

Respiratory protective devices — Light duty construction compressed air line breathing apparatus incorporating a helmet or a hood — Requirements, testing, marking

The European Standard EN 1835:1999 has the status of a British Standard

ICS 13.340.20; 13.340.30

National foreword

This British Standard is the official English language version of EN 1835:1999.

The UK participation in its preparation was entrusted by Technical Committee PH/4, Respiratory protection, to Subcommittee PH/4/5, Air line breathing apparatus, which has the responsibility to:

- aid enquirers to understand the text;
- present to the responsible European committee any enquiries on the interpretation, or proposals for change, and keep the UK interests informed;
- monitor related international and European developments and promulgate them in the UK.

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

Cross-references

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

A British Standard does not purport to include all the necessary provisions of a contract. Users of British Standards are responsible for their correct application.

Compliance with a British Standard does not of itself confer immunity from legal obligations.

Summary of pages

This document comprises a front cover, an inside front cover, the EN title page, pages 2 to 63 and a back cover.

The BSI copyright notice displayed in this document indicates when the document was last issued.

This British Standard, having been prepared under the direction of the Health and Environment Sector Committee, was published under the authority of the Standards Committee and comes into effect on 15 March 2000

© BSI 03-2000

ISBN 0 580 32712 4

Amendments issued since publication

Amd. No.	Date	Comments

English version

**Respiratory protective devices - Light duty construction
compressed air line breathing apparatus incorporating a helmet
or a hood - Requirements, testing, marking**

Appareils de protection respiratoire - Appareils de
protection respiratoire isolants à adduction d'air comprimé
de construction légère, avec casque ou cagoule -
Exigences, essais, marquage

Atemschutzgeräte - Druckluft-Schlauchgeräte für leichte
Einsätze mit Helm oder Haube - Anforderungen, Prüfung,
Kennzeichnung

This European Standard was approved by CEN on 15 April 1999.

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

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

CEN members are the national standards bodies of Austria, Belgium, Czech Republic, Denmark, Finland, France, Germany, Greece, Iceland, Ireland, Italy, Luxembourg, Netherlands, Norway, Portugal, Spain, Sweden, Switzerland and United Kingdom.



EUROPEAN COMMITTEE FOR STANDARDIZATION
COMITÉ EUROPÉEN DE NORMALISATION
EUROPÄISCHES KOMITEE FÜR NORMUNG

Central Secretariat: rue de Stassart, 36 B-1050 Brussels

Contents

	Page
Foreword	4
Introduction	5
1 Scope	5
2 Normative references	5
3 Definitions	6
4 Description	7
5 Classification	7
6 Designation	7
7 Requirements	8
7.1 Materials	8
7.2 Resistance to temperature	8
7.3 Flammability	9
7.4 Cleaning and disinfecting	9
7.5 Body harness or belt	9
7.6 Connectors	9
7.7 Breathing hose	10
7.8 Continuous flow valve	11
7.9 Checking and warning facilities	11
7.10 Compressed air supply tube	12
7.11 Helmets and hoods	13
7.12 Adjustable parts	15
7.13 Noise level inside helmet or hood	16
7.14 Carbon dioxide content of the inhalation air	16
7.15 Breathing resistance	16
7.16 Leaktightness	17
7.17 Inward leakage	17
7.18 Practical performance	17
8 Testing	18
8.1 General	18
8.2 Visual inspection	18
8.3 Resistance to temperature	18
8.4 Flammability	19
8.5 Mechanical resistance of eyepiece(s) or visor(s)	21
8.6 Strength of attachment of exhalation valve	21
8.7 Breathing resistance	21
8.8 Inward leakage	22
8.9 Strength of connections to helmet/hood and waist belt or body harness	28
8.10 Effective mass supported by the facepiece	29
8.11 Strength of compressed air supply tube, couplings and continuous flow valve	29
8.12 Resistance to kinking of the compressed air supply tube	29
8.13 Resistance to collapse of compressed air supply tube	30
8.14 Leaktightness	30
8.15 Heat resistance of compressed air supply tube	30
8.16 Resistance to collapse of breathing hose	31
8.17 Air supply flow rate	31
8.18 Checking and warning facilities	33
8.19 Carbon dioxide content of the inhalation air	33

8.20 Noise level inside helmet or hood	35
8.21 Air porosity	35
8.22 Practical performance	36
9 Marking	39
10 Information to be supplied by the manufacturer	40
Annex A (normative) Fitting procedure for hoods which seal around the neck and which may or may not incorporate a head harness	58
Annex B (informative) Marking of components	62
Annex ZA (informative) Clauses of this European Standard addressing essential requirements or other provisions of EU Directives	63

Foreword

This European Standard 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 June 2000, and conflicting national standards shall be withdrawn at the latest by June 2000.

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(s).

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

According to the CEN/CENELEC Internal Regulations, the national standards organizations of the following countries are bound to implement this European Standard: Austria, Belgium, Czech Republic, Denmark, Finland, France, Germany, Greece, Iceland, Ireland, Italy, Luxembourg, Netherlands, Norway, Portugal, 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 minimum requirements for light duty construction compressed air line breathing apparatus incorporating a helmet or a hood which is intended for use in gaseous, particulate or combined contaminated atmospheres.

Such equipment is intended for use in work situations where the risk of damage to the compressed air supply tube is low and where movements of the wearer are limited.

Escape and diving apparatus and apparatus used in abrasive blasting conditions are not covered by this European Standard.

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

2 Normative references

This European Standard incorporates, by dated or undated reference, provisions from other publications. These normative references are cited at the appropriate places in the text and the publications are listed hereafter. For dated references, subsequent amendments to or revisions of any of these publications apply to this European Standard only when incorporated in it by amendment or revision. For undated references the latest edition of the publication referred to 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 140:1998	Respiratory protective devices - Half and quarter masks - Requirements, testing, marking
EN 142:1989	Respiratory protective devices - Mouthpiece assemblies - Requirements, testing, marking

EN 148-1:1999	Respiratory protective devices - Threads for facepieces - Part 1: Standard thread connection
EN 148-2:1999	Respiratory protective devices - Threads for facepieces - Part 2: Centre thread connection
EN 148-3:1999	Respiratory protective devices - Threads for facepieces - Part 3: Thread connection M 45 x 3
EN 12021:1998	Respiratory protective devices - Compressed air for breathing apparatus
EN 28031:1993	Rubber and plastics hoses and hose assemblies - Determination of electrical resistance (ISO 8031:1987)
IEC 651:1979	Sound level meters
ISO 6941:1984/ AMD 1:1992	Textile fabrics - Burning behaviour - Measurement of flame spread properties of vertically oriented specimens

3 Definitions

For the purposes of this European Standard the definitions given in EN 132 and the nomenclature given in EN 134 apply together with the following.

3.1 suitable facepiece a facepiece which can be a hood as defined in EN 132 or a device which seals on the face, excluding facepieces specified in EN 136, EN 140 or EN 142. Either type can incorporate a helmet to provide head protection and/or a visor to provide eye and face protection

3.2 compressed air supply tube a tube (which can be either straight or spiral coiled), which delivers breathable air at a maximum pressure of 10 bar from a source of compressed air

3.3 spiral coiled tube a tube which is manufactured such that when in its relaxed state it assumes a natural spiral coil with an outside diameter of less than 350 mm

3.4 minimum flow condition those factors appropriate to the design specified by the manufacturer which give rise to the lowest flow rate. These factors may include the maximum length of compressed air supply tube, maximum number of couplings in the compressed air supply tube, tube internal diameter and supply pressure

3.5 maximum flow condition those factors appropriate to the design specified by the manufacturer which give rise to the highest flow rate. These factors may include the minimum length of compressed air supply tube, tube internal diameter and supply pressure

4 Description

A light duty construction compressed air line breathing apparatus incorporating a helmet or hood is an apparatus which is not self-contained and in which the wearer is supplied with breathable air from a source of compressed air at a maximum pressure of 10 bar.

The construction of this apparatus enables the wearer to be provided with breathable air as specified in EN 12021. This can be assured by an air supply system with an additional device (e.g. filters for compressed air) or a special breathable air supply system, supplied at a continuous flow to a suitable facepiece via a breathing hose. The apparatus can incorporate an adjustable continuous flow valve which may be carried by the wearer. A compressed air supply tube having a maximum length of 10 m connects the wearer to a supply of compressed air. The exhaled and excess air flows into the ambient atmosphere.

5 Classification

Classifications are defined by the maximum inward leakage as given in table 1.

Table 1: Classification

Classification	Maximum inward leakage %
LDH 1	10
LDH 2	2
LDH 3	0,5

6 Designation

Respiratory protective devices meeting the requirements of this European Standard shall be designated in the following manner:

Light duty compressed airline BA/EN 1835/helmet/hood (Class) (Options).

7 Requirements

7.1 Materials

7.1.1 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 8.2.

7.1.2 Exposed parts which can be subjected to impact during use of the apparatus shall not be made of aluminium, magnesium, titanium or alloys containing such proportions of these metals as will, on impact, give rise to frictional sparks capable of igniting flammable gas mixtures.

Testing shall be done in accordance with 8.2.

7.1.3 Materials that may come into direct contact with the wearer's skin or that may affect the quality of the breathing air shall not be known to be likely to cause skin irritation or any other adverse effects.

Testing shall be done in accordance with 8.2.

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

Testing shall be done in accordance with 8.2.

7.2 Resistance to temperature

7.2.1 After conditioning in accordance with 8.3.1 and returning to room temperature the apparatus shall show no appreciable deformation or distortion of the lens(es) or visor, and all other requirements of this European Standard shall be met.

7.2.2 After conditioning in accordance with 8.3.1 the apparatus shall continue to operate satisfactorily.

Testing shall be done in accordance with 8.3.2.

7.2.3 Apparatus specifically designed for use in temperatures below 0 °C shall continue to operate satisfactorily at those temperatures.

Testing shall be done in accordance with 8.3.3 and 8.3.4.

7.3 Flammability

No exposed components of the apparatus shall continue to burn for more than 5 s.

Testing shall be done in accordance with 8.4.

The apparatus is not required to meet the other requirements of this European Standard after being subjected to the test in 8.4.

7.4 Cleaning and disinfecting

The materials used shall withstand the cleaning and disinfecting agents and procedures recommended by the manufacturer.

Testing shall be done in accordance with 8.2 and 8.8.

7.5 Body harness or belt

A body harness or belt shall be provided to which the breathing hose and compressed air supply tube shall be attached. When tested, buckles shall not slip and the body harness or belt shall not be damaged.

Testing shall be done in accordance with 8.2, 8.11 and 8.22.

7.6 Connectors

7.6.1 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 of sealing used shall be retained in position when the joints and couplings are disconnected during normal maintenance.

Testing shall be done in accordance with 8.2 and 8.22.

7.6.2 Couplings

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 or tubes to become disconnected. At least one swivelling coupling shall be fitted to the compressed air supply tube adjacent to the wearer.

Testing shall be done in accordance with 8.2.2.

The design of the coupling shall be such as to prevent unintentional interruption of air supply.

Testing shall be done in accordance with 8.22.

7.7 Breathing hose

7.7.1 General

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

Testing shall be done in accordance with 8.2 and 8.22.

7.7.2 Resistance to collapse

The air flow shall not be reduced by more than 10 % of the manufacturer's minimum design air flow rate when a load of 50 N is applied. There shall be no visible distortion 5 min after completion of the test.

Testing shall be done in accordance with 8.16.

7.7.3 Strength of connections to helmet or hood and body harness or waist belt

Connections of the breathing hose to the hood or helmet and at the waist belt or body harness shall withstand an axial force of 50 N and shall not become disconnected or visibly damaged during and after subjection to this force.

Testing shall be done in accordance with 8.2 and 8.9.

7.7.4 Connection between apparatus and helmet or hood

The connection between the helmet or hood and the remainder of the apparatus can be achieved by a permanent or special type of connection or by a screw thread connection.

Threads defined in EN 148-1, EN 148-2 and EN 148-3 shall not be used for the connector between the helmet or hood and the remainder of the apparatus. If any screw thread is

used it shall not be possible to connect it to the threads defined in EN 148-1, EN 148-2 and EN 148-3.

Testing shall be done in accordance with 8.2.

7.8 Continuous flow valve

A continuous flow valve when fitted shall either be pre-set or easily adjustable by the wearer to supply air as required. If the valve is designed to shut off it shall not be possible inadvertently to reduce the air flow below the manufacturer's minimum design flow rate.

When the complete apparatus is in the minimum flow condition, it shall pass the manufacturer's minimum design flow rate within the manufacturer's stated supply pressure range.

Testing shall be done in accordance with 8.17.

7.9 Checking and warning facilities

7.9.1 Checking device

A means shall be provided to enable the user to check that the manufacturer's minimum design air flow rate is achieved or exceeded prior to the use of the apparatus.

Testing shall be done in accordance with 8.18.

7.9.2 Low-flow warning facility

Class LDH3 apparatus shall be fitted with a low-flow warning facility.

Class LDH1 and LDH2 apparatus not complying with the requirements of 7.14.2 shall be fitted with a low-flow warning facility.

The low-flow warning facility shall immediately draw the attention of the wearer to the fact that the apparatus is not supplying the manufacturer's minimum design flow rate.

The low-flow warning facility shall operate at flow rates equal to or less than the manufacturer's minimum design flow rate.

Testing shall be done in accordance with 8.18.

7.10 Compressed air supply tube

7.10.1 General

It shall not be possible to connect the compressed air supply tube directly to the breathing hose or helmet/hood.

Testing shall be done in accordance with 8.2.

7.10.2 Resistance to kinking

With a load of 250 N the reduction in air flow shall not be greater than 10 %.

Testing shall be done in accordance with 8.12.

7.10.3 Resistance to collapse

When tested using an applied load of 250 N the reduction in air flow shall not be greater than 10 %.

Testing shall be done in accordance with 8.13.

7.10.4 Flexibility of straight tubes

When supplied with air in accordance with the information to be supplied by the manufacturer for maximum pressure and minimum flow, the straight tube shall be capable of being wound once around a drum with a diameter of 300 mm.

Testing shall be done in accordance with 8.2.

7.10.5 Strength

The compressed air supply tube, couplings and continuous flow valve (if fitted) shall not separate nor suffer damage.

Testing shall be done in accordance with 8.2 and 8.11.

Additionally the apparatus shall meet the requirements of 7.10.9 and 7.16, both before and after the test.

7.10.6 Heat resistance

Compressed air supply tubes claimed to be resistant to damage from contact with hot surfaces and boiling water shall show no signs of damage or indications of failure and, when tested, the air quality shall not be significantly affected.

Testing shall be done in accordance with 8.15.

7.10.7 Electrostatic properties

Compressed air supply tubes, claimed to be anti-static and making connections to the couplings, shall have an electrical resistance that is greater than $10^3 \Omega$ and less than $10^8 \Omega$.

Testing shall be done in accordance with EN 28031.

7.10.8 Couplings

Where a hand operated connection is fitted to the outlet of the compressed air supply tube it shall incorporate a self-sealing coupling to seal the air supply.

Testing shall be done in accordance with 8.2.

7.10.9 Resistance to air pressure

The compressed air supply tube and its couplings shall be capable of withstanding a pressure of 20 bar for 15 min without damage.

Testing shall be done in accordance with 8.2.

7.10.10 Working length

The maximum working length of straight compressed air supply tube shall be 10 m. The effective working length of the spiral coiled compressed air supply tube shall be determined under a force of 50 N and shall not exceed 10 m at this force.

Testing shall be done in accordance with 8.2.

7.11 Helmets and hoods

7.11.1 General

These devices can incorporate aspects of head, face, eye and hearing protection as claimed by the manufacturer. In such cases, the relevant clauses of the European Standard(s), as claimed by the manufacturer, shall be satisfied.

7.11.2 Mass

The effective mass carried on the head shall not be more than 1,5 kg.

Testing shall be done in accordance with 8.10.

7.11.3 Head harness

The head harness, if provided, shall be designed so that the helmet/hood can be donned and removed readily. It shall be adjustable or self-adjusting and shall hold the helmet/hood firmly and comfortably in position.

Testing shall be done in accordance with 8.2 and 8.22.

7.11.4 Emergency procedure

In case of emergency, e.g. air loss or severe over-inflation, it shall be possible easily to obtain surrounding ambient air or to make use of any emergency system provided.

Testing shall be done in accordance with 8.2 and 8.22.

7.11.5 Hood strength

NOTE: It is proposed to include requirements for strength of hood materials when appropriate test methods and levels of performance have been validated.

7.11.6 Lens(es) and visor

Lenses and anti-mist discs designed to serve as lenses shall be attached in a secure manner to the helmet/hood.

Lenses and visors shall not significantly distort vision as determined in practical performance tests.

Misting of the visor shall not substantially impair vision.

Testing shall be done in accordance with 8.3.4 (where appropriate), 8.5 and 8.22.

Where anti-misting compounds are used as intended they shall be compatible with the components of the helmet/hood, and shall not be known to produce adverse effects to the eyes and skin under normal conditions.

The mechanical strength of the lens(es) or visor of helmet/hood shall be tested in accordance with 8.5. After the test the apparatus shall meet the requirements of 7.17.

7.11.7 Exhalation means

7.11.7.1 General

The complete apparatus may be provided with one or more exhalation means (e.g. exhalation valves). Hoods which incorporate a neck seal operated by a drawstring arrangement shall contain one or more exhalation means other than the neck seal.

7.11.7.2 Exhalation valves (if fitted)

Valve assemblies shall be such that they can be readily maintained and/or correctly replaced.

Testing shall be done in accordance with 8.22.

The valves shall function properly in all orientations.

Testing shall be done in accordance with 8.22.

Exhalation valve(s) shall be protected against or be resistant to dirt and mechanical damage. They may be shrouded or include any other device that can be necessary to comply with 7.17.

Testing shall be done in accordance with 8.2

After a continuous exhalation flow of 160 l/min plus the manufacturer's maximum designed flow rate for $(1,0 \pm 0,1)$ min, apparatus shall continue to satisfy the requirements of 7.15.

Exhalation valve housings shall be securely attached to the facepiece.

Testing shall be done in accordance with 8.6.

After the test, any exhalation valve housing shall be undamaged.

Testing shall be done in accordance with 8.2.

7.11.8 Field of vision

The field of vision shall be satisfactory when the apparatus is subjected to the practical performance tests described in 8.22.

7.12 Adjustable parts

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. Parts that are not intended for adjustment by a wearer shall require the use of tools for their adjustment.

Testing shall be done in accordance with 8.2 and 8.22.

7.13 Noise level inside helmet or hood

The noise level measured in the helmet or hood at the ears of the wearer shall be not greater than 80 dB(A).

Testing shall be done in accordance with 8.20.

7.14 Carbon dioxide content of the inhalation air

7.14.1 Air supply on

All classes of apparatus shall be tested. With the apparatus tested whilst operating at the manufacturer's minimum design flow rate, the carbon dioxide content of the inhalation air shall not exceed an average of 1 % (by volume).

Testing shall be done in accordance with 8.19.

7.14.2 Air supply off

Class LDH1 and LDH2 devices not fitted with a low-flow warning facility shall be tested. All other devices are exempt from this requirement.

When the apparatus is tested with the air supply off, the carbon dioxide content of the inhalation air shall not exceed an average of 3 % (by volume).

Testing shall be done in accordance with 8.19.

7.15 Breathing resistance

7.15.1 Inhalation resistance

The pressure in the hood shall not fall below -0,2 mbar.

Testing shall be done in accordance with 8.7.

7.15.2 Exhalation resistance

The exhalation resistance shall not exceed 5 mbar.

Testing shall be done in accordance with 8.7.

7.16 Leaktightness

When tested, no bubbles shall occur.

This test shall be applied immediately before and after the tests in 8.11, and shall be subsequently applied after all laboratory testing is completed with the exception of that for flammability.

Testing shall be done in accordance with 8.14.

7.17 Inward leakage

The mean inward leakage for each exercise performed by each test subject shall not exceed the maximum levels set out in table 1, when tested at the manufacturer's minimum design flow rate.

Testing shall be done in accordance with 8.8.

7.18 Practical performance

The complete apparatus 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 the wearer's acceptance as indicated by comments recorded in 8.22.5, the test laboratory shall describe the test which revealed the imperfections. This will enable other test laboratories to duplicate the tests and assess the results thereof.

Testing shall be done in accordance with 8.22.

8 Testing

8.1 General

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.

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

All tests shall be carried out on two complete devices: one shall be tested “as received” and the other after conditioning in accordance with 8.3.1. Both devices shall meet the requirements.

The laboratory shall establish the parameters which gives rise to minimum flow conditions and maximum flow conditions prior to testing

Table 4 gives the schedule of tests.

8.2 Visual inspection

A visual inspection of the device is carried out before the laboratory or practical performance tests and can entail some dismantling in accordance with the manufacturer's instructions for maintenance. The visual inspection includes examination of the marking on the equipment and the information supplied by the manufacturer.

8.3 Resistance to temperature

8.3.1 Temperature conditioning

Condition the apparatus, including the hood and the compressed air supply tube, at a temperature of $(60 \pm 3) ^\circ\text{C}$ and a relative humidity of greater than 95 % for a period of not less than 4 h, followed by a period of not less than 4 h at a temperature of $(-30 \pm 3) ^\circ\text{C}$.

NOTE: The change in temperature is not intended to be so sudden as to subject the device to a thermal shock.

Allow the apparatus to regain ambient temperature.

8.3.2 Laboratory test at ambient temperature

Fit the apparatus to a breathing machine at normal laboratory ambient temperature and humidity. With the apparatus in the minimum flow condition, operate the breathing machine at 50 l/min (25 cycles/min, 2,0 l/stroke) for 30 min.

After this period check that the requirements of 7.15 are met.