nature and time of the different activities, complaints e.g. discomfort from wearing the apparatus.

After the escape test an assessment of the apparatus shall be made by the test subject.

7.8.2.2 Escape exercise

During this escape exercise the test subject shall perform the following activities:

— number 3 in accordance with EN 13274-2 at a speed of 6,0 km/h;

— number 12 in accordance with EN 13274-2.

7.8.3 Low temperature practical performance test

7.8.3.1 Preparation of apparatus

Two apparatus, ready for use, are stored at a temperature of (-15 ± 3) °C for a period of (4 ± 1) h.

7.8.3.2 Test procedure

Two warmly clothed subjects don the cooled apparatus in a cold chamber with an ambient temperature of (-15 ± 3) °C and shall perform activity 2 in accordance with EN 13274-2. The walking exercise may be conducted on a treadmill.

The duration of the walking shall be for a period of 10 min. For apparatus with a rated working duration of 5 min, the test has to be carried out for 5 min.

After this test the test subjects shall leave the cold chamber and return to ambient conditions and continue walking at a steady rate of 6,0 km/h for a period of 5 min, except apparatus with a rated working duration up to 10 min.

7.9 Breathing resistance

7.9.1 Inhalation resistance

Testing shall be done in accordance with EN 13274-3:2001, method 2, setting H.

7.9.2 Exhalation resistance

Testing shall be done in accordance with EN 13274-3:2001, method 2, setting H.

8 Marking

8.1 The manufacturer, supplier or importer shall be identified by name, trademark or other means of identification.

8.2 Manufacturers model designation.

8.3 Classification i.e. rated working duration, e.g. "Cl 10".

8.4 The number of this European Standard.

8.5 Serial number of the device.

8.6 Year of manufacture/shelf life (if applicable).

8.7 Where the reliable performance of piece parts may be affected by ageing, means of identifying the date (at least the year) of manufacture shall be given.

8.8 Sub-assemblies and components with considerable bearing on safety shall be marked so that they can be identified (see Annex B).

If sub-assemblies with considerable bearing on safety cannot be marked, the information shall be given in the information supplied by the manufacturer.

8.9 If contained in a sealed carrying container, marking shall be on the carrying container.

8.10 The marking shall be as clearly visible and as durable as possible.

8.11 The apparatus shall be identified as being for escape only, e.g. using a pictogram.

8.12 The maximum pressure vessel pressure shall be clearly marked on the device.

9 Information supplied by the manufacturer

9.1 The manufacturer, supplier or importer shall be identified by name, trademark or other means of identification.

9.2 Manufacturers model designation.

9.3 On delivery information supplied by the manufacturer shall accompany every apparatus.

9.4 Information supplied by the manufacturer shall be in the official language(s) of the country of destination.

9.5 The information supplied by the manufacturer shall contain all information necessary for trained and qualified persons on:

— application/limitation;

— checks prior to use;

— donning, fitting;

— use;

— maintenance (preferably separately printed instructions);

— procedures for cleaning and disinfection which shall specify, and require the use of, agents that are not known to be harmful to the wearer;

— inspection intervals;

— storage;

— shelf life;

of the device.

9.6 The information shall include that the air supply shall meet the requirements for breathable air according to EN 12021.

NOTE The figures given in EN 12021 are valid if measured at normal conditions (atmospheric pressure, room temperature).

9.7 The information shall be unambiguous.

NOTE If helpful, illustrations, part numbers, marking, etc. may be added.

9.8 The information should be complimented by an easy to identify picture (pictogram) on the carrying container showing the donning procedure (size at least 3 cm x 3 cm).

The pictogram may be supplied separately if there should not be sufficient place on the carrying container.

9.9 Warning shall be given against possible problems likely to be encountered, for example:

— use of the apparatus in explosive atmosphere;

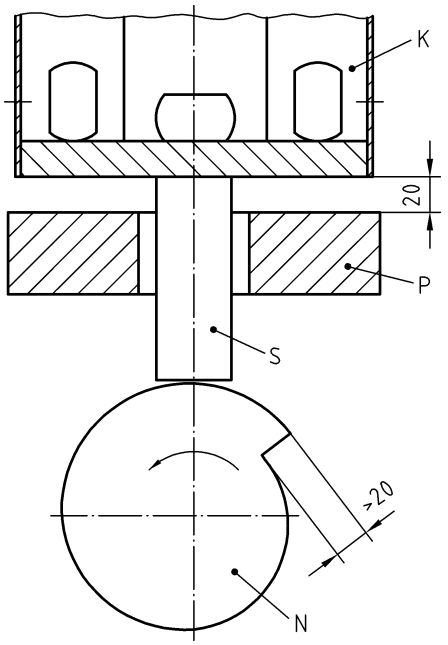
— intactness of the apparatus during carriage or transport;

— procedure of donning;

— possible need for eye protection.

9.10 Any other information the manufacturer may wish to provide.

Dimensions in millimetres



Key

K Steel case

N Rotating cam

P Steel plate

S Moving piston

Figure 1 — Test equipment for test of mechanical strength

Dimensions in millimetres

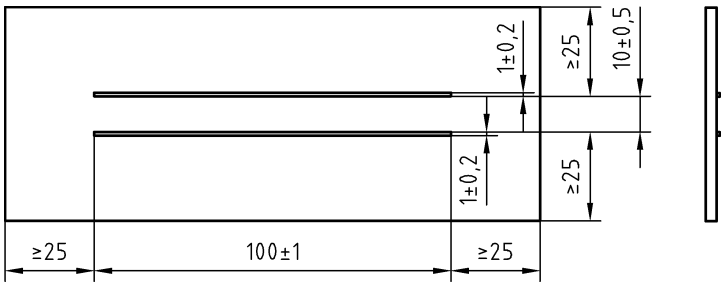
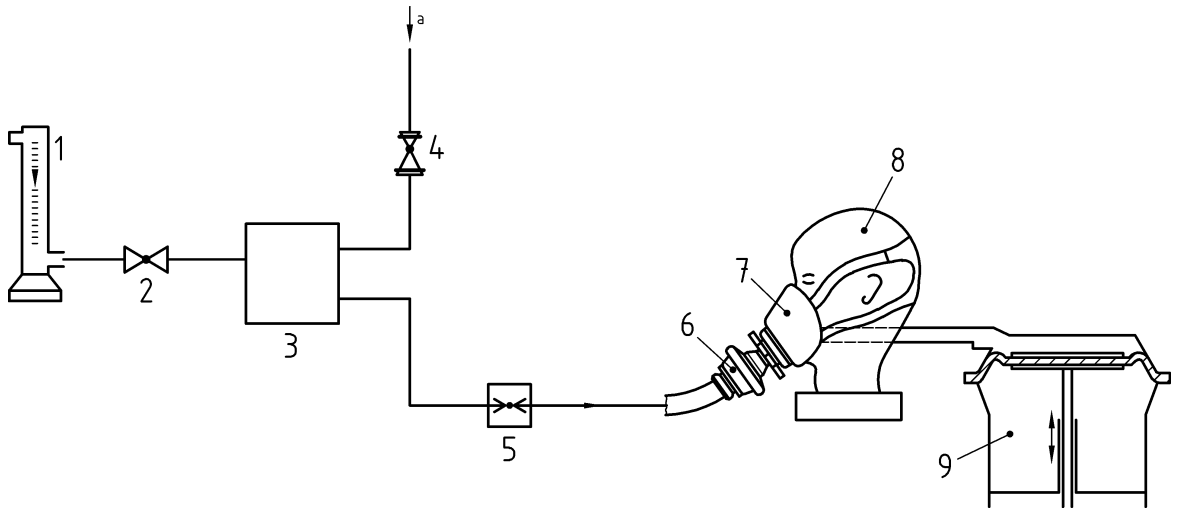


Figure 2 — Test piece with painted electrodes for insulation resistance test



Key

1	Flowmeter	6	Demand valve
2	Relief valve	7	Half mask
3	Pressure reducer	8	Dummy head
4	Pressure regulator	9	Breathing machine
5	Medium pressure gauge	[a]	compressed air supply

Figure 3 — Scheme of a relief valve test

Annex A
(informative)

Methods of measurement of the insulation resistance of the carrying container

A.1 Voltmeter ammeter method

The current shall be measured directly by means of a micro-ammeter, or a galvanometer (Figure A.1), or indirectly by a d.c. amplifier which indicates the current by measuring the voltage drop which it determines in a known resistance (Figure A.2a). The voltage shall be measured by a voltmeter. In certain cases the voltage-current ratio shall be measured by an instrument indicating the resistance directly (Figure A.2b).

A.2 Comparative method

The unknown resistance shall be compared to a known resistance by determining the ratio of the currents when the same voltage is applied in succession to two resistances (Figure A.3a) or by balancing the two resistances in a Wheatstone bridge (Figure A.3b).

For all these methods, the unknown resistance shall be large in relation to any calibrated resistance connected in series with it so as to be submitted to practically all the voltage.

A.2.1 Voltmeter ammeter method

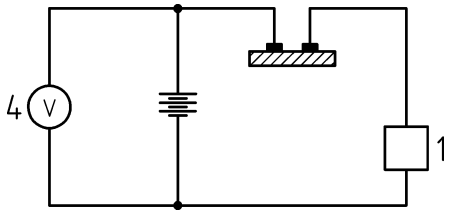


Figure A.1 — Current measurement by micro-ammeter or galvanometer

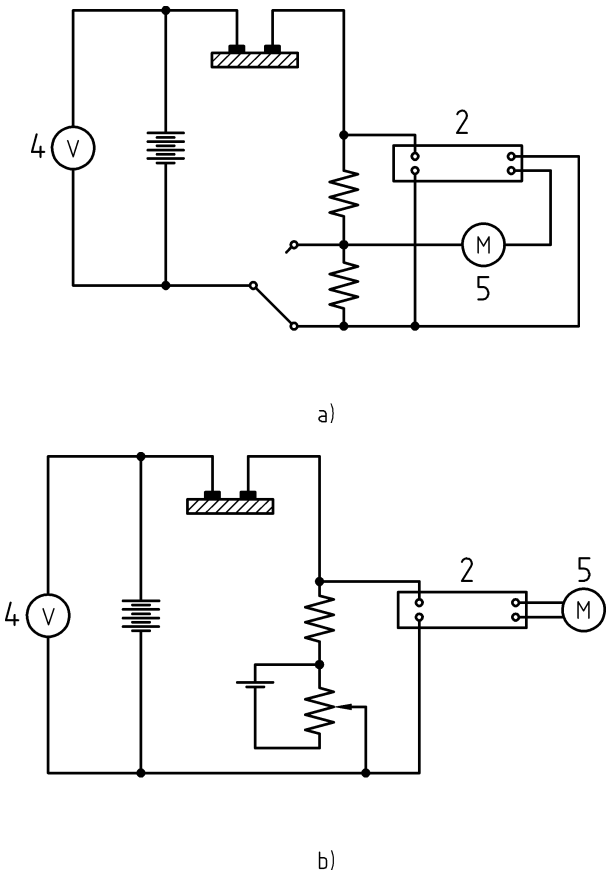


Figure A.2 — Current measurement by means of a d.c. amplifier

A.2.2 Comparative method

a: optional

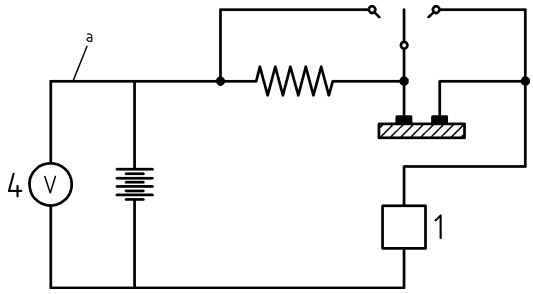


Figure A.3a — Determination of the ratio of currents when the same voltage is applied successively to the two resistances

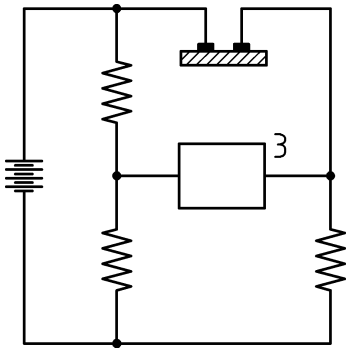


Figure A.3b — Wheatstone bridge method

Key

1 Galvanometer with shunt
2 d.c. amplifier
3 Detector
4 Voltmeter
5 Resistance meter

Annex B
(informative)

Marking

It is recommended to consider for marking the following components and sub-assemblies to be identifiable:

Table B.1 — Marking

Components/ sub-assemblies	Part-marking	Date of manufacture	Remarks
Pressure reducer	+	+	
Lung governed demand valve	+	-	2
Lung governed demand valve diaphragm	+	+	
Breathing hose (if fitted)	+	+	
Inhalation valve disc (if fitted to the lung governed demand valve)	-	-	1
Exhalation valve disc (if fitted to the lung governed demand valve)	-	+	1
Half mask			According to EN 140
Carrying harness	-	-	1
Carrying frame	+	-	
Pressure indicator	+	-	
Medium pressure connecting tube	-	+	
High pressure connecting tube	-	+	
Pressure vessel			According to the relevant standards
Pressure vessel valve			According to the relevant standards

Key

+ The marking is necessary.

- The marking is not necessary.

1 For parts which cannot reasonably be marked the relevant information shall be included in the information to be supplied by the manufacturer.

2 Means of identification may include serial No. and/or date and shall be explained in the information to be supplied by the manufacturer.

The components of a sub-assembly need not be marked when the sub-assembly is identifiable. Those components not offered as spare parts by the manufacturer need not be marked but the relevant information should be given in the information to be supplied by the manufacturer.

Annex ZA
(informative)

Clauses of this European Standard addressing essential requirements or other provisions of EU Directives

This European Standard has been prepared under a mandate given to CEN by the European Commission and the European Free Trade Association to provide a means of conforming to Essential Requirements of the New Approach Directive 89/686/EEC.

Once this standard is cited in the Official Journal of the European Communities under that Directive and has been implemented as a national standard in at least one Member State, compliance with the normative clauses of this standard confers, within the limits of the scope of this standard, a presumption of conformity with the relevant Essential Requirements of that Directive and associated EFTA regulations.

The following clauses of this standard are likely to support requirements of Directive 89/686/EEC, Annex II:

Table ZA.1 – Correspondence between this European Standard and Directive 89/686/EEC

EU Directive 89/686/EEC, Annex II		Clauses of this Standard
1.1.1	Ergonomics	6.3; 6.25
1.1.2.1	Highest level of protection possible	6.25
1.1.2.2	Classes of protection appropriate to different levels of risk	5
1.2.1	Absence of risks and other inherent nuisance factors	6.3
1.2.1.1	Suitable constituent materials	6.4
1.2.1.2	Satisfactory surface condition of all PPE parts in contact with the user	6.3; 6.4, 6.11
1.2.1.3	Maximum permissible user impediment	6.11; 6.21
1.3.2	Lightness and design strength	6.7.2; 6.11; 6.12.1; 6.13; 6.14; 6.21; 6.22; 6.24
1.4	Information supplied by the manufacturer	9
2.1	PPE incorporating adjustment systems	6.8; 6.11
2.6	PPE for use in explosive atmospheres	6.4; 6.11
2.7	PPE intended for emergency use or rapid installation and/or removal	6.8; 6.9
2.8	PPE for use in very dangerous situations	9
2.9	PPE with components that can be adjusted or removed by the user	6.7.1; 6.11
2.10	PPE for connection to another device	6.3; 6.7.2; 6.15; 6.16
2.12	PPE bearing identification marks related to health and safety	8
3.10.1	Respiratory protection	6.3; 6.10; 6.11; 6.19; 6.23; 8; 9

WARNING: Other requirements and other EU Directives may be applicable to the product(s) falling within the scope of this standard.

Annex ZB
(informative)

Relationship between this European Standard and the Essential Requirements of EU Directive 97/23/EC (PED)

This European Standard has been prepared under a mandate given to CEN by the European Commission to provide a means of conforming to Essential Requirements of the New Approach Directive - 97/23/EC (PED) Pressure Equipment Directive.

Once this standard is cited in the Official Journal of the European Communities under that Directive and has been implemented as a national standard in at least one Member State, compliance with the normative clauses of this standard confers, within the limits of the scope of this standard, a presumption of conformity with the relevant Essential Requirements of that Directive and associated EFTA regulations.

Table ZB – Correspondence between this European Standard and Directive 97/23/EC (PED)

Essential Requirements (ERs) of Directive 97/23/EC (PED)	Clause(s)/sub-clause(s) of this EN
1	1
2.1	6.3
2.2.2	6.3
2.3	6.15
2.8	6.7, 6.10, 6.12, 6.21, 6.22, 6.25
2.9	6.14, 6.15, 6.16, 6.17
3.2.2	6.14
3.3	8.1, 8.2, 8.5, 8.6, 8.7, 8.8
3.4	9.3, 9.5

WARNING: Other requirements and other EU Directives may be applicable to the product(s) falling within the scope of this standard.

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