BRITISH STANDARD

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137:2006

Respiratory protective devices — Self-contained open-circuit compressed air breathing apparatus with full face mask — Requirements, testing, marking

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National foreword

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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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Respiratory protective devices - Self-contained open-circuit compressed air breathing apparatus with full face mask - Requirements, testing, marking

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This European Standard was approved by CEN on 22 September 2006.

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Contents

Foreword

This European Standard (EN 137:2006) 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of an identical text or by endorsement, at the latest by May 2007, and conflicting national standards shall be withdrawn at the latest by May 2007.

This document supersedes EN 137:1993.

This document has been prepared under a mandate given to CEN by the European Commission and the European Free Trade Association, and supports essential requirements of EU Directive(s).

For relationship with EU Directive(s), see informative Annex ZA, which is an integral part of this document.

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, Romania, 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 standard or part of a standard and practical performance tests have been carried out successfully on complete apparatus where specified in the appropriate standard. If for a particular reason a complete apparatus is not tested then simulation of the apparatus is permitted provided the respiratory characteristics and mass distribution are similar to those of the complete apparatus.

1 Scope

This European Standard specifies minimum performance requirements for self-contained open-circuit compressed air breathing apparatus with full face mask used as respiratory protective devices, except escape apparatus and diving apparatus.

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

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 136:1998, *Respiratory protective devices — Full face masks — Requirements, testing, marking*

EN 144-1, *Respiratory protective devices — Gas cylinder valves — Part 1: Thread connections for insert connector*

EN 144-2, *Respiratory protective devices — Gas cylinder valves — Part 2: Outlet connections*

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

EN 469, *Protective clothing for firefighters Performance requirements for protective clothing for firefighting*

EN 837-1:1996, *Pressure gauges — Part 1: Bourdon tube pressure gauges — Dimensions, metrology, requirements and testing*

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

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

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

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

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

EN 50020, *Electrical apparatus for potentially explosive atmospheres — Intrinsic safety "i"*

EN 60079-0, *Electrical apparatus for explosive gas atmospheres — Part 0: General requirements (IEC 60079-0:2004)*

EN 61000-6-2, *Electromagnetic compatibility (EMC) — Part 6-2: Generic standards — Immunity for industrial environments (IEC 61000-6-2:2005)*

3 Terms and definitions

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

3.1
rated filling pressure
maximum allowable pressure to which the valved pressure vessel is intended to be filled

3.2
rated working pressure
maximum allowable pressure for which the apparatus is designed

4 Description

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

It may include a pressure reducer, pressure reducer relief valve, supplementary air supply, second medium pressure connector, ambient air bypass device or other components and parts.

The apparatus functions by enabling the wearer to breathe compressed air on demand. The exhaled air from the wearer then passes without re-circulation to the ambient atmosphere.

5 Classification

Self-contained open-circuit compressed air breathing apparatus are classified in types as follows:

— Type 1: apparatus for industrial use;

— Type 2: apparatus for fire fighting.

6 Requirements

6.1 General

In all tests all test samples shall meet the requirements.

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

Where fitted, auxiliary equipment identified in Annexes A and B shall in addition meet the requirements listed in those annexes.

6.2 Ergonomics

The requirements of this European Standard are intended to take account of the interaction between the wearer, the self-contained open-circuit compressed air breathing apparatus, and where possible the working environment in which the self-contained open-circuit compressed air breathing apparatus is likely to be used. The device shall satisfy 6.3, 6.9 and 6.10.

6.3 Design

The diameter of pressurised parts with a pressure greater than 0,5 bar downstream of the shut-off valve(s) shall not exceed 32 mm.

The design of the apparatus shall be such as to allow its inspection in accordance with the information supplied by the manufacturer.

The apparatus shall be sufficiently robust to withstand the rough usage it is likely to receive in service with respect to its classification.

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

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

All parts requiring manipulation by the wearer shall be readily accessible and easily distinguishable from one another by touch. All adjustable parts and controls shall be constructed so that their adjustment is not liable to accidental alteration during use.

The apparatus shall be so designed that the wearer can remove it and, while still wearing the full face mask, continue to breathe from the apparatus.

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

The main valve(s) of pressure vessel(s) shall be arranged so that the wearer can operate it (them) while wearing the apparatus.

If apparatus (of the same type) are designed for use with different sizes of pressure vessels, changing of pressure vessels shall be possible without the use of special tools. Where the manufacturer claims the apparatus can be used with a different range of pressure vessels then the worst case(s) shall be identified and tested.

Apparatus fitted with more than one pressure vessel may be fitted with individual valves on each pressure vessel.

It shall not be possible simultaneously to fit two or more pressure vessels of different rated filling pressures to the same apparatus.

It shall not be possible to fit an apparatus which is designed to operate with a lower rated working pressure to a pressure vessel with a higher rated filling pressure.

Testing shall be done in accordance with 7.3 and 7.11.

The apparatus shall continue to function satisfactorily after being submerged in water. Before immersion and after removal from the water the apparatus shall meet the requirements of 6.21.

Testing shall be done in accordance with 7.8.

6.4 Materials

All materials used in the construction shall have adequate resistance to deterioration by heat and adequate mechanical strength.

Testing shall be done in accordance with 7.3, 7.4 and 7.11 after pre-conditioning according to 6.24.

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.

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

Testing shall be done in accordance with 7.3 and 7.11.

6.5 Cleaning and disinfecting

All material 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 7.11.

6.6 Mass

The mass of the apparatus as ready for use with full face mask and fully charged pressure vessel(s) shall not exceed 18 kg.

Testing shall be done in accordance with 7.1 and 7.3.

6.7 Connections

6.7.1 General

Components of the apparatus shall be readily separated for cleaning, examining and testing. All demountable connections shall be readily connected and secured, where possible by hand. Any means for sealing used shall be retained in position when the joints and couplings are disconnected during normal use and maintenance.

Testing shall be done in accordance with 7.3 and 7.11.

6.7.2 Couplings (if fitted)

The apparatus shall be constructed so that any twisting of the hoses and tubes does not affect the fit or performance of the apparatus, or cause the hoses and or tubes to become disconnected. The design of the couplings shall be such as to prevent unintentional interruption of the air supply.

Testing shall be done in accordance with 7.3 and 7.11.

6.7.3 Strength of connections to full face mask, demand valve and breathing hose (if fitted)

Connections of the breathing hose (if fitted) to the full face mask connector and to the demand valve or between the full face mask connector and the demand valve shall withstand a force of 250 N.

Testing shall be done in accordance with 7.9.

6.7.4 Connection between apparatus and full face mask

The connection between the apparatus and the full face mask may be achieved by a permanent, special or thread type connector. If a thread connector is used, either it shall comply with the requirements of one of the following two European Standards:

— EN 148-1 for breathing apparatus without positive pressure;

EN 148-3 for breathing apparatus with positive pressure;

or, if any other thread type connector is used, it shall not be possible to connect it with the above mentioned threads.

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

If a thread connector in accordance with EN 148-3 is used then the requirements of Annex C shall be met, when tested in accordance with Annex C.

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

For all equipment connectors of the full face mask a pull test as described in 7.12.4.3 and 8.9 of EN 136:1998 shall be applied and no separation shall occur.

After temperature pre-conditioning in accordance with 6.24 and return to ambient temperature the connectors between apparatus and full face mask shall be examined and the performance requirements of the threads shall be satisfied.

Testing shall be done in accordance with 7.3.

6.7.5 High, medium and low pressure connections

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

Testing shall be done in accordance with 7.3.

6.8 Full face mask

Type 1 self-contained open-circuit compressed air breathing apparatus shall have at least a full face mask class 2 according to EN 136:1998.

Type 2 self-contained open-circuit compressed air breathing apparatus shall be equipped with a full face mask class 3 according to EN 136:1998.

Testing shall be done in accordance with 7.3.

6.9 Body harness

The body harness shall be designed to allow the user to don and doff the apparatus quickly and easily without assistance and shall be adjustable. All adjusting devices shall be so constructed that once adjusted they will not slip inadvertently.

The body harness shall be constructed such that when tested in practical performance tests the apparatus shall be worn without avoidable discomfort, the wearer shall show no undue sign of strain attributable to wearing the apparatus, and that the apparatus shall impede the wearer as little as possible when in a crouched position or when working in any space with restricted access or limited movement.

The body harness shall be considered satisfactory if during the practical performance test it does not slip and continues to hold the apparatus securely to the wearer's body throughout the duration of test.

Testing shall be done in accordance with 7.11.

6.10 Practical performance

The complete apparatus shall undergo practical performance tests under realistic conditions. These general tests serve the purpose of checking 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.

The test house shall provide full details of those parts of the practical performance tests which revealed these imperfections.

NOTE This will enable other test houses to duplicate the tests and assess the results thereof.

Testing shall be done in accordance with 7.4.2 and 7.11.

6.11 Resistance to temperature and flammability

6.11.1 Temperature performance

6.11.1.1 General

The apparatus shall operate trouble-free over the temperature range of -30 °C to 60 °C.

Apparatus specifically designed for temperatures beyond these limits shall be tested and the temperature(s) shall be marked on the apparatus.

Apparatus shall meet the breathing resistance requirements given in 6.11.1.2 and 6.11.1.3 at the extremes of the temperature range given.

6.11.1.2 Breathing resistance at low temperatures

For breathing apparatus without positive pressure the inhalation resistance shall not exceed 10 mbar.

For breathing apparatus with positive pressure a positive pressure shall be maintained in the cavity of the mask adjacent to the face seal.

The exhalation resistance of all types of apparatus shall not exceed 10 mbar.

Testing shall be done in accordance with 7.4.1.1.

6.11.1.3 Breathing resistance at high temperature

6.11.1.3.1 Apparatus without positive pressure

For breathing apparatus without positive pressure the inhalation resistance shall not exceed 7 mbar.

The exhalation resistance shall not exceed 3 mbar.

Testing shall be done in accordance with 7.4.1.2.

6.11.1.3.2 Apparatus with positive pressure

For breathing apparatus with positive pressure a positive pressure shall be maintained in the cavity of the mask adjacent to the face seal.

The exhalation resistance shall not exceed 10 mbar.

Testing shall be done in accordance with 7.4.1.2.

6.11.2 Flammability

6.11.2.1 Components

The material of the straps and buckles shall not burn or continue to burn for more than 5 s after removal from the flame.

Testing shall be done in accordance with 7.3 and 7.4.1.4.

The breathing hose(s) (leading to full face mask), medium pressure tube(s) and lung governed demand valve shall prove to be "self-extinguishing", i.e. the material shall not be of highly flammable nature and the parts shall not continue to burn for more than 5 s after removal from the flame.

The components shall remain leak-tight, fulfil the breathing resistance requirements and the air supply shall not be interrupted after the test although they may be deformed.

Testing shall be done in accordance with 7.4.1.4 and 7.7.

6.11.2.2 Flame engulfment

Type 2 breathing apparatus shall be subjected to a flame engulfment test. No after-flame shall continue for more than 5 s. Additionally, no component that secures the apparatus to the user's body or that secures the pressure vessel to the apparatus shall separate or be displaced to such an extent that would cause the breathing apparatus to become detached from the wearers body or to fail the breathing resistance requirement of 6.21.

Testing shall be done in accordance with 7.4.1.4.

6.11.3 Resistance to radiant heat

For type 2 breathing apparatus the breathing hose(s) (leading to full face mask), medium pressure tube(s) and lung governed demand valve shall be tested for resistance to radiant heat.

The components are considered to be resistant to radiant heat if they remain leak-tight, fulfil the breathing resistance requirements of 6.21 and the air supply shall not be interrupted after a test period of 20 min although they may be deformed.

Testing shall be done in accordance with 8.6 of EN 136:1998.

6.12 Protection against particulate matter

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

Testing shall be done in accordance with 7.3.

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

All medium pressure parts 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.

6.14 Pressure vessel(s)

The pressure vessel(s) shall be designed in accordance with national regulations.

Any pressure vessel outlet connection shall comply with EN 144-1.

Testing shall be done in accordance with 7.3.

6.15 Pressure vessel valve(s)

The pressure vessel valve(s) shall comply with EN 144-1 and EN 144-2.

The inlet and outlet connections on the pressure vessel valve(s) shall comply with the requirements given in EN 144-1 for the thread connection for the inlet connection and EN 144-2 for the outlet connection.

The pressure vessel valve(s) shall be protected against blockage and transmission of particulate matter that may be contained in the compressed air.

The valve(s) shall be so designed that the valve spindle cannot be completely unscrewed from the assembly during normal operation.

The valve(s) shall be designed or so located that it cannot be closed inadvertently.

Testing shall be done in accordance with 7.3 and 7.11.

6.16 Pressure reducer

6.16.1 General

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.

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

Testing shall be done in accordance with 7.3.

6.16.2 Apparatus with a pressure reducer relief valve

The pressure reducer 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 reducer relief valve activated the inhalation and exhalation breathing resistance shall not exceed 25 mbar.

Testing shall be done in accordance with 7.5.1 and 7.5.2.

6.16.3 Apparatus without a pressure reducer relief valve

Where a pressure reducer relief valve is not provided the inhalation and exhalation breathing resistance shall not exceed 25 mbar.

Testing shall be done in accordance with 7.5.1 and 7.5.3.

6.17 Pressure indicator and tube

6.17.1 General

The information given by the pressure indicator and the warning device (see 6.18.1) shall be complementary in every case.

NOTE Whatever technology is used the devices should be designed in order to avoid a common mode fault unless failure mode is fail to safe.

The apparatus shall be equipped with a reliable pressure indicator which will read the pressure in the pressure vessel(s) on opening the valve(s) to ensure that the individual or equilibrated pressure is measured respectively.

The pressure indicator shall be positioned to enable the pressure to be read conveniently by the wearer.

The pressure indicator tube shall be sufficiently robust to withstand rough usage which it is likely to receive in service with respect to its classification. Where the tube is protected by a cover the enclosed space shall be vented to the atmosphere.

Testing shall be done in accordance with 7.3 and 7.11.

The pressure indicator shall be resistant to water and shall withstand immersion in water at a depth of 1 m for 24 h. After the test no water shall be visible in the device.

The pressure indicator shall be graduated from the zero mark up to a value of at least 50 bar above the maximum filling pressure of the pressure vessel.

The pressure indicator shall have accuracy class 1.6 as defined in Clause 6 of EN 837-1:1996.

It shall be possible to read the gauge marking in poor light.

The design of the gauge shall enable the wearer to estimate the pressure to within 10 bar.

When pressure indicator and connecting hose are removed from the apparatus then the flow shall not exceed 25 l/min at 200 bar.

Testing shall be done in accordance with 7.1 and 7.3.

6.17.2 Pressure indicator of the pointer type

The pressure indicator shall be provided with a blow out release which protects the wearer against injuries.

The gauge window shall be made of a material being non-splintering when breaking.

Testing shall be done in accordance with 7.3.

6.17.3 Pressure indicator of the tactile type

The indicator shall be secured against accidental blow out.

Testing shall be done in accordance with 7.3.

6.17.4 Electronic pressure indicator

If the pressure indicator is equipped with an electrical energy source it shall comply with the class EEx ia IIC T4, or for mining industry EEx ia I, in accordance with EN 50020 and EN 60079-0 respectively.

Testing shall be done in accordance with EN 50020 and EN 60079-0.

Testing shall additionally be done at –30 °C and 60 °C in accordance with EN 50020 and EN 60079-0.

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

Testing shall be done in accordance with EN 61000-6-2.

6.18 Warning device

6.18.1 General

The information given by the warning device and the pressure indicator (see 6.17.1) shall be complementary in every case.

NOTE Whatever technology is used the devices should be designed in order to avoid a common mode fault unless failure mode is fail to safe.

The apparatus shall have a suitable warning device that operates when the pressure vessel pressure drops to a predetermined level to warn the wearer.

The warning device shall either be activated automatically when the pressure vessel valve(s) is (are) opened or if manually activated it shall not be possible to use the apparatus before the device is activated.

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

If there is an audible warning device the sound pressure level shall be at least 90 dB(A) measured at the ear nearest to the device.

The signal may be continuous or intermittent. When activated, the duration of the warning at 90 dB(A) shall be at least 15 s for a continuous signal and 60 s for an intermittent signal and thereafter shall continue to sound down to 10 bar.

In case of an intermittent warning device the peak sound pressure level shall be at least 90 dB(A).

The frequency range shall be between 2 000 Hz and 4 000 Hz.

After response of the warning device the wearer shall be able to continue breathing without difficulty.

Testing shall be done in accordance with 7.3 and 7.6.

6.18.2 Pneumatic warning device

The air loss that might be caused by the warning signal shall not exceed an average of 5 l/min from response of signal to a pressure of 10 bar.

The warning device shall continue to operate in a temperature range of 0 °C to 10 °C at a relative humidity of 90 %.

Testing shall be done in accordance with 7.1 and 7.6.

6.18.3 Electronic warning device

Warning devices which operate electrically shall comply with the class EEx ia IIC T4, or for mining industry EEx ia I, in accordance with EN 50020 and EN 60079-0 respectively.

Testing shall be done in accordance with EN 50020 and EN 60079-0.

Testing shall additionally be done at –30 °C and 60 °C in accordance with EN 50020 and EN 60079-0.

The requirements of 6.18.1 shall be maintained when testing the device on electromagnetic compatibility in accordance with EN 61000-6-2.

Testing shall be done in accordance with 7.6 and EN 61000-6-2.

6.19 Flexible hoses and tubes

6.19.1 Resistance to collapse of breathing hose

The air flow shall not be reduced by more than 10 % at the specified test air flow rate. There shall be no visible distortion 5 min after completion of the test.

Testing shall be done in accordance with 7.10.

6.19.2 Medium pressure connecting tube

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

Testing shall be done in accordance with 7.1 and 7.3.

6.20 Lung governed demand valve

6.20.1 General

The breathable air supply shall be sufficient for a sinusoidal flow of 40 x 2,5 l/min at all pressure vessel pressures

above 20 bar and of 25 x 2 l/min at a pressure vessel pressure of 10 bar.

Testing shall be done in accordance with 7.1 and 7.12.1.

6.20.2 Apparatus without positive pressure

The negative pressure for opening the lung governed demand valve shall be between 0,5 mbar and 3,5 mbar when tested using a continuous flow of 10 l/min from maximum filling pressure to 10 bar.

A self-opening of the demand valve at negative pressures of less than 0,5 mbar shall not occur.

Testing shall be done in accordance with 7.1 and 7.3.

6.20.3 Apparatus with positive pressure

The lung governed demand valve for positive pressure apparatus shall be fitted with a manual or an automatic change-over switch.

Testing shall be done in accordance with 7.3.

6.20.4 Supplementary air supply

Apparatus without positive pressure shall be provided with a manually operated means of providing a supply of air at a flow rate of at least 60 l/min at all pressure vessel pressures above 50 bar.

Apparatus with positive pressure may be provided with such a device.

Testing shall be done in accordance with 7.1 and 7.3.

6.21 Breathing resistance

6.21.1 Inhalation resistance

6.21.1.1 Apparatus without positive pressure

The inhalation resistance of an apparatus without full face mask fitted shall not exceed 4,5 mbar at all pressure vessel pressures from maximum filling pressure to 10 bar, when tested at 25 x 2 l/min.

Where a lung governed demand valve is attached to a full face mask the negative pressure shall not exceed 7 mbar.

The inhalation resistance of an apparatus without full face mask fitted shall not exceed 10 mbar at all pressure vessel pressures from maximum filling pressure to 20 bar, when tested at 40 x 2,5 l/min.

Testing shall be done in accordance with 7.12.1.1.

6.21.1.2 Apparatus with positive pressure

The apparatus shall be designed such that positive pressure is maintained in the cavity of the mask adjacent to the face seal. The pressure shall be positive but not exceed 5 mbar.

At a sinusoidal flow of 40 x 2,5 l/min this requirement shall be met at all pressure vessel pressures above 20 bar and at a sinusoidal flow of 25 x 2 l/min the requirement shall be met down to a pressure vessel pressure of 10 bar.

Testing shall be done in accordance with 7.12.1.2.

6.21.2 Exhalation resistance

6.21.2.1 General

This requirement applies only to apparatus with incorporated full face mask.

6.21.2.2 Apparatus without positive pressure

The exhalation resistance shall not exceed 3,0 mbar.

Testing shall be done in accordance with 7.12.2.1.

6.21.2.3 Apparatus with positive pressure

The exhalation resistance shall not exceed 6 mbar at a continuous flow of 10 l/min, 7 mbar at a sinusoidal flow of 25 x 2 l/min and 10 mbar at a sinusoidal flow of 40 x 2,5 l/min.

Testing shall be done in accordance with 7.12.2.2.

6.22 Static pressure

For apparatus with positive pressure, the static pressure in the mask cavity under conditions of equilibrium shall not exceed 5 mbar.

Testing shall be done in accordance with 7.1 and 7.3.

6.23 Leak-tightness

6.23.1 General

The assembled apparatus shall satisfy the following requirements for leak-tightness, at both low and high pressures. Any leakage of the full face mask (if fitted) at the dummy head is prevented by sealing the facepiece to the dummy head.

NOTE These tests are not intended to simulate face fit testing.

6.23.2 Low pressure

The assembled apparatus without full face mask fitted shall be tested for leak-tightness at a negative and a positive pressure of 7,5 mbar. After the pressure has stabilised the pressure change shall not be greater than 0,3 mbar in 1 min.

Testing shall be done in accordance with 7.7.1.

6.23.3 High pressure

6.23.3.1 Apparatus without positive pressure

When tested in accordance with 7.7.2, the pressure change shall not be greater than 10 bar in 1 min.

Testing shall be done in accordance with 7.7.2.

6.23.3.2 Apparatus with positive pressure

When tested in accordance with 7.7.2, the pressure change shall not exceed 20 bar in 1 min.

Testing shall be done in accordance with 7.7.2.

6.24 Pre-conditioning

The apparatus shall undergo the following pre-conditioning 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 vessels shall be charged to not more than 50 % of filling pressure during conditioning**.

Testing shall be done in accordance with 7.3.

7 Testing

7.1 General

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

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

Positive pressure apparatus shall be tested as complete apparatus including the full face mask as supplied by the applicant.

If not otherwise specified, two apparatus shall be tested.

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 from 16 °C to 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 Resistance to temperature and flammability

7.4.1 Laboratory tests with a breathing machine

7.4.1.1 Tests at low temperature

The apparatus including the pressure vessel(s) and full face mask shall be cooled in an ambient temperature of (-30 ± 3) °C for (4 ± 1) h.

In the case of wrapped composite pressure vessels the time shall be at least 12 h.

Subsequently, the apparatus shall be connected to a breathing machine placed outside the cooling system and shall be tested in accordance with EN 13274-3, method 2, setting E. The breathing machine shall then be operated until the compressed air supply is exhausted (20 bar).

The test shall be repeated with the same cooled apparatus after having replaced the empty pressure vessel(s) by a fully charged pressure vessel(s) previously stored at room temperature.

7.4.1.2 Tests at high temperature

The apparatus including pressure vessel(s) (filling pressure: 100 bar) and a full face mask is stored in a chamber at a temperature of (60 ± 3) °C and a relative humidity of not more than 50 % for (4 ± 1) h.

In the case of wrapped composite pressure vessels the time shall be at least 12 h.

The apparatus without positive pressure shall be tested in accordance with EN 13274-3, method 2, setting E until the compressed air supply is exhausted (20 bar).

The apparatus with positive pressure shall be tested in accordance with EN 13274-3, method 2, setting H until the compressed air supply is exhausted (20 bar).

7.4.1.3 Flame engulfment

7.4.1.3.1 General

The apparatus, mounted on a manikin, is pre-heated in an oven then engulfed in flame and subsequently subjected to a drop test. During the whole test, the apparatus is connected to a machine which simulates breathing. Details of the related test equipment, the burner and the manikin are given in Figures 3, 4 and 5. The manikin shall wear a fire fighters jacket according to EN 469 during the testing. The complete protective covering shall be discarded and shall not be used after three flame exposures of the flame and heat test. During this test no helmet shall be fitted to the manikin's head. One apparatus shall be tested.

7.4.1.3.2 Procedure

The complete apparatus shall be mounted on the test manikin to simulate the normal wearing position. The breathing machine shall be set to operate at a rate of 25 cycles/min and 2 l/stroke. The apparatus mounted on the test manikin shall be placed in the oven which has been pre-heated to (90 ± 5) °C. After the oven door is closed and the temperature recovers to (90 ± 5) °C, the test exposure time of (15 ± 1) min shall begin. The test oven recovery time shall not exceed 1 min. At the completion of the (15 ± 1) min exposure, the apparatus mounted on the test manikin shall be moved out of the oven and into the centre of the burner array.

The complete apparatus shall then be exposed to direct flame contact for 10 s. The flame temperature at a distance of 250 mm from the burner tip shall be (950 ± 50) °C. The exposure shall begin at (30 ± 5) s after removal of the apparatus from the test oven. The apparatus shall be observed for any after-flame and the after-flame duration shall be recorded to determine pass or fail as specified in 6.11.2.2.

(20 ± 5) s after completing the directly flame exposure, the test manikin with the apparatus mounted on the manikin shall be raised to $\left(150\ ^{-5}_{0}\right)$ mm and dropped freely. The apparatus shall then be observed to determine pass/fail as specified in 6.11.2.2.

The breathing resistance during the entire test shall be recorded. Any pressure spike exceeding the limits specified in 6.21 caused by the impact of the drop test and measured within 3 cycles of the breathing machine after the apparatus is dropped shall be disregarded.

7.4.1.3.3 Test rig

The general design of the test rig is free of requirements but the following recommendations ensure homogeneous results.

7.4.1.3.3.1 Pre-heating oven

The pre-heating oven shall be designed to receive the manikin equipped with the device and to maintain a homogeneous temperature around it. This can be achieved by circulating air heating. The power has to be determined such that the re-heating time does not exceed 1 min to be in the range of the requirement.

7.4.1.3.3.2 Burners

The flame engulfment is achieved by means of a two burner array at the front and the back of the manikin. Each burner array is made by 4 rows of linear burners spaced 190 mm apart from one another. The length of each burner is 900 mm. Details of the burner are given in Figure 4 and can be obtained from the secretariat of CEN/TC 79.

7.4.1.3.3.3 Gas mixture

Each burner array is supplied with a gas mixture of at least 99,5 Vol.-% of propane and ambient air injected at a pressure of 1,5 bar through a jet size of 4,5 mm and additionally mixed with compressed air at 5 bar through a jet size of 6 mm.

Gas mixture and compressed air shall be set in dynamic conditions.

7.4.1.3.3.4 Flame conditions

All the burners in both arrays shall be ignited simultaneously and stopped simultaneously.

7.4.1.3.3.5 Transport trolley and drop device

The trolley is used:

— first to move, manually or automatically, the sample in test from the oven to the engulfment part;

secondly, following the flame engulfment test, to raise and to drop the device in test.

7.4.1.4 Flammability

The material of the straps and of the buckles shall be tested in accordance with EN 13274-4, method 2.

The breathing hose(s) medium pressure tube(s) and the lung governed demand valve shall be tested in accordance with EN 13274-4, method 1.

7.4.2 Practical performance test

7.4.2.1 Test at low temperature

7.4.2.1.1 Preparation of apparatus to be tested

Two sets of apparatus, as ready for use, shall be cooled at a temperature of (-30 ± 3) °C for a period of (4 ± 1) h.

7.4.2.1.2 Test procedure

Two warmly clothed subjects shall don the cooled apparatus in a cold chamber and perform work at an ambient temperature of (-15 ± 3) °C. The test shall be continuous without removal of the apparatus over a period of 30 min or at least until the warning device starts to operate.

The test shall be conducted according to activity 17 of EN 13274-2 with the exception that the apparatus shall be donned in the cold chamber at an ambient temperature of (-15 + 3) °C.

At the end of the test, the resistance to breathing shall be measured at room temperature according to 7.12 to determine whether there is any obstruction and the apparatus shall be examined for malfunction due to the low temperature.

7.4.2.2 Test at low temperature after storage at room temperature

7.4.2.2.1 Preparation of apparatus to be tested

Two sets of apparatus, as ready for use, shall be stored at room temperature (from 16 °C to 32 °C) for a period of (4 ± 1) h.

7.4.2.2.2 Test procedure

Two warmly clothed subjects shall don the apparatus at room temperature (from 16 °C to 32 °C) and enter a cold chamber (-6 ± 2) °C. The same test program as that described in 7.4.2.1.2 shall be carried out for a period of 30 min or at least until the warning device starts to operate.

7.5 Pressure reducer

7.5.1 General

The apparatus including full face mask is connected to a breathing machine by a suitable connector. Apparatus shall be fitted to a dummy head. The breathing machine is adjusted to 25 cycles/min and 2 l/stroke (see Figure 1).

7.5.2 Apparatus with a pressure reducer 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 sample point.

7.5.3 Apparatus without a pressure reducer 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 demand valve is recorded.

Under these conditions a breathing machine test is conducted on the complete apparatus including the full face mask and the breathing resistance is measured at the appropriate pressure sample point.

7.6 Warning device

The performance of the warning device is measured during a breathing machine test at 25 cycles/min x 2 l/stroke.

To test the warning device at temperatures between 0 °C and 10 °C air shall be passed through the apparatus in a climatic test chamber using a breathing machine (adjusted to 25 cycles/min x 2 l/stroke) outside the climatic chamber at room temperature.

During the test the environment of the apparatus shall have a temperature of (3 ± 1)°C and a relative humidity of > 90 %.

Every 5 min water shall be sprayed on for 3 s using a spray gun (information may be obtained from the secretariat of CEN/TC 79) directed at the warning device from a distance of 200 mm.

7.7 Leak-tightness

7.7.1 Low pressure test

The apparatus is tested with the pressure vessel(s) closed and with the demand valve connected to a device which will create a negative and a positive pressure of 7,5 mbar and also to a manometer.

NOTE It may be necessary to seal the warning device during the negative pressure test.

7.7.2 High pressure test

The apparatus including the fully charged pressure vessel(s) shall be assembled according to the manufacturers instructions.

The pressure vessel valve is opened and when the apparatus is completely pressurised the pressure vessel valve(s) is (are) closed and the pressure drop is measured by observing the high pressure gauge of the apparatus.

When testing positive pressure apparatus the full face mask seal shall be completely sealed using a dummy head or similar.

After the pressure vessel valve has been opened the positive pressure device is actuated.

7.8 Water immersion

The dummy head is connected to a breathing machine by a flexible hose. The full face mask of the complete apparatus is fitted to a dummy head.

The test is conducted with the breathing machine adjusted to 25 cycles/min and 2 l/stroke. The complete apparatus as worn is immersed in water to a depth of between 0,25 m and 0,80 m for a period of not less than 3 and not more than 5 full breathing cycles. A series of tests is carried out with the apparatus immersed and with the dummy head in two orientations, which represent respectively the maximum and minimum differential pressures between the lung governed demand valve and the exhalation valve.

The apparatus and dummy head are removed from the water after each test at each orientation.

Measurements of breathing resistance shall be made at the appropriate pressure sample points using a precision gauge. The breathing resistance is recorded prior to and immediately after each immersion. The presence of water in the full face mask after the test does not constitute a reason for failure and any water present may be removed prior to measurement of breathing resistance.

7.9 Strength of connections to full face mask, demand valve and breathing hose (if fitted)

For devices employing a breathing hose connect the breathing hose to the full face mask and to the demand valve. Suspend the connection - and apply the force of 250 N for 10 s to the demand valve. For devices with the demand valve mounted directly on the full face mask suspend the full face mask - not by its harness - with demand valve fitted and apply the force of 250 N for 10 s to the demand valve in a direction axial to the direction to the demand valve connection.

7.10 Resistance to collapse of breathing hose

7.10.1 Principle

A specified air flow is passed through the breathing hose which is subjected to a specified load. The change in air flow is measured.

7.10.2 Apparatus

Two circular plates, 100 mm in diameter and thickness of at least 10 mm. One plate is fixed and the other is capable of moving at right angles to the plane of the plates. The moving plate is capable of being loaded to ensure a total force of 50 N can be applied between the plates (see Figure 2).

7.10.3 Procedure

Place the breathing hose centrally between the two plates and pass air at a rate of 120 l/min through the hose. Apply the test force of 50 N (which includes that due to the moveable plate itself) to the hose and measure the air flow again. Calculate the reduction in flow.

7.11 Practical performance

7.11.1 General

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

7.11.2 Walking test

Two subjects shall carry out the activity number 6 of EN 13274-2.

If the warning device has not operated during the 30 min test period the pressure vessel pressure shall be reduced manually to the warning pressure range to check the effectiveness of the latter which shall conform with the requirements of 6.16.

7.11.3 Work simulation test

The apparatus shall be tested under conditions which can be expected during normal use. During this test the following activities shall be done in simulation of the practical use of the apparatus. The test shall be completed within a total working time of 30 min.

The sequence of activities and durations are at the discretion of the test authority. The individual activities shall be arranged so that sufficient time is left for the measurements prescribed.

a) activity 15 of EN 13274-2;

b) activity 4 of EN 13274-2;

c) activity 3 of EN 13274-2;

d) activity 10 of EN 13274-2;

e) activity 12 of EN 13274-2;

f) activity 11 of EN 13274-2;

g) activity 20 of EN 13274-2.

This test shall be continuous without removal of the apparatus for an initial period of approximately 15 min after which the subject shall have a rest period of 5 min during which he can be medically assessed and allows for time to change the pressure vessel if the testing officer considers that there may be insufficient air to complete the test.

The second section of the test shall then continue to complete a working time of 30 min. If the exercises have been completed within less than 30 min the remaining time is used by the subject to walk at 6 km/h.

7.12 Breathing resistance

7.12.1 Inhalation resistance

7.12.1.1 Apparatus without positive pressure

For this test, EN 13274-3, method 2, settings E and H shall be used.

7.12.1.2 Apparatus with positive pressure

For this test, EN 13274-3, method 2, settings E and H shall be used.

7.12.2 Exhalation resistance

7.12.2.1 Apparatus without positive pressure

For this test, EN 13274-3, method 2, setting E shall be used.

7.12.2.2 Apparatus with positive pressure

For this test, EN 13274-3, method 2, settings E and H shall be used.

8 Marking

The apparatus shall be marked as follows:

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 The number and year of this European Standard and classification.

8.4 Serial number.

8.5 Year of manufacture or equivalent.

8.6 Where the apparatus meets temperature requirements outside those specified in 6.11.1.1 it shall be marked with the range.

8.7 Where the apparatus meets the requirements of 6.11.2.2 the full face mask shall be marked with "cl 3+".

8.8 Where the recommendations of Annex C have been adopted, the demand valve shall be marked with "A".

8.9 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.

8.10 Sub-assemblies and components with considerable bearing on safety shall be marked so that they can be identified.

NOTE See Annex D.

If sub-assemblies with considerable bearing on safety are too small to be marked, the information shall be given in the information supplied by the manufacturer.

8.11 The pressure reducer shall be durably marked with a serial number. The marking shall be such that the year of production can be ascertained. In addition, provision shall be made to mark the date (year and month) and test marks of the last testing performed.

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

9 Information supplied by the manufacturer

9.1 On delivery information supplied by the manufacturer shall accompany every apparatus enabling trained and qualified persons to use it.

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

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

— application/limitation;

— checks prior to use;

— donning and fitting;

use;

— maintenance (preferably separately printed instructions, these shall include reference to relevant standards or for the periodic inspection and testing of the pressure vessels);

— storage;

of the equipment.

9.4 The information supplied by the manufacturer 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).

9.5 The information supplied by the manufacturer shall be unambiguous.

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

9.6 Any other information the manufacturer may wish to supply.

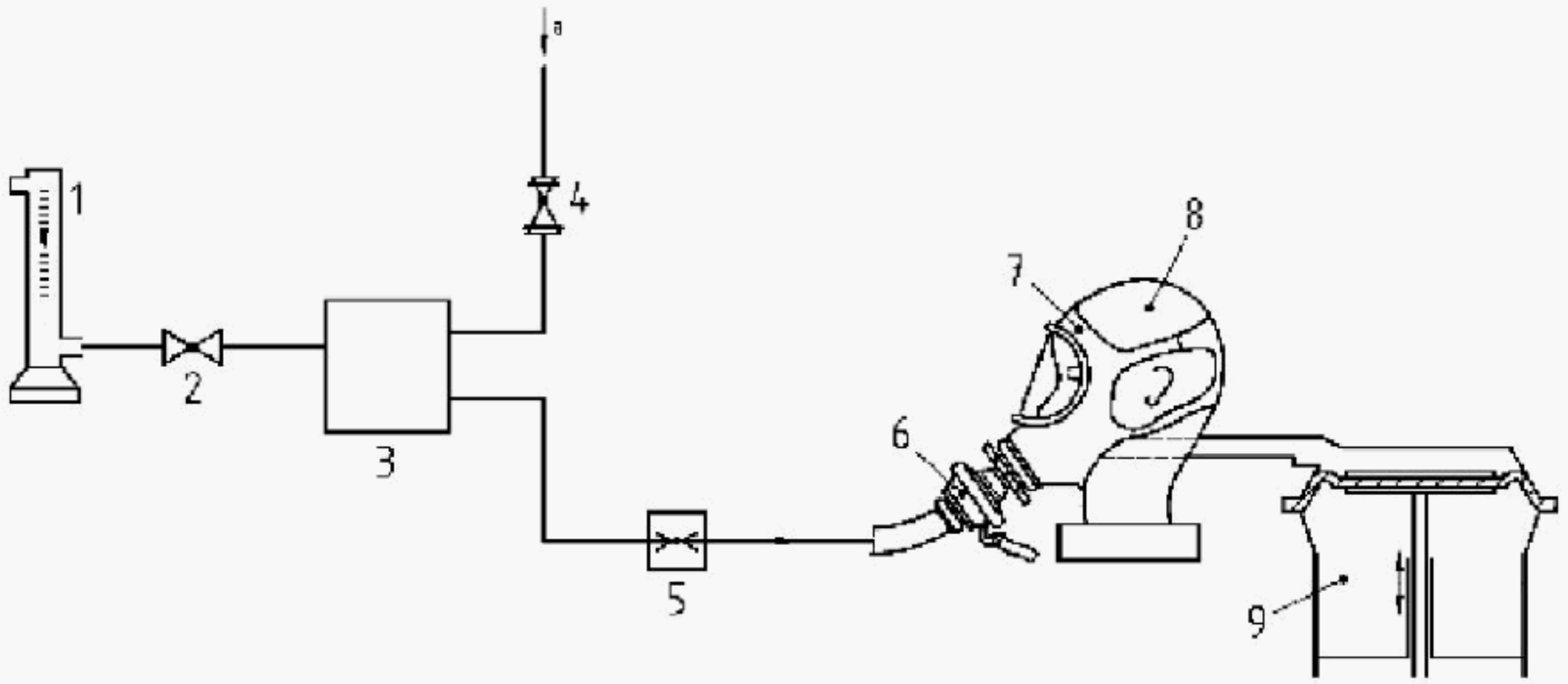
9.7 Information on spare parts (if appropriate).

9.8 Markings required by Clause 8 shall be explained.

9.9 To avoid undesirable effects associated with expansion of gases at different filling pressures, a warning shall be given that for devices using more than one valved pressure vessel each of those shall be filled to their rated filling pressure prior to use. This warning shall include the information that after the correct connection of those valved pressure vessels all shut-off valves shall be in the "OPEN" position prior to and during use.

Table 1 — Testing schedule

Test clause	Title	Pre-conditioning in accordance with 6.24	Requirement subclause
7.3	Visual inspection	Yes	**6.3; 6.4; 6.5; 6.6; 6.7; 6.8; 6.11; 6.12; 6.13; 6.14; 6.15; 6.16; 6.17; 6.18; 6.19; 6.20; 6.22**
7.4	Resistance to temperature and flammability	Yes	**6.4; 6.10; 6.11**
7.5	Pressure reducer	Yes	**6.16**
7.6	Warning device	Yes	**6.18**
7.7	Leak-tightness	Yes	**6.11; 6.23**
7.8	Water immersion	No	**6.3**
7.9	Strength of connections to full face mask, demand valve, medium pressure tube and breathing hose	Yes	**6.7**
7.10	Resistance to collapse of breathing hose	Yes	**6.19**
7.11	Practical performance	Yes	**6.3; 6.4; 6.5; 6.7; 6.9; 6.10; 6.15; 6.17**
7.12	Breathing resistance	Yes	**6.20; 6.21**

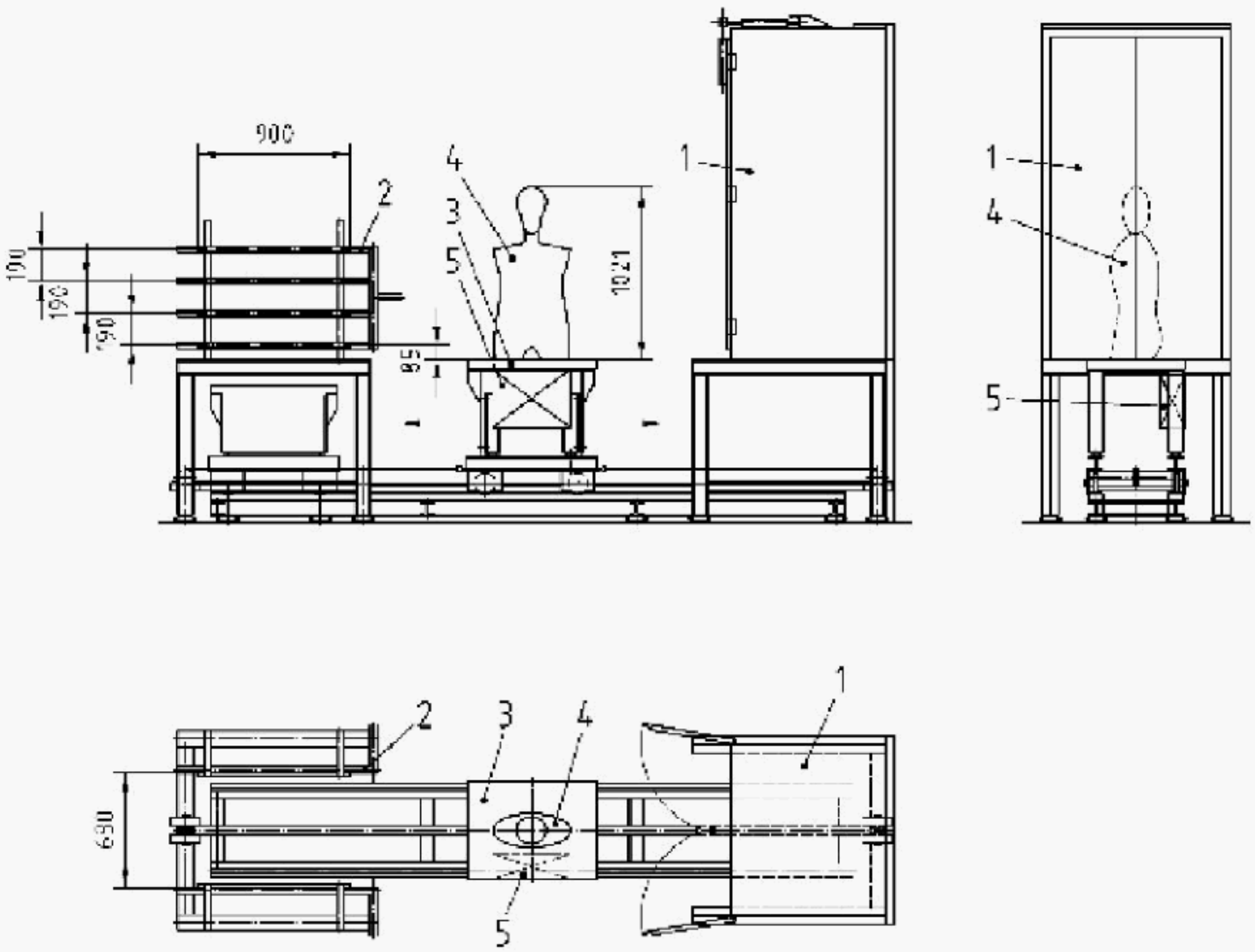


Key

1	flowmeter	6	demand valve
2	relief valve	7	full face mask
3	pressure reducer	8	dummy head
4	pressure regulator	9	breathing machine
5	medium pressure gauge	a)	compressed air supply

Figure 1 — Scheme of relief valve test

Dimensions in millimetres



Key

1 pre-heating oven

2 burners

3 transport trolley with drop device

4 manikin

5 breathing machine

Figure 3 — Flame engulfment test rig

Annex A
(normative)

Second medium pressure connector

A.1 General

A.1.1 Outlet connector

A second medium pressure connector is used for the supply of air to a second person for the purposes of rescue.

A.1.2 Inlet connector

A second medium pressure connector is used for the supply of air from an alternative medium pressure air source.

A.1.3 Combined connector

A second medium pressure connector is used for the supply of air to a second person as in A.1.1 and for the supply of air from an alternative air source as is in A.1.2.

A.2 Requirements

A.2.1 General

A.2.1.1 The connector shall be arranged such that the wearer of the self-contained open-circuit compressed air breathing apparatus can operate it (connect and disconnect) without assistance or doffing the apparatus.

Testing shall be done in accordance with 7.11.

A.2.1.2 The connector shall be attached such that in connected position the proper use of the apparatus shall not be impaired if a pull of 250 N is applied.

Testing shall be done in accordance with 7.9.

A.2.1.3 When disconnected the connector shall be self-sealing.

Testing shall be done in accordance with 7.3.

A.2.1.4 When not in use the connector shall be protected from contamination.

Testing shall be done in accordance with 7.3.

A.2.2 Use as outlet connector

A.2.2.1 The breathing resistance requirements according to this European Standard shall be met by the self-contained open-circuit compressed air breathing apparatus whilst a constant flow of 110 l/min is taken out of the connector.

Testing shall be done in accordance with 7.12.

A.2.2.2 Where the manufacturer has defined a compatible rescue device the breathing resistance requirements according to this European Standard shall be met by the self-contained open-circuit compressed air breathing apparatus whilst a sinusoidal flow of 25 x 2 l/min is taken out of the connector. Only compatible rescue devices shall be used.

Testing shall be done in accordance with 7.12.

A.2.3 Use as inlet connector

When the connector is used for an alternative source of medium pressure air, the pressure vessel(s) of the self-contained open-circuit compressed air breathing apparatus shall be excluded either by an automatic switch valve or by a manual operation.

Testing shall be done in accordance with 7.3 and 7.12.

A.3 Information supplied by the manufacturer

A.3.1 The manufacturer shall specify those auxiliary devices which may be used in conjunction with the self-contained open-circuit compressed air breathing apparatus.

A.3.2 When using the connector as inlet connector for an alternative source of medium pressure air (e.g. compressed air line breathing apparatus) the manufacturer shall specify the compatible maximum and minimum medium pressure value of the alternative source to be connected. Reference shall be made as to how the air supply from pressure vessel(s) of the self-contained open-circuit compressed air breathing apparatus shall be closed off, to avoid loss of air from these pressure vessel(s). The user shall be given a warning that the detailed procedure described in the information supplied by the manufacturer shall be followed in order to avoid the exposure to higher risks (e.g. air loss).

A.3.3 All necessary information to allow the planning of the intervention shall be given. The user shall be given a warning when using the outlet connector for rescue purposes the reduced duration of use resulting from the increased consumption of breathing air by the person being rescued has to be considered.

Annex B
(normative)

Ambient air bypass device

B.1 General

An ambient air bypass device is used for the supply of breathable ambient air to the wearer of a self-contained open-circuit compressed air breathing apparatus before entering and after leaving irrespirable atmospheres.

B.2 Requirements

The ambient air bypass device shall be arranged such that the wearer of the self-contained open-circuit compressed air breathing apparatus can operate it with the apparatus pressurised, without assistance and readily distinguish it by touch from any other component.

Testing shall be done in accordance with **7.11**.

B.2.1 If the ambient air bypass device is in open mode no significant air loss shall occur from the demand valve of the self-contained open-circuit compressed air breathing apparatus, i.e. no pressure change shall exceed 20 bar in 1 min.

Testing shall be done in accordance with **7.11**.

B.2.2 With the ambient air bypass device in open mode the inhalation resistance of the apparatus shall not exceed 7 mbar.

Testing shall be done in accordance with **7.12**.

B.2.3 It shall not be possible to inadvertently open the ambient air bypass device during use of the apparatus or by contact with an other object.

Testing shall be done in accordance with **7.11**.

B.2.4 The device shall be fitted with a warning facility that actively draws the attention of the wearer to the fact that the ambient air bypass device is in open mode.

If an acoustic warning device is used the sound pressure level shall be at least 90 dB(A) measured at the ear nearest to the warning device. This warning shall be distinguishable from any other warning fitted to the apparatus.

Testing shall be done in accordance with 7.6 but with a breathing rate of 20 cycles/min and 1,5 l/stroke.

If alternative warning devices are used testing shall be done in accordance with 7.3 and **7.11**.

B.3 Information supplied by the manufacturer

Information supplied by the manufacturer shall provide full details of the operation and shall include a warning that incorrect use of the ambient air bypass device or failure to close it will negate the protection afforded by the apparatus.

Warning shall be given that the correct closing mode of the ambient air bypass device is checked prior to entering the irrespirable atmosphere.

Annex C
(normative)

Requirements for static and dynamic pressure for apparatus with thread connector in accordance with EN 148-3

C.1 General

This annex is provided for apparatus with thread connectors according to EN 148-3 which may be inadvertently connected to an existing full face mask with EN 148-3 thread connector. In the event of inadvertent coupling of such full face masks to EN 137 apparatus, these additional clauses are recommended to ensure safe compatibility.

This annex does not imply that apparatus and full face masks which have not been tested and approved as complete apparatus may be used.

C.2 Static pressure

The lung governed demand valve of apparatus designed with a connector according to EN 148-3 shall maintain a static pressure of ≤ 3,9 mbar in the positive pressure mode.

For testing, the lung governed demand valve shall be fitted with a cap that can be ventilated and has a port for measuring the pressure using a precision manometer. An air flow of 5 l/min shall be released for a short time. The static pressure shall be measured after the ventilation is shut off.

C.3 Dynamic pressure

A positive pressure shall be maintained when the apparatus is tested with a breathing machine (adjusted to 40 cycles/min, 2,5 l/stroke) at all pressure vessel pressures above 20 bar.

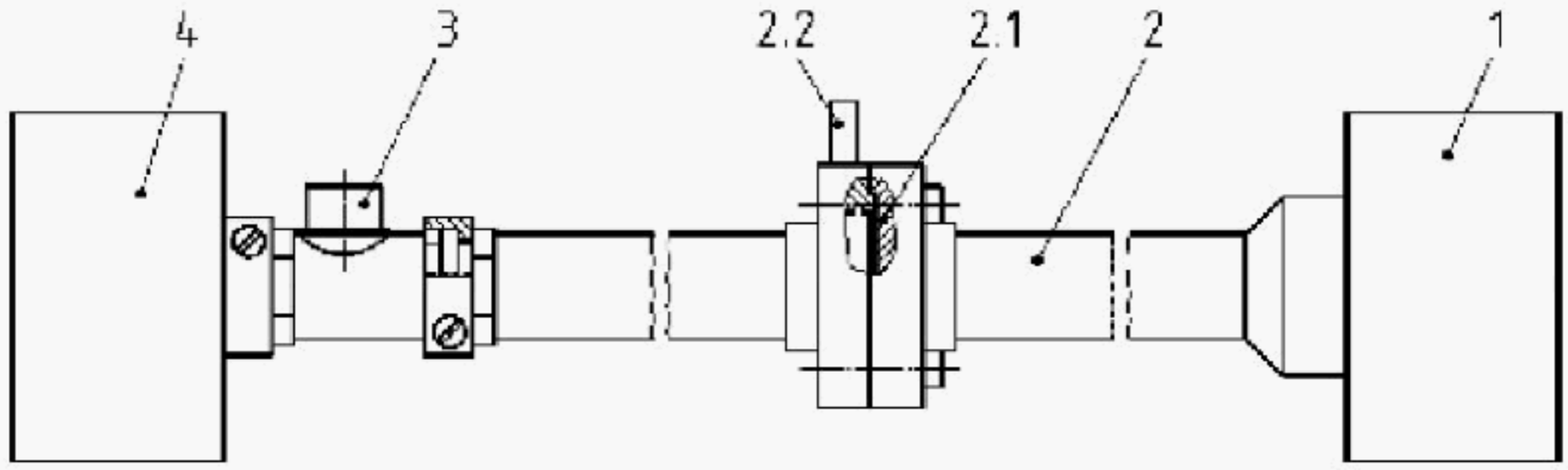
During the inhalation phase the positive pressure shall not exceed 4,2 mbar.

C.4 Exhalation valve

If the lung governed demand valve has an exhalation valve the opening pressure of this exhalation valve shall be at least 4,2 mbar measured at a continuous flow of 10 l/min.

C.5 Testing of dynamic pressure

For testing a test rig as shown schematically in Figure C.1 is used.



Key

1 M 45 x 3 threaded connector

2 orifice module

2.1 orifice

2.2 measuring point

3 exhalation valve

4 breathing machine connector

Figure C.1 — Scheme of a test rig for dynamic pressure

A breathing machine delivering sinusoidal flow shall be used. The pressure shall be measured at the port near the orifice. The orifice module shall be designed to have a resistance to airflow of 3,5 mbar at a continuous flow of 300 l/min.

Annex D
(informative)

Marking

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

Table D.1 — Marking

Components/ sub-assemblies	Part-marking	Date of manufacture	Remarks
Pressure reducer	+	+	
Lung demand valve	+	-	2
Lung demand valve diaphragm	+	+	
Breathing hose (if fitted)	+	+	
Inhalation valve disc (if fitted to the lung demand valve)	+	+	1
Exhalation valve disc (if fitted to the lung demand valve)	+	+	1
Full face mask			According to EN 136:1998
Carrying harness	-	-	1
Carrying frame	+	-	
Pressure indicator	+	-	
Medium pressure connecting tube	-	+	
High pressure connecting tube	-	+	
Warning device (if separate from other function parts)	+	-	
Pressure vessel			According to the relevant standards
Pressure vessel valve			According to the relevant standards

\+ 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)

Relationship between this European Standard and the Essential Requirements of EU Directive 89/686/EEC (PPE)

This European Standard has been prepared under a mandate given to CEN/CENELEC 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 on the Approximation of the laws of the Member States relating to Personal Protective Equipment.

Once this European Standard is cited in the Official Journal of the European Union under that Directive and has been implemented as a national standard in at least one Member State, compliance with the clauses of this European Standard given in Table ZA.1 confers, within the limits of the scope of this European Standard, a presumption of conformity with the corresponding Essential Requirements of that Directive and associated EFTA regulations.

Table ZA.1 — Correspondence between this European Standard and Directive 89/686/EEC (PPE)

Clause(s)/subclause(s) of this EN	Essential Requirements (ERs) of Directive 89/686/EEC
5	1.1.2.2 Classes of protection appropriate to different levels of risk
6.2	1.1.1 Ergonomics
6.3	1.2.1 Absence of risks and other inherent nuisance factors
6.3.	1.2.1.2 Satisfactory surface condition of all PPE parts in contact with the user
6.3	1.3.2 Lightness and design strength
6.3	2.9 PPE with components that can be adjusted or removed by the user
6.3	2.10 PPE for connection to another, external complementary device
6.4.	1.2.1.1 Suitable constituent materials
6.4	1.3.2 Lightness and design strength
6.4	2.6 PPE for use in explosive atmospheres
6.6	1.3.2 Lightness and design strength
6.7.1	2.9 PPE with components that can be adjusted or removed by the user
6.7.2	1.2.1 Absence of risks and other inherent nuisance factors
6.7.3	1.3.2 Lightness and design strength
6.7.4	1.3.2 Lightness and design strength
6.7.5	1.3.2 Lightness and design strength
6.8	1.1.2.2 Classes of protection appropriate to different levels of risk
6.8	1.3.1 Adaptation of PPE to user morphology
6.8	2.3 PPE for the face, eyes and respiratory tracts
6.8	2.7. PPE intended for emergency use or rapid installation and/or removal
6.8	2.9 PPE with components that can be adjusted or removed by the user
6.8	3.10.1 Respiratory protection
6.9	1.1.1 Ergonomics

Table ZA (*concluded*)

Clause(s)/subclause(s) of this EN	Essential Requirements (ERs) of Directive 89/686/EEC
6.9	1.2.1.3 Maximum permissible user impediment
6.9	1.3.1 Adaptation of PPE to user morphology
6.9	2.1 PPE incorporating adjustment systems
6.9	2.7 PPE intended for emergency use or rapid installation and/or removal
6.10	1.1.1 Ergonomics
6.10	1.1.2.1 Highest level of protection possible
6.10	1.2.1.2 Satisfactory surface condition of all PPE parts in contact with the user
6.10	1.2.1.3 Maximum permissible user impediment
6.10	1.3.1 Adaptation of PPE to user morphology
6.10	2.3 PPE for the face, eyes and respiratory tracts
6.11.1	3.10.1 Respiratory protection
6.11.2	1.3.2 Lightness and design strength
6.11.3	1.3.2 Lightness and design strength
6.12	1.2.1 Absence of risks and other inherent nuisance factors
6.13	1.3.2 Lightness and design strength
6.14	1.3.2 Lightness and design strength
6.15	1.2.1 Absence of risks and other inherent nuisance factors
6.16.1	2.1 PPE incorporating adjustment systems
6.16.2	3.10.1 Respiratory protection
6.16.3	3.10.1 Respiratory protection
6.17	1.2.1 Absence of risks and other inherent nuisance factors
6.17	2.8 PPE for use in very dangerous situations
6.17.4.	2.6 PPE for use in explosive atmospheres
6.17.4	2.10 PPE for connection to another, external complementary device
6.18	2.8 PPE for use in very dangerous situations
6.18.3	2.6 PPE for use in explosive atmospheres
6.19.1	1.2.1 Absence of risks and other inherent nuisance factors
6.19.2	1.3.2 Lightness and design strength
6.20	3.10.1 Respiratory protection
6.21	3.10.1 Respiratory protection
6.22	3.10.1 Respiratory protection
6.23	3.10.1 Respiratory protection
8	2.12 PPE bearing identification marks related to health and safety
8	3.10.1 Respiratory protection
9	1.4 Information supplied by the manufacturer
9	2.8 PPE for use in very dangerous situations
9	2.12 PPE bearing identification marks related to health and safety

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

Bibliography

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

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

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