BRITISH STANDARD

BS EN 405:2001 +A1:2009

Respiratory protective devices — Valved filtering half masks to protect against gases or gases and particles — Requirements, testing, marking

ICS 13.340.30

National foreword

This British Standard is the UK implementation of EN 405:2001+A1:2009. It supersedes BS EN 405:2002 which is withdrawn.

The start and finish of text introduced or altered by amendment is indicated in the text by tags. Tags indicating changes to CEN text carry the number of the CEN amendment. For example, text altered by CEN amendment A1 is indicated by [A1] ⟨A1⟩.

The UK participation in its preparation was entrusted to Technical Committee PH/4, Respiratory protection.

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

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

Compliance with a British Standard cannot confer immunity from legal obligations.

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EUROPEAN STANDARD

NORME EUROPÉENNE

EUROPÄISCHE NORM

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English Version

Respiratory protective devices - Valved filtering half masks to protect against gases or gases and particles - Requirements, testing, marking

Appareils de protection respiratoire - Demi-masques filtrants à soupapes contre les gaz ou contre les gaz et les particules - Exigences, essais, marquage

Atemschutzgeräte - Filtrierende Halbmasken mit Ventilen zum Schutz gegen Gase oder Gase und Partikeln - Anforderungen, Prüfung, Kennzeichnung

This European Standard was approved by CEN on 8 November 2001 and includes Amendment 1 approved by CEN on 26 March 2009.

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 CEN Management Centre 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 respons bility of a CEN member into its own language and notified to the CEN Management Centre has the same status as the official versions.

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Contents

Foreword

This document (EN 405:2001+A1:2009) 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 November 2009, and conflicting national standards shall be withdrawn at the latest by November 2009.

This European Standard supersedes ⟦A1⟩ EN 405:2001 ⟨A1⟧.

This document includes Amendment 1, approved by CEN on 2009-03-26.

The start and finish of text introduced or altered by amendment is indicated in the text by tags ⟦A1⟩ ⟨A1⟧.

This draft European Standard 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 89/686/EEC.

For relationship with EU Directive, see informative Annex ZA, which is an integral part of this standard.

The annexes A and ZA are informative.

According to the CEN/CENELEC Internal Regulations, the national standards organizations of the following countries are bound to implement this European Standard: Austria, Belgium, Bulgaria, 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 the 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 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 the performance requirements, test methods and marking requirements for valved filtering half masks incorporating either gas or combined filters as respiratory protective devices except for escape purposes. It does not cover gas filtering half masks which do not have valves or are fitted only with exhalation valves. It does not cover devices designed for use in circumstances where there is or might be an oxygen deficiency (oxygen less than a volume fraction of 17 %).

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

2 Normative references

[A1] The following referenced documents are indispensable for the application of this document. For dated references, only the edition cited applies. For undated references, the latest edition of the referenced document (including any amendments) applies. [A1]

EN 132, *Respiratory protective devices - Definition of terms and pictograms*

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

[A1] *deleted text* [A1]

EN 143, *Respiratory protective devices - Particle filters - Requirements, testing, marking*

[A1] *deleted text* [A1]

[A1] EN 13274-7, *Respiratory protective devices – Methods of test – Part 7: Determination of particle filter penetration*

EN 14387, *Respiratory protective devices – Gas filter(s) and combined filter(s) - Requirements, testing, marking* [A1]

3 Terms and definitions

For the purposes of this European Standard the terms and definitions in EN 132 and the nomenclature given in EN 134 apply [A1] together with the following:

3.1
re-usable particle filtering component for valved combined filtering half mask
particle filtering component which is intended to be used for more than a single shift [A1]

4 Description

A valved filtering half mask covers the nose and mouth and the chin and has both inhalation and exhalation valves and

a) consists entirely or substantially of filter material or,

b) comprises a facepiece in which the gas filter(s) form(s) an inseparable part of the device and where particle filters can be replaceable.

It provides adequate sealing for the intended use on the face of the wearer against the ambient atmosphere, when the skin is dry or moist and when the head is moved.

Inhaled air enters through the filter material and through an inhalation valve(s). Exhaled air passes through an exhalation valve(s) to the ambient atmosphere.

Since the devices are discarded on depletion of the gas filter, it is not expected that replaceable components will be provided, e.g. valves or head harness.

In addition to providing protection against gases and vapours these devices can be designed to also protect against solid and liquid aerosols.

Gas filters remove specified gases and vapours. Combined filters remove dispersed solid and liquid particles and specified gases and vapours.

5 Classification

5.1 General

Gas and combined valved filtering half masks are classified into types and classes according to their application and protection capacity.

5.2 Types of gas filtering half masks

5.2.1 Valved gas filtering half masks

Type FFA — for use against certain organic gases and vapours with a boiling point higher than 65 °C as specified by the manufacturer.

Type FFB — for use against certain inorganic gases and vapours as specified by the manufacturer (excluding carbon monoxide).

Type FFE — for use against sulfur dioxide and other acid gases and vapours as specified by the manufacturer.

Type FFK — for use against ammonia and organic ammonia derivatives as specified by the manufacturer.

Type FFAX — for use against certain low boiling organic compounds as specified by the manufacturer.

Type FFSX — for use against specific named gases and vapours.

5.2.2 Valved multi-type gas filtering half masks

Gas valved filtering half masks which are a combination of two or more of the above types and which meet the requirements of each type separately.

5.2.3 Valved combined filtering half masks

Gas or multi-type valved gas filtering half masks incorporating a particle filter. [A1] In addition, the particle filtering component of the half masks are classified as single shift use only or re-usable (more than one shift). [A1]

5.3 Designs of combined valved filtering half masks

There are two designs of valved combined filtering half masks described in this European Standard: one with integral particle filter(s), the second one with replaceable particle filter(s). Examples of classifications are:

[A1] FFA1P1 NR D; FFA1P2 R D. [A1]

„D“ stands for optional clogging with dolomite.

5.4 Classes of valved gas filtering half masks

Valved filtering half masks may incorporate gas filters of types listed in 5.2.1 or 5.2.2, belonging to one of the two following classes relating to their capacity:

Class 1 — low capacity FFGas1 filtering half mask e.g. FFA1;

Class 2 — medium capacity FFGas2 filtering half mask e.g. FFB2.

The protection provided by Class 2 devices includes that provided by the corresponding Class 1 device of the same type.

FFAX and FFSX devices are not classified in accordance with this clause.

6 Designation

Valved filtering half masks meeting the requirements of this European Standard shall be designated in the following manner:

[A1] Valved filtering half mask EN 405, year of publication, type, classification, option (where "D" is an option for a non re-useable particle filtering component and mandatory for re-useable particle filtering component).

EXAMPLE Valved filtering half mask EN 405:2001 FFA2P3 NR D [A1]

7 Requirements

7.1 General

In all tests, all test samples shall meet the requirements.

7.1.1 Materials used shall be suitable to withstand handling and wear over the period for which the valved filtering half mask is designed to be used.

Testing shall be done in accordance with 8.4.

After undergoing the treatment described in 8.3.2 and 8.3.3 none of the devices shall collapse or shall have suffered mechanical failure of the facepiece body or straps.

7.1.2 Any material of the filter media or any gaseous products that may be released by the airflow through the filter shall not be known to constitute a hazard or nuisance for the wearer.

Testing shall be done in accordance with 8.2.

7.1.3 [A1] If the valved filtering half mask is designed to be re-usable, the materials used shall withstand the cleaning and disinfecting agents and procedures to be specified by the manufacturer.

With reference to 7.7.1, for valved filtering half mask with non separable particle filters, after cleaning and disinfecting the re-usable valved filtering half mask shall satisfy the penetration requirement of the relevant class.

Testing shall be done in accordance with 7.7.1 using EN 13274-7.

NOTE Separable filters are not subjected to cleaning and disinfecting. [A1]

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 limit deviation 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 a limit deviation of ± 1 °C.

7.3 Visual inspection

The visual inspection shall also include the marking and information supplied by the manufacturer.

7.4 Packaging

Valved filtering half masks shall be offered for sale packaged in such a way that they are protected against mechanical damage and contamination before use.

They shall be factory sealed to protect the filter media against environmental influences in such a way, that the breaking of the factory sealing can be identified.

Testing shall be done in accordance with 8.2.

7.5 Practical performance

The device shall undergo practical performance tests under realistic conditions. These general tests serve the purpose of checking the equipment for imperfections that cannot be determined by the tests described elsewhere in this European Standard.

Where practical performance tests show the apparatus has imperfections related to wearer's acceptance, the test house shall provide full details of those parts of the practical performance tests which revealed these imperfections.

Testing shall be done in accordance with 8.4.

7.6 Leakage

When the valved filtering half mask is tested in accordance with 8.5, the values of inward leakage (total inward leakage excluding filter penetration) shall comply with the following.

At least 46 out of the 50 individual results for the inward leakage over each of the exercise periods as defined in 8.5 (i.e. 10 subjects $\times$ 5 exercise periods) shall be not greater than 5 %.

In addition, at least 8 out of the 10 individual wearer arithmetic means of measured values (10 subjects) for the inward leakage, averaged over all exercise periods shall be not greater than 2 %.

Testing shall be done in accordance with 8.5.

7.7 Filter penetration/capacity

7.7.1 Particle filter penetration

For all devices the penetration of the particle filter of the valved filtering half mask, whether with integral or separable filters, shall meet the requirements given in Table 1.

Table 1 — Particle filter penetration

Classification	Maximum initial penetration of test aerosols at 95 l/min	
	Sodium chloride %	Paraffin oil %
FFGasP1	20	20
FFGasP2	6	6
FFGasP3	1	1

[A1] A total of 6 samples of valved combined filtering half masks shall be tested for each aerosol.

The Penetration test according to EN 13274-7 shall be performed on:

- 3 samples as received.

The Exposure test with a specified mass of test aerosol of 120 mg, and for valved filtering half mask claimed to be re-usable additionally the Storage test, according to EN 13274-7, shall be performed:

- for non-re-usable devices on:

  - 3 samples after the test for mechanical strength in accordance with 8.3.4 followed by temperature conditioning in accordance with 8.3.3.

- for re-usable devices on:

  - 3 samples after the test for mechanical strength in accordance with 8.3.4 followed by temperature conditioning in accordance with 8.3.3 and followed by one cleaning and disinfecting cycle according to the manufacturer's instruction. [A1]

Separable particle filters, other than prefilters, designed to be used additionally with devices other than devices according to this standard shall meet the requirements of EN 143.

7.7.2 Gas filtering capacity

7.7.2.1 When tested in accordance with 8.6 the devices shall meet the requirements given in Table 2 for minimum breakthrough times for FFGas1 and/or FFGas2 devices and/or the requirements of [A1] EN 14387 [A1].

Table 2 — Gas filtering capacity

Classification	Test agent	Test gas concentration in air		Breakthrough concentration	Minimum breakthrough time
		% by volume	mg/l	ml/m^3	min
FFA1	Cyclohexane (C_6H_{12})	0,1	3,5	10	70
FFB1	Chlorine (Cl_2)	0,1	3,0	0,5	20
	Hydrogen sulfide (H_2S)	0,1	1,4	10	40
	Hydrogen cyanide (HCN)	0,1	1,1	10[a]	25
FFE1	Sulfur dioxide (SO_2)	0,1	2,7	5	20
FFK1	Ammonia (NH_3)	0,1	0,7	25	50
FFA2	Cyclohexane (C_6H_{12})	0,5	17,5	10	35
FFB2	Chlorine (Cl_2)	0,5	15,0	0,5	20
	Hydrogen sulfide (H_2S)	0,5	7,1	10	40
	Hydrogen cyanide (HCN)	0,5	5,6	10[a]	25
FFE2	Sulfur dioxide (SO_2)	0,5	13,3	5	20
FFK2	Ammonia (NH_3)	0,5	3,5	25	40

NOTE The minimum breakthrough time is intended only for laboratory tests under standardized conditions. It does not give an indication of the possible service time in practical use. Possible service times can differ from the breakthrough times determined according to this European Standard in both directions positive or negative depending on the conditions of use.

[a] C_2N_2 may sometimes be present in the effluent air. The total concentration of (C_2N_2 + HCN) shall not exceed 10 ml/m^3.

7.7.2.2 Where a device is a combination of types, it shall meet the requirements of each type separately.

7.7.2.3 Test requirements shall apply to the capacity of the complete device.

7.8 Finish of parts

Parts of the device likely to come into contact with the wearer shall have no sharp edges or burrs.

Testing shall be done in accordance with 8.2.

7.9 Inhalation and exhalation valves

7.9.1 Inhalation valve(s) and exhalation valve(s) shall function correctly in all orientations.

Testing shall be done in accordance with 8.9.

7.9.2 Exhalation valve(s) shall be protected against or be resistant to dirt and mechanical damage. They may be shrouded or may include any other device that may be necessary to comply with 7.6.

Testing shall be done in accordance with 8.2.

7.9.3 Exhalation valve(s) shall continue to operate correctly after a continuous exhalation flow of 300 l/min over a period of 30 s.

Testing shall be done in accordance with 8.9.

7.9.4 The exhalation valve housing shall show no signs of damage or of being loosened.

Testing shall be done in accordance with 8.10.

7.10 Breathing resistance

7.10.1 General

The breathing resistances of the various classes of valved gas and combined filtering half masks shall meet the requirements of 7.10.2 and 7.10.3.

7.10.2 Inhalation resistance

7.10.2.1 Valved gas filtering half masks

When tested in accordance with 8.9 the inhalation resistance shall meet the requirements given in Table 3.

Table 3 — Inhalation resistance: valved gas filtering half masks

Classification	Maximum inhalation resistance mbar	
	30 l/min	95 l/min
FFGas1	1,0	4,0
FFGas2	1,4	5,6
FFAX	1,4	5,6
FFSX	1,4	5,6

7.10.2.2 Valved combined filtering half masks

When tested in accordance with 8.9, the inhalation resistance of all devices, whether with separable or integral particle filters, shall meet the requirements given in Table 4.

Table 4 — Inhalation resistance: valved combined filtering half masks

Classification	Maximum inhalation resistance mbar	
	30 l/min	95 l/min
FFGas1P1	1,6	6,1
FFGas1P2	1,7	6,4
FFGas1P3	2,0	7,0
FFGas2P1	2,0	7,7
FFGas2P2	2,1	8,0
FFGas2P3	2,4	8,6
FFAXP1	2,0	7,7
FFAXP2	2,1	8,0
FFAXP3	2,4	8,6
FFSXP1	2,0	7,7
FFSXP2	2,1	8,0
FFSXP3	2,4	8,6

7.10.3 Exhalation resistance

When tested in accordance with 8.9, the exhalation resistance of the valved gas or combined filtering half mask shall not exceed 3 mbar.

7.11 Clogging

7.11.1 General

This test is applicable to all valved combined filtering half masks. For [A1] single shift use [A1] devices only, the clogging test is optional.

7.11.2 Devices with separable particle filters

Where the particle filters of devices with separable particle filters are claimed only to meet this standard, the filters shall meet the requirements of 7.11.3.

Where the particle filters of devices with separable particle filters are additionally claimed to meet EN 143, the filters shall additionally meet the respective requirements of EN 143.

Testing shall be done in accordance with 8.9 and EN 143.

7.11.3 Devices with integral or separable particle filters

Where devices with integral or separable particle filters are claimed to meet clogging performance requirements they shall be subjected to the dolomite dust clogging procedure given in EN 143. The breathing resistance shall then be measured in accordance with 8.9 and the device shall meet the requirements given in Table 5 and 7.11.4. The filter penetration shall not exceed the values given in Table 1.

[A1] Valved combined filtering half masks claimed to meet the clogging requirement shall also meet the requirements given in Table 1, for the Penetration test according to EN 13274-7, after the clogging treatment. [A1]

Table 5 — Inhalation resistance

Classification	Maximum inhalation resistance at 95 l/min mbar
FFGas1P1	8,0
FFGas1P2	9,0
FFGas1P3	9,8
FFGas2P1	9,6
FFGas2P2	10,6
FFGas2P3	11,4
FFAXP1	9,6
FFAXP2	10,6
FFAXP3	11,4
FFSXP1	9,6
FFSXP2	10,6
FFSXP3	11,4

Testing shall be done in accordance with 8.9 ▌A1⟩ ,EN 143 and EN 13274-7 ⟨A1▌.

7.11.4 Exhalation resistance

When tested in accordance with 8.9 the exhalation resistance of a valved combined filtering half mask with either separable or integral particle filters shall not exceed 3,0 mbar.

7.12 Compatibility with skin

Materials that may come into 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 8.2, 8.4 and 8.5.

7.13 Flammability

The materials used shall not present a danger for the wearer and shall not be of highly flammable nature.

When tested in accordance with 8.7 a valved filtering half mask shall either not burn or not continue to burn for more than 5 s after removal from the flame.

It is not required that the valved filtering half mask still has to be useable after the test.

Testing shall be done in accordance with 8.7.

7.14 Carbon dioxide content of the inhalation air

When tested in accordance with 8.8 the carbon dioxide content of the inhalation air (dead space) shall not exceed an average of a volume fraction of 1,0 %.

7.15 Head harness

7.15.1 The head harness shall be designed so that the valved filtering half mask can be donned and removed easily.

Testing shall be done in accordance with 8.4.

7.15.2 The head harness shall be adjustable or self-adjusting and shall be sufficiently robust to hold the valved filtering half mask firmly in position and be capable of maintaining inward leakage requirements for the device.

Testing shall be done in accordance with 8.4 and 8.5.

7.16 Field of vision

The field of vision is acceptable if determined so in practical performance tests.

Testing shall be done in accordance with 8.4.

7.17 Demountable parts

All demountable parts (if fitted) shall be readily connected and secured, where possible by hand.

Testing shall be done in accordance with 8.2 and 8.4.

8 Testing

8.1 General

All samples shall fulfill all requirements.

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.

NOTE For summary of testing see Table 6.

8.2 Visual inspection

The visual inspection shall be carried out where appropriate by the test station prior to laboratory or practical performance tests.

8.3 Conditioning

8.3.1 General

Where conditioning is required before subsequent testing the procedures used shall be one or more of those described in 8.3.2, 8.3.3, 8.3.4 as specified in Table 6.

Devices shall be removed from their packaging but still be sealed.

8.3.2 Donning and doffing

The wearers shall fit the valved filtering half mask in accordance with the manufacturer's information and then remove it.

8.3.3 Temperature

The valved filtering half masks as received shall be exposed to the following thermal cycle:

a) for 24 h to a dry atmosphere at (70 ± 3) °C;

b) for 24 h to a temperature of (–30 ± 3) °C

and allowed to return to room temperature for at least 4 h between exposures and prior to subsequent testing.

The conditioning shall be carried out in a manner which ensures that no thermal shock occurs.

8.3.4 Mechanical strength

8.3.4.1 Apparatus

The apparatus as 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 to 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 mass of the steel plate onto which the steel case falls should be at least 10 times the mass of the steel case. This may be achieved by bolting the steel plate to a hard floor without dampening elements.

8.3.4.2 Procedure

The valved filtering half mask shall be tested in the sealed condition as described in 7.4.

The devices shall be placed vertically in the case (K) so that the sealed packages do not touch each other during the test, allowing 6 mm horizontal movement and free vertical movement. The test apparatus shall be operated at the rate of approximately 100 min^{-1} for approximately 20 min and a total of 2 000 rotations. After the test, any loose material that may have been released from the device shall be removed prior to the performance testing.

8.4 Practical performance

8.4.1 General

A total of 2 valved filtering half masks shall be tested: both as received.

Prior to the test the valved filtering half masks shall be examined to ensure that they are in good working order and can be used without hazard.

All tests shall be carried out by two test subjects at ambient temperature and the test temperature and humidity shall be recorded.

For the test, persons shall be selected who are familiar with using such or similar equipment.

During the tests, the valved filtering half mask shall be subjectively assessed by the wearer and, after the test, comments on the following shall be recorded:

a) head harness comfort;

b) security of fastenings;

c) field of vision;

d) any other comments reported by the wearer on request.

8.4.2 Walking test

The subjects wearing normal working clothes and wearing the valved filtering half mask shall walk at a regular rate of 6 km/h on a level course. The test shall be continuous, without removal of the valved filtering half mask, for a period of 10 min.

8.4.3 Work simulation test

During this test the following activities shall be carried out in simulation of the practical use of the valved filtering half mask. The test shall be completed within a total working time of 20 min.

The sequence of activities is at the discretion of the testofficer. The individual activities shall be arranged so that sufficient time is left for the comments prescribed.

a) Walking on the level with headroom of (1,3 ± 0,2) m for 5 min;

b) Crawling on the level with headroom of (0,70 ± 0,05) m for 5 min;

c) Filling a small basket (see Figure 2, approximate volume = 8 l) with chippings or other suitable material from a hopper which stands 1,5 m high and has an opening at the bottom to allow the contents to be shovelled out and a further opening at the top where the basket full of chippings shall be returned. The subject shall stoop or kneel (as desired) and fill the basket with chippings. The test subject shall then lift the basket and empty the contents back into the hopper. This shall be done 20 times in 10 min.

8.5 Inward Leakage

8.5.1 General

A total of 10 samples shall be tested: five in the state as received and five after temperature conditioning in accordance with 8.3.3.

The samples, depending upon design, can require modification in order to ensure that the measurements taken, are those corresponding to faceseal leakage. This is done by modifying the test sample (as per examples provided in 8.5.6) to ensure that any contribution to inward leakage, attributable to filter penetration, will be negligible.

The test arrangement and the test procedure are common to both test agents.

8.5.2 Principle

A test subject wearing a device conditioned as specified, walks at a specified speed on a horizontal treadmill surrounded by an atmosphere containing a known concentration of a test agent. The percentage inward leakage of the test agent into the breathing zone is measured.

Two methods are specified, namely, one using sodium chloride and the other sulphur hexafluoride. The general principle of the test is the same.

Dilution of the test atmosphere by clean air emanating from the device under test does not affect the accuracy of the measurement of leakage because of the large volume and continuous replacement of the test atmosphere.

8.5.3 Apparatus

8.5.3.1 Enclosure

An enclosure shall be positioned over a treadmill and shall be capable of being charged with the test agent, which preferably enters the top of the enclosure via a duct and flow distributor and shall be directed downwards over the head of the test subject. The concentration of the test agent inside the effective working volume shall be checked to ensure it is homogeneous. The enclosure shall be large enough to permit walking on the treadmill without interference.

The air velocity through the enclosure measured close to the test subject's head, with the test subject standing centrally on the treadmill shall be 0,1 m/s to 0,2 m/s.

The design of the enclosure shall be such that the device worn by the test subject can be supplied if necessary with breathable air (free of the test agent).

It is important that the attachment of the hose supplying clean air does not affect the fit of the device on the test subject nor should its fitting replace any seals incorporated in the device under test. If necessary the hose can be supported.

8.5.3.2 Treadmill

A level treadmill capable of working at 6 km/h.

8.5.3.3 Sampling probe

The probe shall be fitted securely in an airtight manner to the device as near as possible to the centre line of the device. A multiple hole sampling probe is strongly recommended. For the method using sodium chloride measures shall be taken to prevent the influence of condensation in the sampling probe on the measurement by supplying dry air. Figure 5 shows a design that has been found suitable. The probe is adjusted so that it just touches the wearer's lips.

8.5.3.4 Detection systems

The detection system including sampling probes and connections shall have a response time of less than 20 s for a response of 10 % to 90 % of the full scale deflection of the indicator used.

8.5.4 Conditioning and number of test samples

10 samples shall be tested: five in the state as received and five after temperature conditioning in accordance with 8.3.3.

8.5.5 Test subjects

Test subjects shall be selected from persons who are familiar with using such or similar equipment.

A panel of ten clean-shaven persons (without beards or sideburns) shall be selected covering the spectrum of facial characteristics of typical users (excluding significant abnormalities). It is to be expected that exceptionally some persons cannot be satisfactorily fitted with a device. Such exceptional subjects shall not be used in this test. In the test report, the faces of the ten test subjects shall be described (for information only) by the four facial dimensions (in millimetres) illustrated in Figure 6.

8.5.6 Preparation of samples

8.5.6.1 General

The procedures described in 8.5.6.2 and 8.5.6.3 provide ways in which devices can be prepared for face seal leakage measurements. The procedure in 8.5.6.2 involves the use of integral or separable P3 filters and utilizes a total inward leakage method; that in 8.5.6.3 involves the provision of a supply of clean air to the device and utilizes a face seal leakage method.

8.5.6.2 Devices with integral or separable P3 filters

If the device is equipped with high efficiency particle filter(s) or available with optional high efficiency particle filters, and the facepiece elements are common throughout the range, this option may be used to test (provided that the mass and breathing resistance is consistent with the worst case arrangement) without further modification to provide the face seal leakage results required.

Alternatively, it may be possible to bond/attach high efficiency particle filters to the filter area(s) - possibly by their attachment to the plenum housing described in 8.5.6.3.1. This "surrogate" device shall then be used for testing.

When the device is not ordinarily available with high efficiency particle filters, the total resistance and mass of the "surrogate" device shall be adjusted to match that of the original device.

8.5.6.3 Devices tested with supply of clean air

8.5.6.3.1 Attachment of air supply plenums

Lightweight hose(s) and plenum cap(s) shall be attached to the filter element(s) of the device and fresh air supplied to it at a flow resistance (including hoses) representative of that measured for the unmodified device.

It shall be ensured that the plenum does not affect the "flexibility" of the device.

It shall be ensured that exhalate escapes outside plenum area(s).

It shall be ensured that any air supply system shall not obscure possible leakages attributable to connections between filter holder and faceblank. If this is not possible these leakages have to be assessed during filter performance testing.

8.5.6.3.2 Sealing of exposed filter surface

The surface of the filtering area(s) can be sealed with "flexible" sealant. The sealed filtering area(s) can then be penetrated to allow clean air to be supplied via lightweight hoses, as in 8.5.6.3.1. The mass of filter removed shall be compensated for if it is more than 5 % of the mass of the device.

8.5.7 Test procedure

8.5.7.1 The test subjects shall be asked to read the manufacturer's fitting instructions and if necessary shall be shown how to fit the device correctly in accordance with the fitting instructions. If more than one size of device is available, the test subjects shall be asked to select the size deemed by them to be the most appropriate.

8.5.7.2 The test subjects shall be informed that if they wish to adjust the device during the test they may do so. However, if this is done the relevant section of the test shall be repeated having allowed the system to re-settle.

8.5.7.3 After fitting the device the test subject shall be asked "Does the device fit?". If the answer is "Yes", the test shall be continued. If the answer is "No", the test subject shall be taken off the panel, and replaced with another test subject and the fact reported.

8.5.7.4 It shall be ensured that the test subjects have no indication of the results as the test proceeds.

8.5.7.5 It shall be ensured that the test atmosphere is OFF.

8.5.7.6 The test subject shall be placed in the enclosure. The sampling probe shall be connected up. The test subject shall walk at 6 km/h for 2 min. The concentration of the test agent shall be measured inside the device to establish the background level.

8.5.7.7 It shall be waited until a stable reading is obtained.

8.5.7.8 The test atmosphere shall be turned ON.

8.5.7.9 The test subject shall be instructed to continue to walk for a further 2 min or until the test atmosphere has stabilized.

8.5.7.10 Whilst still walking the test subject shall perform the following exercises:

a) walking without head movement or talking for 2 min;

b) turning head from side to side (approximately 15 times), as if inspecting the walls of a tunnel for 2 min;

c) moving head up and down (approximately 15 times), as if inspecting the ceiling and floor for 2 min;

d) reciting the alphabet or an agreed text out loud as if communicating with a colleague for 2 min;

e) walking without head movement or talking for 2 min.

8.5.7.11 Record

a) chamber concentration, and

b) the concentration of test agent in the breathing zone of the device over each exercise period.

8.5.7.12 The test atmosphere shall be turned off and when the test agent has cleared from the chamber the test subject shall be removed.

8.5.7.13 The procedure shall be repeated with the next test subject and a new sample.

8.5.8 Test using sulfur hexafluoride as test agent

8.5.8.1 Apparatus

The general arrangement is shown in Figure 11.

8.5.8.1.1 Test agent

Sulphur hexafluoride.

It is recommended that a test atmosphere concentration between a volume fraction of 0,1 % and 1 % should be used. Accurate determinations of leakage with appropriate instruments are possible within the range from 0,01 % to approximately 20 % dependent on the test challenge concentration.

8.5.8.1.2 Detection means

The concentration of sulphur hexafluoride in the test atmosphere and inside the facepiece of the device is measured and recorded by suitable instruments ensuring that the response time for the detection system complies with 8.5.3.4.

8.5.8.1.3 Sampling rate

The sampling is continuous at a rate up to 3 l/min.

8.5.8.2 Atmospheric conditions for test

The test is performed at ambient temperature and humidity.

8.5.8.3 Procedure

The procedure specified in 8.5.7 shall be used.

8.5.8.4 Calculation of inward leakage

The inward leakage (P) is calculated from measurements made over the last 100 s of each of the exercise periods to avoid carry over of results from one exercise to the other.

The value of P, expressed as a percentage, is calculated from the equation:

$$P\ (\%) = \frac{C_2}{C_1} \times 100$$

where

C_1 is the challenge concentration;

C_2 is the measured mean concentration in the breathing zone of the test subject.

Measurement C_2 is taken via an integrating recorder, or equivalent.

8.5.9 Test using sodium chloride as test agent

8.5.9.1 Apparatus

The general arrangement is shown in Figure 9.

8.5.9.1.1 Aerosol generator

The sodium chloride aerosol is generated from a 2 % solution of reagent grade sodium chloride in distilled water. A single large Collison atomiser (Figure 4) is used. This requires an airflow rate of 100 l/min at a pressure of 7 bar. The atomiser and its housing are fitted into a duct through which a constant flow of air is maintained. It may be necessary to heat or dehumidify the air in order to obtain complete drying of the aerosol particles.

The mean sodium chloride concentration within the enclosure shall be (8 ± 4) mg/m³ and the variation throughout the effective working volume shall not be more than 10 %. The particle size distribution shall be 0,02 µm to 2 µm equivalent aerodynamic diameter with a mass median diameter of 0,6 µm.

8.5.9.1.2 Flame photometer

A flame photometer is used to measure the concentration of sodium chloride inside the facepiece. Essential performance characteristics for a suitable instrument are as follows:

a) it shall be specifically designed for the direct analysis of sodium chloride aerosol;

b) it shall be capable of measuring concentrations of NaCl aerosol between 15 mg/m³ and 5 ng/m³;

c) the total aerosol sample volume flow rate required by the photometer should not be greater than 15 l/min;

d) the response time of the photometer, excluding the sampling system, shall not be greater than 500 ms;

e) the response to other elements needs to be reduced. This applies, particularly to carbon, the concentration of which will vary during the breathing cycle. The reduced response can be achieved by ensuring that the band pass width of the interference filter is not greater than 3 nm and that all necessary side-band filters are included.

8.5.9.1.3 Sample selector

The sample is switched to the photometer only during the inhalation phase of the respiratory cycle. During the exhalation phase, clean air shall be fed to the photometer. The essential elements of such a system are:

a) an electrically operated valve with a response time of the order of 100 ms. The valve should have the minimum possible dead space compatible with straight-through, unrestricted flow when open;

b) a pressure sensor capable of detecting a minimum pressure change of approximately 0,05 mbar and which can be connected to a probe inserted in the cavity of the device. The sensor shall have an adjustable threshold and be capable of differential signalling when the threshold is crossed in either direction. The sensor shall work reliably when subjected to the accelerations produced by the head movements of the subject;

c) an interfacing system to actuate the valve in response to a signal from the pressure sensor;

d) a timing device to record the proportion of the total respiratory cycle during which sampling took place.

8.5.9.1.4 Sampling probe

The probe similar to that specified in 8.5.3.3 shall be used.

8.5.9.1.5 Sample pump

If no pump is incorporated into the photometer, an adjustable flow pump shall be used to withdraw an air sample from the half mask under test. This pump shall be so adjusted as to withdraw a constant flow of 2 l/min from the sample probe. However, 1 l/min of drying air is fed to the probe. The resultant is a sample flow of 1 l/min from the half mask.

8.5.9.1.6 Sampling means for enclosure concentration

The enclosure aerosol concentration shall be monitored during the tests using a separate sampling system, to avoid contamination of the half mask sampling lines. It is preferable to use a separate flame photometer for this purpose.

If a second photometer is not available, sampling of the enclosure concentration using a separate sampling system and the same photometer can be made. However, time will then be required to allow the photometer to return to a clean background.

8.5.9.1.7 Pressure detection probe

Fitted near to the sampling probe and used to operate the sampling system in the inhalation phase only.

8.5.9.2 Atmospheric conditions for test

The test is performed at ambient temperature and a relative humidity of not greater than 60 %.

8.5.9.3 Procedure

The procedure specified in 8.5.7 shall be used.

8.5.9.4 Calculation of inward leakage

The leakage (P) is calculated from measurements made over the last 100 s of each of the exercise periods to avoid carry over of results from one exercise to another.

The value of P, expressed as a percentage, is calculated from the equation:

$$P\ (\%) = \frac{C_2}{C_1} \times \left(\frac{t_{IN} + t_{EX}}{t_{IN}} \right) \times 100$$

where

C_1 is the challenge concentration;

C_2 is the mean concentration in the breathing zone of the device under test;

t_{IN} is the total duration of inhalation;

t_{EX} is the total duration of exhalation.

Measurement of C_2 is preferably made using an integrating recorder.

8.6 Gas filtering capacity

All performance tests shall be conducted, so that the test gas or air will pass through the filter horizontally.

Three test samples shall be used for each test gas. The test samples shall be conditioned using the procedures specified in Table 6.

The samples shall be clamped and sealed to a suitable adapter without influencing the effective surface. The exhalation valve shall be sealed.

Any experimental method may be employed for obtaining the specified influent concentration, and for measuring the effluent concentration, provided it conforms to the following limits:

Influent concentration within ± 10 % of specified value;

Effluent concentration within ± 20 % of specified value.

The recorded breakthrough time shall be adjusted if necessary by simple proportion to conform with the specified influent concentration.

Protection capacity (minimum breakthrough time) shall be measured at a flow rate of (30 ± 0,5) l/min, at (70 ± 2) % relative humidity and at (20 ± 1) °C.

8.7 Flammability

A total of four valved filtering half masks shall be tested: two in the state as received and two after temperature conditioning in accordance with 8.3.3.

The single burner test is carried out according to the following procedure.

The facepiece is put on a metallic dummy head which is motorized such that it describes a horizontal circle with a linear speed, measured at the tip of the nose, of (60 ± 5) mm/s.

The head is arranged to pass over a propane burner the position of which can be adjusted. By means of a suitable gauge, the distance between the top of the burner, and the lowest part of the facepiece (when positioned directly over the burner) shall be set to (20 ± 2) mm.

A burner described in ISO 6941 has been found suitable.

With the head turned away from the area adjacent to the burner, the propane gas is turned on, the pressure adjusted to between 0,2 bar and 0,3 bar and the gas ignited. By means of a needle valve and fine adjustments to the supply pressure, the flame heigt shall be set to (40 ± 4) mm. This is measured with a suitable gauge. The temperature of the flame measured at a height of (20 ± 2) mm above the burner tip by means of a 1,5 mm diameter mineral insulated thermocouple probe, shall be (800 ± 50) °C.

Failure to meet the temperature requirement indicates that a fault such as a partially blocked burner exists. This shall need to be rectified.

The head is set in motion and the effect of passing the facepiece once through the flame shall be noted.

The test shall be repeated to enable an assessment to be made of all materials on the exterior of the device. Any one component shall be passed through the flame once only.

8.8 Carbon dioxide content of the inhalation air

The apparatus consists essentially of a breathing machine with solenoid valves controlled by the breathing machine, a connector, a CO_2 flow meter and CO_2 analyser.

The apparatus shall subject the valved filtering half mask to a respiration cycle by the breathing machine.

For this test the valved filtering half mask is fitted securely in a leak-tight manner but without deformation on a Sheffield dummy head (see Figure 8). If necessary, the valved filtering half mask may be sealed to the dummy head with e.g. PVC tape or other suitable sealants. The insert for measuring the breathing resistance shall not be used for this test.

Air shall be supplied to it from a breathing machine adjusted to 25 cycles/min and 2,0 l/stroke and the exhaled air shall have a carbon dioxide content with a volume fraction of 5 %.

A typical test arrangement is shown in Figure 7.

If the design of the test equipment causes a carbon dioxde build-up, a carbon dioxide absorber shall be used in the inhalation branch between solenoid valve and breathing machine.

The CO_2 is fed into the breathing machine via a control valve, a flow meter, a compensating bag and two non-return valves.

Immediately before the solenoid valve a small quantity of exhaled air is preferably continuously withdrawn through a sampling line and then fed into the exhaled air via a CO_2 analyser.

To measure the CO_2 content of the inhaled air, 5 % of the stroke volume of the inhalation phase of the breathing machine is drawn off at the marked place by an auxiliary lung and fed to a CO_2 analyser. The total dead space of the gas path (excluding the breathing machine) of the test installation should not exceed 2 000 ml.

The carbon dioxide content of the inhaled air shall be measured and recorded continuously.

Test conditions are ambient atmospheric conditions.

The ambient carbon dioxide level is measured 1 m in front of and level with the tips of the nose of the dummy head. The ambient level is measured once a stabilized level for carbon dioxide in the inhalation air has been attained. Alternatively, the ambient level of carbon dioxide may be measured at the sampling tube with the carbon dioxide supply turned off. Results are deemed acceptable only if the measured value of the ambient level of carbon dioxide is less than 0,1 %.

The laboratory ambient carbon dioxide level shall be subtracted from the measured value.

The air flow from the front shall be 0,5 m/s.

For test arrangement see Figure 9.

The test shall be performed until a constant carbon dioxide content in the inhalation air is achieved.

8.9 Breathing resistance

A total of 9 valved filtering half masks shall be tested: 3 as received, 3 after temperature conditioning in accordance with 8.3.3, and 3 after the test for mechanical strength in accordance with 8.3.4.

The valved filtering half mask shall be fitted securely in a leak-tight manner but without deformation on the Sheffield dummy head. The exhalation resistance shall be measured at the opening for the mouth of the dummy head using the adapter shown in Figure 8 and a breathing machine adjusted to 25 cycles/min and 2,0 l/stroke or a continuous flow of 160 l/min. A suitable pressure transducer shall be used.

The inhalation resistance shall be tested at 30 l/min and 95 l/min continuous flow.

The flow rate at which the resistance is measured shall be corrected to 23 °C and 1 bar absolute.

Measure the exhalation resistance with the dummy head successively placed in 5 defined positions:

1) facing directly ahead;

2) facing vertically upwards;

3) facing vertically downwards;

4) lying on the left side;

5) lying on the right side.

8.10 Strength of attachment exhalation valve housing

Clamp the valved filtering half mask as shown in Figure 10 and apply a load of 10 N for 10 s. Examine the housing for signs of damage or loosening from its mounting on the valved filtering half mask.

9 Marking

9.1 Packaging

The following information shall be clearly and durably marked on the smallest commercially available packaging or be legible through it if the packaging is transparent.

9.1.1 The name, trademark or other means of identification of the manufacturer or supplier.

9.1.2 Type-identifying marking.

9.1.3 Type, class, option (letter „D“).

9.1.4 The number and year of this European Standard.

9.1.5 At least the year of end of shelf life. The end of shelf life may be informed by a pictogram as shown in Figure 12b, where yyyy/mm indicates the year and month.

9.1.6 The sentence “see information supplied by the manufacturer” at least in the official language(s) of the country of destination or by using the pictogram shown in Figure 12a.

9.1.7 The manufacturer’s recommended conditions of storage (at least temperature and humidity) or equivalent pictogram as shown in Figures 12c and 12d.

9.2 Valved gas filtering half mask with separable particle filters

9.2.1 Valved gas filtering half mask

The valved gas filtering half mask shall be clearly and durably marked with the following information.

9.2.1.1 The name, trademark or other means of identification of the manufacturer or supplier.

9.2.1.2 Type-identifying marking.

9.2.1.3 The symbols according to type and class — for example FFA1.

9.2.1.4 The number and year of this European Standard.

9.2.1.5 Sub-assemblies and components with considerable bearing on safety shall be marked so that they can be identified (see annex A).

9.2.1.6 The use of colour coding on the device to indicate filter type(s) is optional. If a colour code is used it shall be in accordance with ⟦A1⟩ EN 14387 ⟦A1⟧.

9.2.2 Separable particle filters

Filters meeting this standard shall be clearly and durably marked with the following information. Filters additionally meeting EN 143 shall be dual marked in accordance with EN 143 and this standard (as follows):

9.2.2.1 The name, trademark or other means of identifying the manufacturer or supplier.

9.2.2.2 The type-identifying marking.

9.2.2.3 [A1] The appropriate type and class of the separable particle filter, followed by a single space and then:

- "NR" if it is limited to single shift use only. Example: FFGasP1 NR, or

- "R" if it is re-usable. Example: FFGasP3 R D. [A1]

9.2.2.4 The number and year of this European Standard.

9.2.2.5 If appropriate the letter „D" signifying compliance with the clogging requirement which shall form part of the type and class designation 9.2.2.3. [A1] This letter shall follow the classification marking preceded by a single space. [A1]

[A1] Example FFGasP1 NR D [A1]

9.2.2.6 Sub-assemblies and components with considerable bearing on safety shall be marked so that they can be identified (see annex A).

9.3 Valved gas filtering half masks with integral particle filters

The valved filtering half mask shall be clearly and durably marked with the following information:

9.3.1 The name, trademark or other means of identifying the manufacturer or supplier.

9.3.2 The type-identifying marking.

9.3.3 [A1] The appropriate type and class of the valved gas filtering half mask with integral particle filter(s), followed by a single space and then:

- "NR" if the particle filter part is limited to single shift use only. Example: FFA1P1 NR, or

- "R" if the particle filter part is re-usable. Example: FFAB2E1K2P3 R D. [A1]

9.3.4 The number and year of this European Standard.

9.3.5 If appropriate the letter „D" signifying compliance with the clogging requirement, which shall form part of the type and class designation in 9.3.3. [A1] This letter shall follow the classification marking preceded by a single space. [A1]

[A1] Example FFA1B2P1 NR D [A1]

9.3.6 Sub-assemblies and components with considerable bearing on safety shall be marked so that they can be identified (see annex A).

9.3.7 The use of colour coding on the device to indicate filter type(s) is optional. If a colour is used it shall be in accordance with [A1] EN 14387 [A1] as appropriate.

10 Information supplied by the manufacturer

10.1 Information supplied by the manufacturer shall accompany every smallest commercially available package of valved filtering half masks and compatible filters as appropriate.

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

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

— which type(s) of filter(s) are to be used with which valved gas filtering half mask;

— application/limitation:

  — [A1] *deleted text* [A1]

  — whether or not the device with does or does not meet clogging requirements;

— checks prior to use;

— donning, fitting;

— use;

— cleaning and disinfecting, if applicable;

— maintenance;

— storage;

— the meaning of any symbols/pictograms;

of the equipment used.

10.4 The information for use shall be clear and comprehensible. If helpful, illustrations, part numbers, marking shall be added.

10.5 Warnings shall be given concerning problems likely to be encountered, for example

— fit of valved filtering half mask (specify method of check prior to use);

— it is unlikely that the requirements for leakage will be achieved if facial hair passes under the face seal;

— air quality (contaminants and oxygen deficiency);

— use of equipment in explosive atmosphere;

— whether or not the device uses colour to indicate filter type(s).

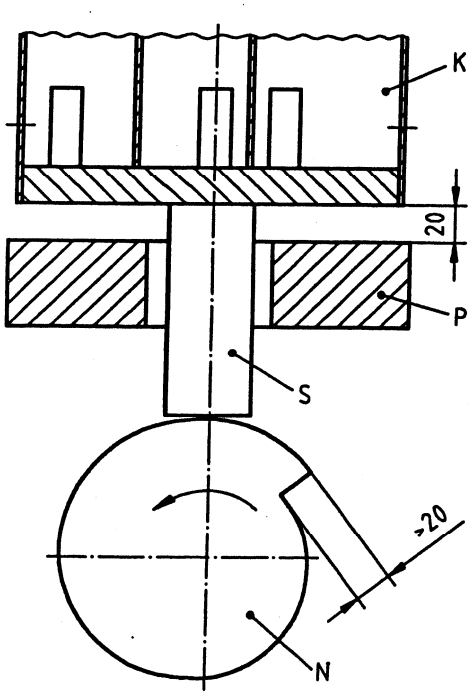
10.6 The information for use shall provide recommendations as to when the valved gas or combined filtering half mask shall be discarded.

[A1] 10.7

a) For devices with inseparable particle filters which are marked ‘NR’, a warning shall be given that the device shall not be used for more than one shift.

b) For devices with separable particle filters, where the particle filter is marked ‘NR’ a warning shall be given that the particle filter shall not be used for more than one shift. 〈A1〉

Dimensions in millimetres



Key

K Steel case

P Steel plate

S Piston

N Cam

Figure 1 — Test equipment for test of mechanical strength

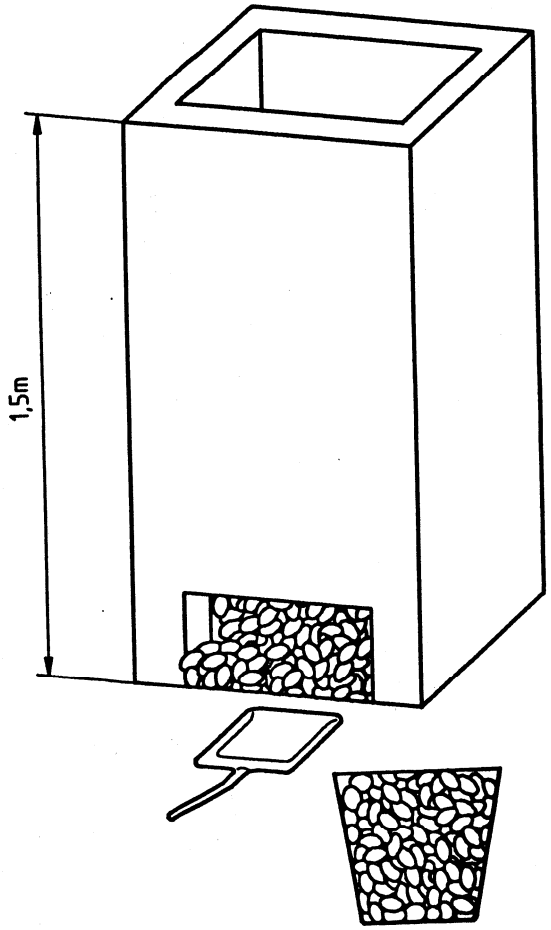
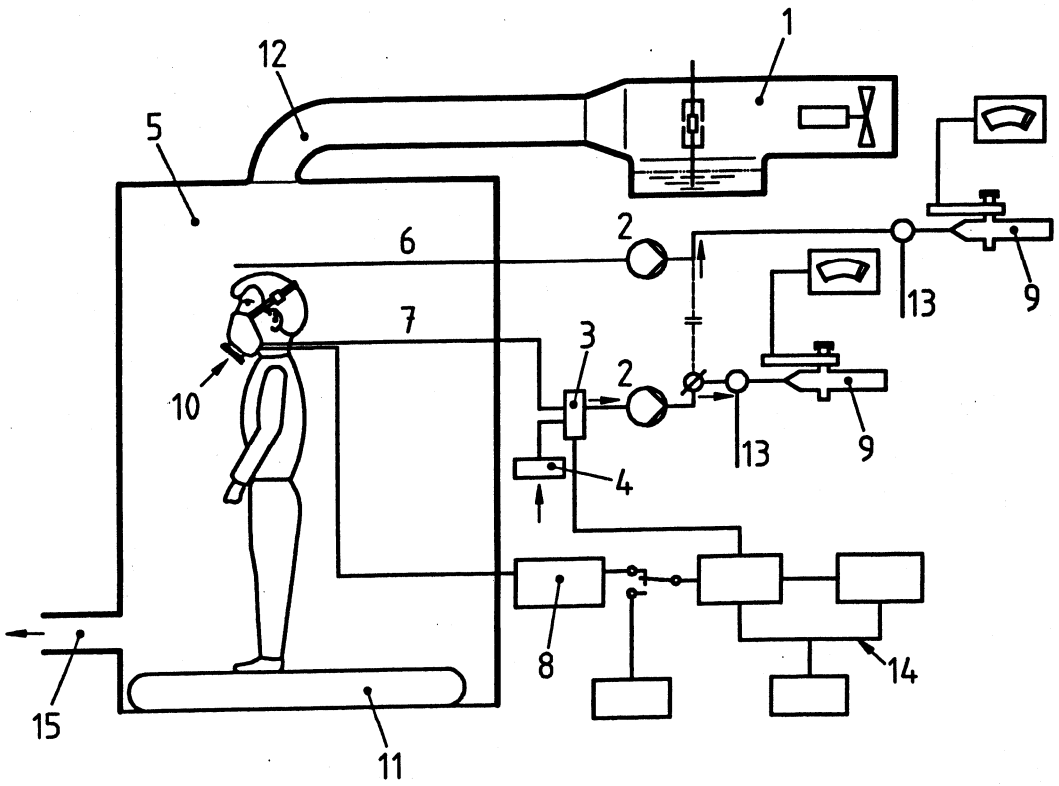


Figure 2 — Basket and hopper, chippings

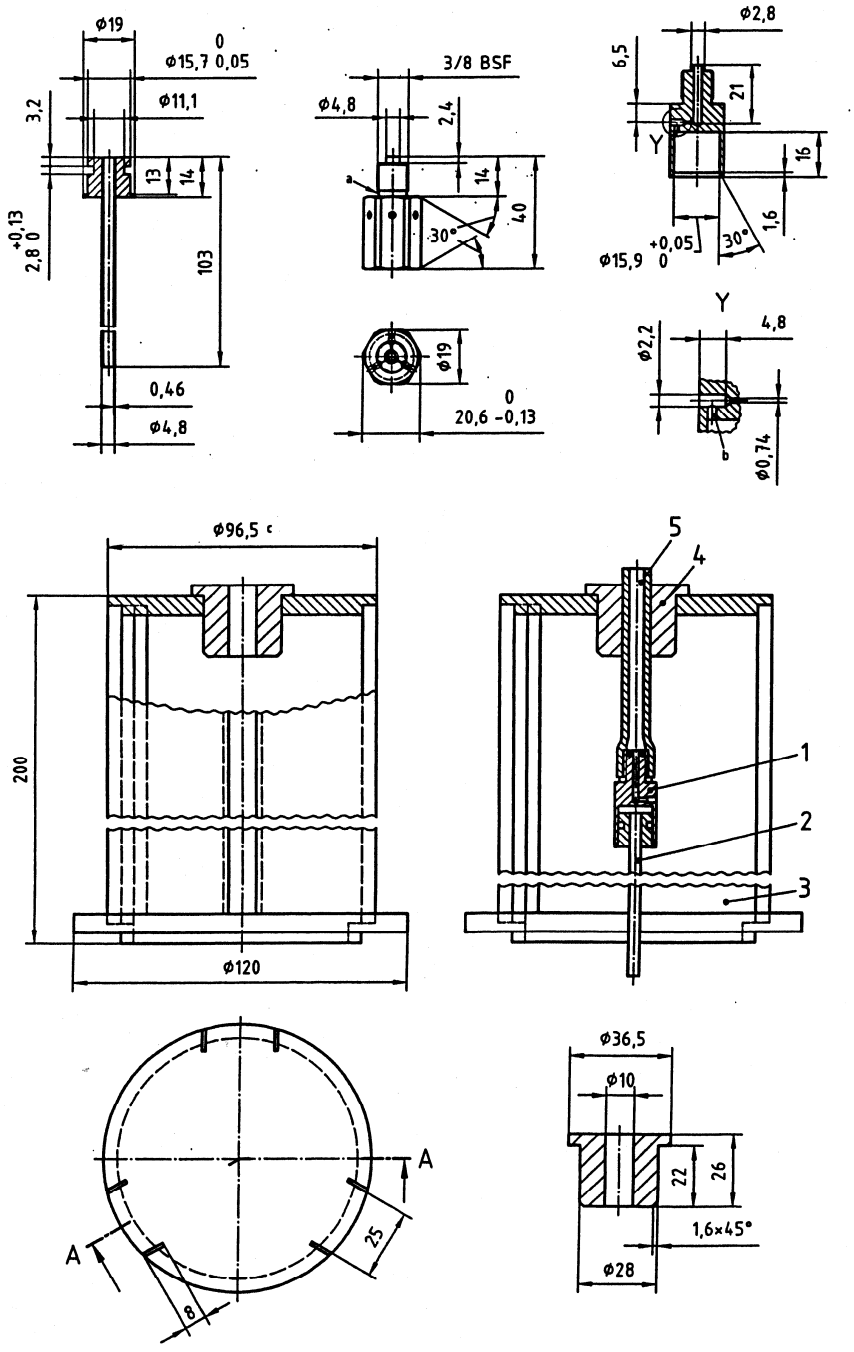


Key

1 Atomizer
2 Pump
3 Change-over-valve
4 Filter
5 Enclosure
6 Enclosure sample
7 Mask sample
8 Flow meter
9 Photometer
10 Valved filtering half mask
11 Treadmill
12 Ducting and baffle
13 Additional air
14 Pulsed sampling interface
15 Exhaust

Figure 3 — Typical apparatus used in the determination of inward leakage using sodium chloride

Dimensions in millimetres

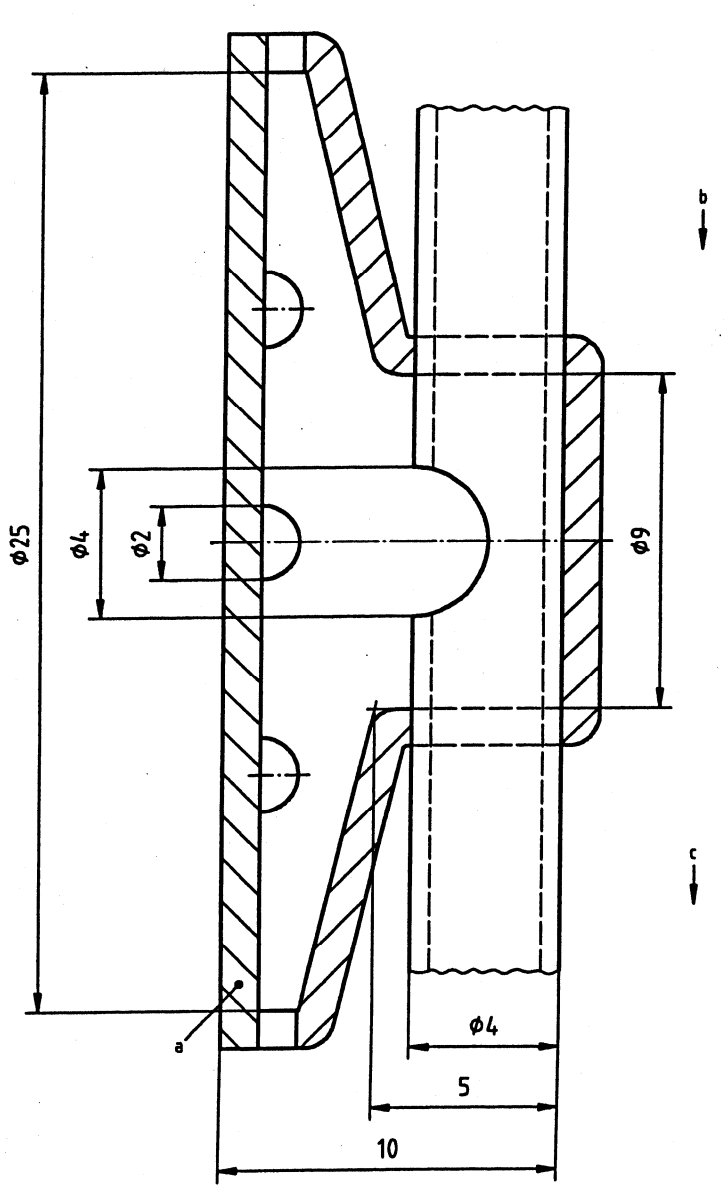


Key

1 Nozzle
2 Feed tube (salt solution)
3 Sleeve
4 Bush
5 Air tube (10,0 Outer diameter)

Figure 4 — Typical Assembly of atomizer

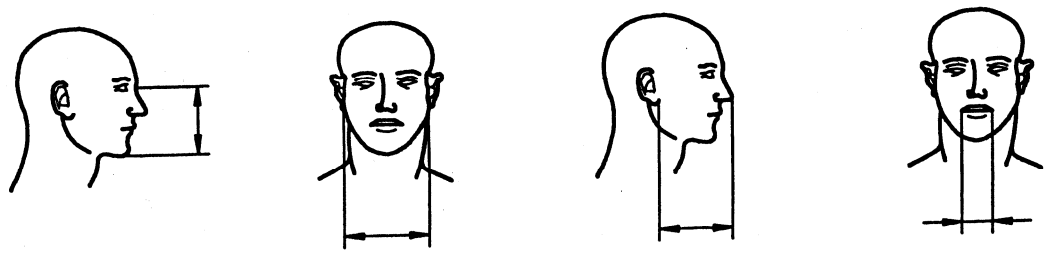
Dimensions in millimetres



Key

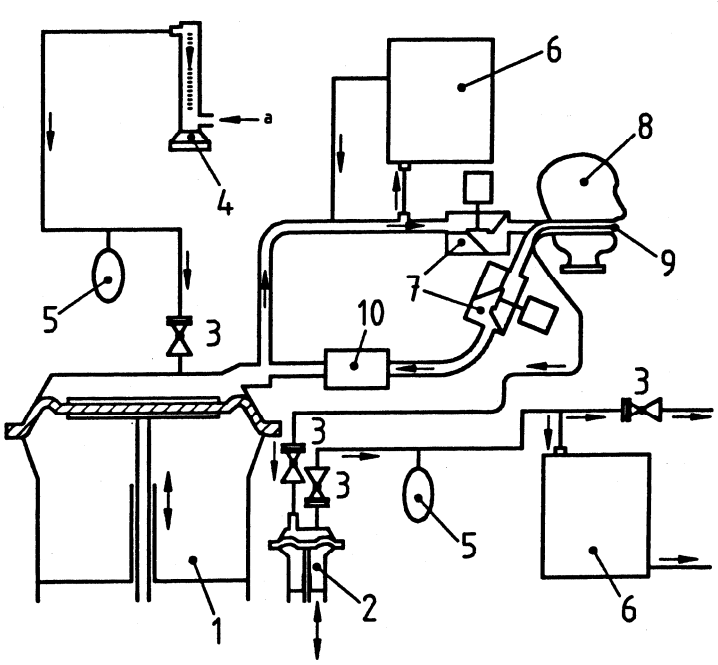
a Clear material
b Drying air
c Drying air plus sample

Figure 5 — Typical Sample probe



length of face (nasion-menton) | width of face (bizygomatic diameter) | depth of face | width of mouth

Figure 6 — Facial dimensions



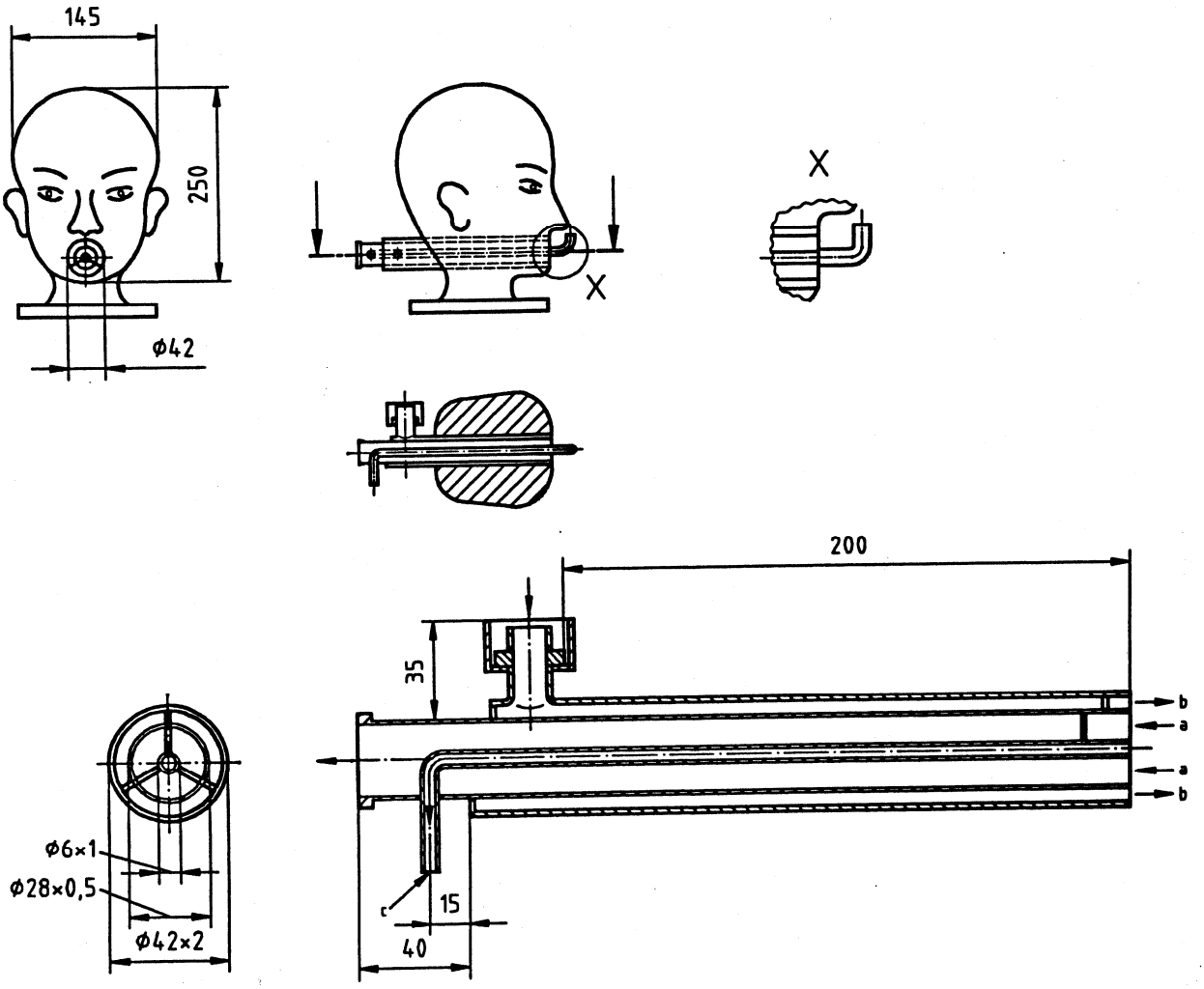
Key

a CO_2

1 Breathing machine
2 Auxiliary lung
3 Non-return valve
4 Flow meter
5 Compensator
6 Carbon dioxide analyser
7 Solenoid valve
8 Dummy head
9 Sampling tube for inhalation air (see Figure 8); tubing of the dummy head shall end flush with the opening of the mouth
10 Carbon dioxide absorber

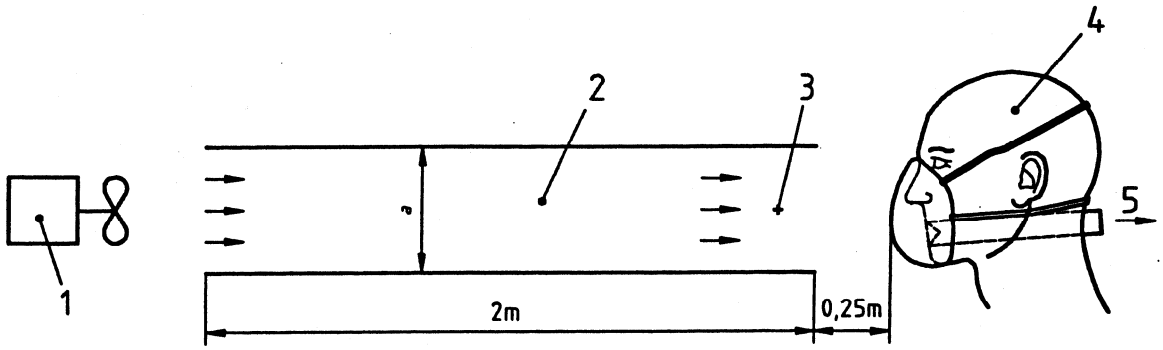
Figure 7 — Scheme of typical test rig for carbon dioxide content of inhalation air

Dimensions in millimetres



Key
a Inhalation
b Exhalation
c CO_2 measuring (inhalation)

Figure 8 — Dummy head for carbon dioxide content test of the inhalation air (dead space) for a valved filtering half mask and insert for measuring the breathing resistance



Key

1 Blower
2 Duct
3 Sensor for air flow
4 Dummy head
5 Towards the breathing machine
Dimension „a“: 0,3 m to 0,5 m

Figure 9 — Scheme of test arrangement and air flow for carbon dioxide content test

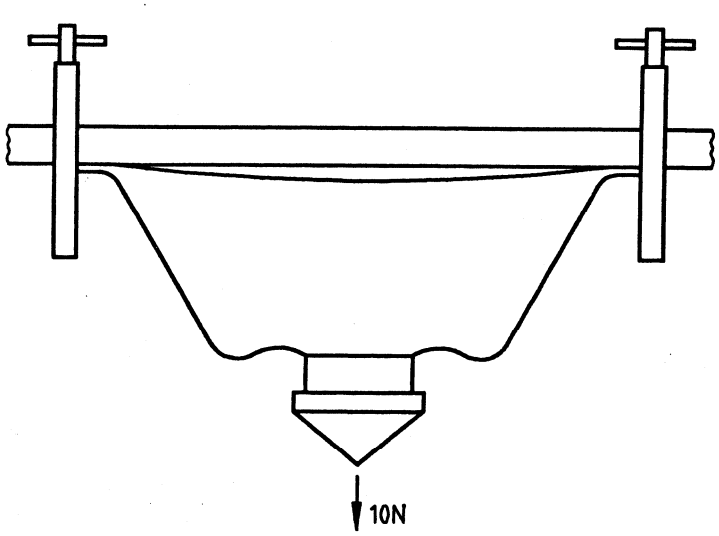
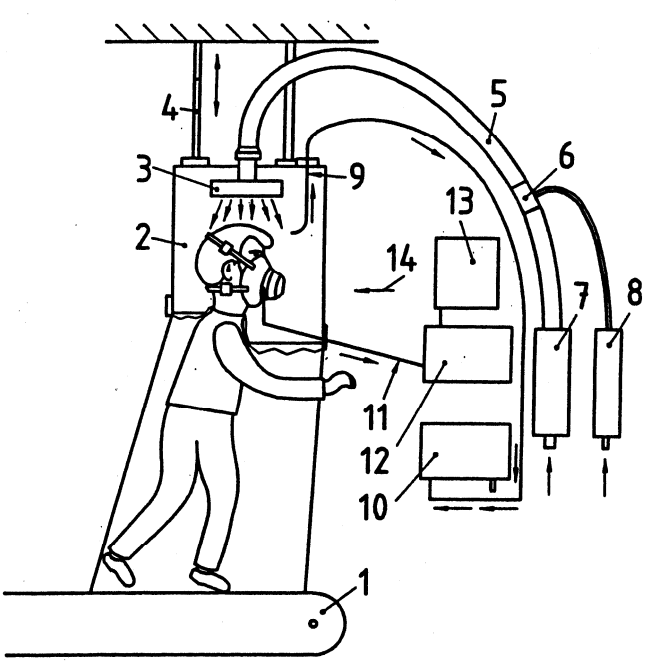


Figure 10 — Typical arrangement of axial tensile force test on exhalation valve housing



Key

1 Treadmill
2 Enclosure
3 Flow distributor
4 Suspension
5 Test agent supply hose
6 Mixing point air/SF_6
7 Flow meter for air with superposed control device
8 Flow meter for SF_6 (volume fraction of 100 %) with superposed control valve
9 Test atmosphere sampling probe
10 Measuring instrument for test atmosphere
11 Sampling tube for the inhaled gas concentration
12 Measuring instrument for inhaled gas concentration
13 Recorder
14 Breathable air

Figure 11 - Typical apparatus used in the determination of inward leakage using sulphur hexafluoride

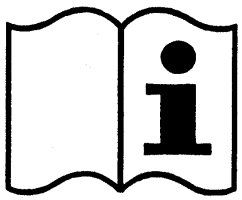


Figure 12a — See information supplied by the manufacturer

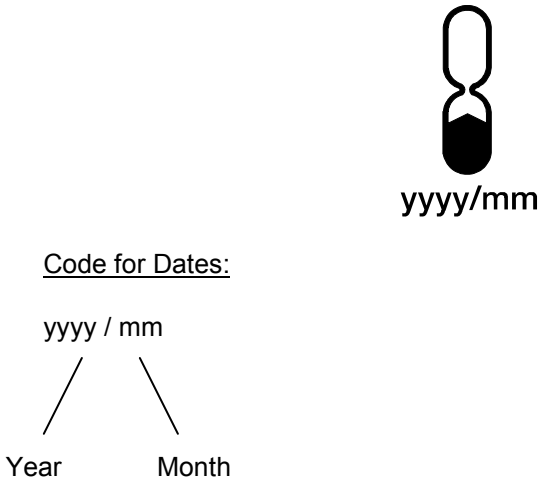


Figure 12b— End of shelf life

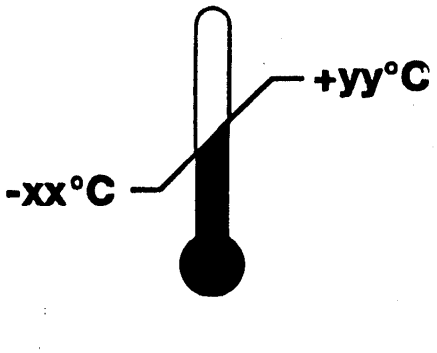


Figure 12c — Temperature range of storage conditions

Figure 12d — Maximum relative humidity of storage conditions

Figure 12 — Pictograms

Table 6 — Summary of testing valved gas or combined filtering half masks

[A1]

Test	No. of samples	Conditioning	Test clauses
Visual inspection	All	A.R.	8.2
Cleaning and disinfection (if applicable)	6	(M.S.+T.C) (6)	In accordance with information supplied by the manufacturer and 7.7.1
Flammability	4	A.R. (2) T.C. (2)	8.7
Carbon dioxide content	3	A.R. (3)	8.8
Exhalation valve pull test	3	A.R. (1) T.C. (2)	8.10
Exhalation valve flow test	3	A.R. (1) T.C. (2)	7.9.3, 8.9
Breathing resistance	9	A.R. (3) M.S. (3) T.C. (3)	8.9
Particle filter penetration	6 (for each aerosol)	A.R. (3) (M.S.+T.C.+ C.D.) (3)	EN 13274-7
Gas filtering capacity	3 (for each test gas)	M.S. (3)	8.6, EN 14387
Leakage	10	(A.R.+ D.D.) (5) (T.C.+ D.D.) (5)	8.5
Clogging test (optional for single shift use devices)	3	A.R. (1) T.C. (2)	8.9, EN 143
Practical performance	2	(A.R.) (2)	8.4

Abbreviations:

A.R. **as received**

D.D. **donning and doffing**

M.S. **mechanical strength**

T.C. **temperature conditioned**

C.D. **cleaning and disinfecting, if applicable**

[A1]

Annex A
(informative)

Marking

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

Table A.1 — Marking

Components/ sub-assemblies	Part-marking	Date of manufacture	Remarks
Exhalation valve disc	-	+	1
Connector (if fitted)	+	-	-
Face blank	+	+	-
Head harness	+	+	1

+ 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.

The components of a sub-assembly not to be marked when the sub-assembly is identifiable. Those components not offered as spare parts by the manufacturer need not to be marked but the relevant information needs to 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 and supports essential requirements of EU Directive 89/686/EEC.

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

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

EU Directive 89/686/EEC, Annex II	Clauses of this standard
1.1.1	7.5, 7.6, 7.7
1.1.2.1	5, 7.5, 7.6, 7.7, 7.9
1.1.2.2	5, 7.5, 7.6, 7.7
1.2.1	7.1, 7.12
1.2.1.1	7.1, 7.10, 7.12
1.2.1.2	7.1, 7.5, 7.6, 7.11
1.2.1.3	7.5, 7.15
1.3.1	7.5, 7.14
1.3.2	7.1, 7.5, 7.14
1.4	10
2.1	7.14
2.3	7.15
2.4	9, 10
2.6	10
2.8	10
2.9	7.14, 7.16
2.12	9
3.10.1	7.1, 7.5, 7.6, 7.9, 7.13, 9, 10

Compliance with the clauses of this standard provides one means of conforming with the specific essential requirements of the Directive concerned and associated EFTA regulations.

Bibliography

EN 136, *Respiratory protective devices - Full face masks - Requirements, testing, marking.*

EN 140, *Respiratory protective devices - Half masks and quarter masks - Requirements, testing, marking.*

EN 149, *Respiratory protective devices - Filtering half masks to protect against particles - Requirements, testing, marking.*

ISO 6941, *Textile fabrics – Burning behavior – Measurement of flame spread properties of vertically oriented specimens.*

BS EN 405:2001 +A1:2009

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