

Respiratory protective devices — Full face masks — Requirements, testing, marking

The European Standard EN 136:1998 has the status of a
British Standard

ICS 13.340.30

National foreword

This British Standard is the English language version of EN 136:1998, including Corrigendum December 2003. It supersedes BS 7355:1990 and BS EN 136-10:1992 which are withdrawn.

The UK participation in its preparation was entrusted by Technical Committee PH/4, Respiratory protection, to Subcommittee PH/4/3, Facepieces, 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;
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CEN

European Committee for Standardization
Comité Européen de Normalisation
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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 replaces EN 136:1989 and EN 136-10:1992.

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of an identical text or by endorsement, at the latest by July 1998, and conflicting national standards shall be withdrawn at the latest by July 1998.

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.

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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 successful practical performance tests have been carried out 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 minimum requirements for full face masks for respiratory protective devices.

Full face masks for diving apparatus are not included in the scope of this European Standard.

Laboratory 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 132:1990, *Respiratory protective devices — Definitions*.

EN 134:1990, *Respiratory protective devices — Nomenclature of components*.

EN 148-1:1987, *Respiratory protective devices — Threads for facepieces — Standard thread connection*.

EN 148-2:1987, *Respiratory protective devices — Threads for facepieces — Centre thread connection*.

EN 148-3:1992, *Respiratory protective devices — Threads for facepieces — Thread connection M 45 × 3*.

ISO 6941:1984/AMD 1:1992, *Textile fabrics — Burning behaviour — Measurement of flame spread properties of vertically oriented specimens*.

ISO 6942:1993, *Clothing for protection against heat and fire — Evaluation of thermal behaviour of materials and material assemblies when exposed to a source of radiant heat*.

3 Definition

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

A full face mask is a facepiece which covers the eyes, nose, mouth and chin and provides adequate sealing on the face of the wearer of a respiratory protective device against the ambient atmosphere, when the skin is dry or moist, and even when the head is moved or when the wearer is speaking.

4 Description

Air enters the full face mask through the connector(s) and passes either directly to the nose and mouth area or via the eye (visor) area of the full face mask.

The exhaled air flows back either through the connector into the breathing apparatus (closed-circuit breathing apparatus, pendulum breathing) or directly to the ambient atmosphere, via the exhalation valve(s), or by other appropriate means in other types of respiratory protective devices.

An inner mask may be used to separate the nose and mouth from the eye (visor) area(s) of the full face mask.

5 Classification

Three classes of full face masks are described, each providing the same level of respiratory protection but having some differences which reflect intended areas of application.

Class 1: Full face masks for light duty use.

Class 2: Full face masks for general use.

Class 3: Full face masks for special use.

6 Designation

Designation of a full face mask meeting the requirements of this standard:

Full face mask EN 136 (Class) (Options).

7 Requirements

7.1 General

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

7.2 Nominal values and tolerances

Unless otherwise specified, the values stated in this standard are expressed as nominal values. Except for temperature limits, values which are not stated as maxima or minima shall be subject to a tolerance of $\pm 5\%$. Unless otherwise specified, the ambient temperature for testing shall be $(24 \pm 8)^\circ\text{C}$, the temperature limits shall be subject to an accuracy of $\pm 1^\circ\text{C}$ and the relative humidity shall be $(50 \pm 30)\%$.

7.3 Visual inspection

The visual inspection shall include that of the marking and of any information to be supplied by the manufacturer.

Testing shall be done in accordance with 8.3.

7.4 Materials

For class 2 and class 3 full face masks exposed parts i.e. those which may be subjected to impact during use of the apparatus shall not be made of aluminium, magnesium, titanium or 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 8.3.

7.5 Resistance to temperature

Before and after this test the full face mask shall meet the requirement of 7.16.

Following the conditioning in accordance with 8.2 and after being allowed to return to ambient temperature the full face mask shall show no appreciable deformation and any incorporated threaded connector to EN 148-1, EN 148-2 or EN 148-3 shall be gauged and shall comply with the appropriate standard.

In addition with class 3 full face masks, the threads specified in EN 148-1, EN 148-2 or EN 148-3 as appropriate shall also be accurate according to the gauge, at the end of the conditioning period in accordance with 8.2b).

Testing shall be done in accordance with 8.3, 8.4, 8.13 and 8.16.

7.6 Flammability

7.6.1 General

Before and after these tests the full face mask shall meet the requirement of 7.16.

7.6.2 Class 1 full face masks

Parts of the full face mask that might be exposed to a flame during use shall not burn or continue to burn for more than 5 s after removal from the flame.

Testing shall be done in accordance with 8.3 and 8.5.1.

7.6.3 Class 2 and class 3 full face masks

Parts of the full face mask that might be exposed to a flame during use shall not burn or continue to burn for more than 5 s after removal from the flame.

Testing shall be done in accordance with 8.3 and 8.5.2.

7.7 Resistance to thermal radiation

Class 3 full face masks shall be resistant to thermal radiation. This may be achieved in one of two ways, i.e.:

The full face mask is considered to be resistant to thermal radiation in accordance with this standard if it remains leaktight after a test period of 20 min although it may be deformed.

Alternatively the full face mask can be considered to be resistant to thermal radiation if the visibility becomes impaired after a test period of ≥ 4 min and the facepiece is still leaktight after a further minute.

Before and after the thermal radiation test the full face mask shall meet the requirement of 7.16.

Testing shall be done in accordance with 8.6.

7.8 Cleaning and disinfecting

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

Testing shall be done in accordance with 8.7.

7.9 Finish of parts

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

Testing shall be done in accordance with 8.3 and 8.18.

7.10 Replaceable components

This requirement applies to class 3 full face masks only.

Unless integral with the full face mask the following components (when fitted) shall be replaceable:

Inner mask, head harness, lens/visor, connector(s), inhalation and exhalation valves, check valves, speech diaphragm, lens wiper.

Testing shall be done in accordance with 8.3.

7.11 Head harness

7.11.1 The head harness shall be designed so that the full face mask can be donned and removed easily.

Testing shall be done in accordance with 8.3 and 8.18.

7.11.2 The head harness shall be adjustable or self-adjusting and shall hold the full face mask firmly and comfortably in position.

Testing shall be done in accordance with 8.3 and 8.18.

7.11.3 Strength

7.11.3.1 For class 1 full face masks each strap of the harness shall withstand a pull of 100 N applied for 10 s in the direction of pulling when the full face mask is donned.

Buckles and attachment lugs (if present) shall withstand the same pull.

Testing shall be done in accordance with 8.3 and 8.8.1.

7.11.3.2 For class 2 and class 3 full face masks each strap of the head harness shall withstand a pull of 150 N applied for 10 s in the direction of pulling when the full face mask is donned.

Buckles and attachment lugs (if present) shall withstand the same pull.

Testing shall be done in accordance with **8.3** and **8.8.1**.

7.11.4 There shall be no permanent linear deformation of each strap of more than 5 % after having been tested at a pull of 50 N for 10 s.

Testing shall be done in accordance with **8.3** and **8.8.2**.

7.11.5 For class 3 full face masks once fitted the head harness shall be easily adjustable by the wearer or self-adjusting.

Testing shall be done in accordance with **8.3** and **8.18**.

7.12 Connector

7.12.1 General

The connection between the full face mask and the apparatus may be achieved by a permanent or special type of connection or by a threaded connection.

If more than one connector is fitted the design of the facepiece or of the remainder of the equipment shall be such that the use of different types or combinations of respiratory protective devices does not present a risk.

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 connection is disconnected during normal maintenance.

Correct and reliable connection between facepiece and other parts of the equipment shall be assured.

Testing shall be done in accordance with **8.3**, **8.16** and **8.18**.

7.12.2 Class 1 full face masks

Class 1 full face masks shall not have threaded connectors defined in EN 148-1, EN 148-2 and EN 148-3.

Testing shall be done in accordance with **8.3**.

7.12.3 Class 2 and class 3 full face masks

Full face masks shall have only one threaded connector defined in EN 148-1, EN 148-2 or EN 148-3.

If any other connector is used it shall not be possible to connect it to the threads defined in EN 148-1, EN 148-2 or EN 148-3.

Testing shall be done in accordance with **8.3**.

7.12.4 Strength of connection

7.12.4.1 Before and after this test the full face mask shall meet the requirement of **7.16**.

7.12.4.2 For class 1 full face masks the connection between the faceblank and the connector shall be sufficiently robust to withstand axially a tensile force of 250 N.

Testing shall be done in accordance with **8.9** and **8.13**.

7.12.4.3 For class 2 and class 3 full face masks the connection between the faceblank and the connector shall be sufficiently robust to withstand axially a tensile force of 500 N.

Testing shall be done in accordance with **8.9** and **8.13**.

7.13 Speech diaphragm

7.13.1 Where the facepiece includes a speech diaphragm the latter shall be protected against mechanical damage as assessed by visual inspection in accordance with **8.3**.

The speech diaphragm shall withstand a differential pressure of 80 mbar (static pressure) with the positive pressure on the outside (ambient atmosphere).

Testing shall be done in accordance with **8.3** and **8.10.1**.

7.13.2 When a speech diaphragm assembly can be subjected to an external force it shall withstand axially a tensile force of 150 N applied for 10 s. The test shall be repeated nine times at 10 s intervals.

Testing shall be done in accordance with **8.3** and **8.10.2**.

7.13.3 After a class 3 full face mask has been subjected to the thermal radiation test in accordance with **8.6** and allowed to return to ambient temperature, the requirements of **7.13.1** and **7.13.2** shall be met.

Testing shall be done in accordance with **8.3** and **8.10.3**.

7.14 Eyepieces/visor

7.14.1 Eyepieces/visor and anti-mist discs designed to serve as visors shall be attached in a reliable and gastight manner to the faceblank.

Testing shall be done in accordance with **8.3**.

7.14.2 Eyepieces and visors shall not distort vision as determined in practical performance tests.

Testing shall be done in accordance with **8.18**.

7.14.3 The manufacturer shall provide means to reduce misting of the eyepieces or visors so that vision is not interfered with when the apparatus is tested in the practical performance tests.

Where anti-fogging compounds are used as intended or specified by the manufacturer, they shall not be known to be likely to cause irritation or any other adverse effect to health.

Testing shall be done in accordance with **8.3** and **8.18**.

7.14.4 After the test for mechanical strength of the eyepiece(s) or visor the facepiece shall not be damaged in any way that may make it ineffective or cause injury to the wearer. The effectiveness shall be tested by comparing the tightness of the full face mask before and after the test. The full face mask shall meet the requirements of **7.16** both before and after the test for mechanical strength of the eyepiece or visor.

Testing shall be done in accordance with **8.3**, **8.11** and **8.13**.

7.15 Inhalation valves and exhalation valves

7.15.1 General

Valve assemblies shall be such that they can be readily maintained and if intended by the manufacturer correctly replaced.

It shall not be possible to fit an exhalation valve assembly into the inhalation circuit or an inhalation valve assembly into the exhalation circuit.

Inhalation and exhalation valve assemblies, sub-assemblies and piece parts that are designed by the manufacturer to be identical, are acceptable.

Differently designed inhalation and exhalation valve assemblies, sub-assemblies and piece parts are acceptable if a precise and comprehensible description is given in the information supplied by the manufacturer. This information should be supported by illustrations (photographs, drawings) on how to assemble the unit correctly.

To enable correct assembling, the parts shall be unambiguously described or marked.

Means to check the correct assembly shall be described (visual inspection, simple check by wearer, test by maintenance personnel — whatever may be appropriate).

Testing shall be done in accordance with **8.3**.

7.15.2 Inhalation valves

7.15.2.1 Inhalation valves shall function correctly in all orientations and meet the requirements of **7.19**.

7.15.2.2 A full face mask with a threaded connection to EN 148-2 shall not have an inhalation valve. If a threaded connection to EN 148-1 is used, an inhalation valve shall be incorporated in the full face mask. If a full face mask has to be used with filters it shall be provided with an inhalation valve, if there is no valve in the filter.

Testing shall be done in accordance with **8.3**.

7.15.3 Exhalation valves

7.15.3.1 A full face mask with a threaded connection to EN 148-2 shall not have an exhalation valve.

Testing shall be done in accordance with **8.3**.

7.15.3.2 Exhalation valves shall function correctly in all orientations and meet the requirements of **7.19**.

Testing shall be done in accordance with **8.3** and **8.15.1**.

7.15.3.3 A full face mask fitted with a threaded connection to EN 148-1 or EN 148-3 and a full face mask class 1 shall have at least one exhalation valve or other appropriate means to allow the escape of exhaled air and/or excess air.

Testing shall be done in accordance with **8.3**.

7.15.3.4 Exhalation valves (if fitted) shall be protected against or be resistant to dirt and mechanical damage. They may be shrouded or include any other device that may be necessary to comply with **7.20**.

Testing shall be done in accordance with **8.3**.

7.15.3.5 Exhalation valves shall continue to operate correctly and meet the requirements of **7.19** after (a) a continuous exhalation flow of 300 l/min and (b) a negative pressure (static) in the facepiece of 80 mbar (30 s for each test).

Testing shall be done in accordance with **8.3** and **8.12.1**.

7.15.4 Tensile force

7.15.4.1 Class 1 full face masks

Before and after the test the full face mask shall meet the requirement of **7.16**.

When the exhalation valve housing is attached to the faceblank it shall withstand axially a tensile force of 50 N applied for 10 s.

The test shall be repeated 9 times at 10 s intervals.

Testing shall be done in accordance with **8.3** and **8.12.2**.

7.15.4.2 Class 2 and class 3 full face masks

Before and after the test the full face mask shall meet the requirement of **7.16**.

When the exhalation valve housing is attached to the faceblank it shall withstand axially a tensile force of 150 N applied for 10 s.

The test shall be repeated 9 times at 10 s intervals.

Testing shall be done in accordance with **8.3** and **8.12.2**.

7.16 Leaktightness

The leakage of the full face mask shall not exceed that indicated by a change of pressure of 1 mbar in 1 min, when tested with 10 mbar negative pressure.

Testing shall be done in accordance with **8.13**.

7.17 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 have any other adverse effect to health.

Testing shall be done in accordance with **8.3** and **8.18**.

7.18 Carbon dioxide content of the inhalation air

The carbon dioxide content of the inhalation air (dead space) shall not exceed an average of 1 % (by volume).

Testing shall be done in accordance with 8.14.

7.19 Breathing resistance

7.19.1 According to its class and type including the kind of connection a full face mask (except for positive pressure breathing apparatus) shall meet the requirements specified in 7.19.2 or 7.19.3.

When the facepiece has a special connection for use only with positive pressure breathing apparatus, its breathing resistance is not assessed separately but as a part of the complete apparatus, which shall meet the requirements of the appropriate standard for breathing apparatus.

7.19.2 Facepieces with connections other than those in 7.19.3 and 7.19.4 shall meet the requirements given in Table 1.

Testing shall be done in accordance with 8.15.1.

Table 1

Inhalation resistance mbar			Exhalation resistance mbar
30 l/min continuous flow	95 l/min continuous flow	160 l/min continuous flow or 50 l/min sinusoidal (25 cycles/min, 2,0 l/stroke)	160 l/min continuous flow or 50 l/min sinusoidal (25 cycles/min, 2,0 l/stroke)
≤ 0,5	≤ 1,5	≤ 2,5	≤ 3,0

7.19.3 Class 2 and class 3 facepieces with threaded connection to EN 148-2 and without valve(s) shall meet the requirements given in Table 2.

Table 2

Inhalation resistance mbar	Exhalation resistance mbar
160 l/min continuous flow or 50 l/min sinusoidal (25 cycles/min, 2,0 l/stroke)	160 l/min continuous flow or 50 l/min sinusoidal (25 cycles/min, 2,0 l/stroke)
≤ 0,6	≤ 0,6

Testing shall be done in accordance with 8.15.1.

7.19.4 Class 2 and class 3 full face masks with a threaded connection in accordance with EN 148-3, for use with positive pressure breathing apparatus, shall meet the requirements of Table 3.

Testing shall be done in accordance with 8.15.3.

Table 3

Inhalation resistance mbar	Exhalation resistance mbar		
100 l/min sinusoidal (40 cycles/min, 2,5 l/stroke)	100 l/min continuous flow	50 l/min sinusoidal (25 cycles/min, 2,0 l/stroke)	100 l/min sinusoidal (40 cycles/min, 2,5 l/stroke)
≤ 3,5	≥ 4,2	≤ 7,0	≤ 10,0

7.20 Inward leakage

A full face mask shall fit against the contours of the face. The inward leakage of the test agent shall not exceed an average value of 0,05 % of the inhaled air for any of the ten test subjects in any of the test exercises.

Testing shall be done in accordance with 8.16.

7.21 Field of vision

A full face mask equipped with a single visor shall be designed so that the effective field of vision shall be not less than 70 %, related to the natural field of vision, and the overlapped field of vision, related to the natural overlapped field of vision, shall be not less than 80 %.

A full face mask with two eyepieces shall be designed so that the effective field of vision shall be not less than 70 %, related to the natural field of vision, and the overlapped field of vision, related to the natural overlapped field of vision, shall be not less than 20 %.

Testing shall be done in accordance with **8.17**.

7.22 Practical performance

The full face mask shall meet all laboratory tests except flammability and inward leakage before practical performance testing.

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 standard. In addition to the tests described in this standard details of practical performance tests for respiratory protective devices are given in the relevant 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. This will enable other test houses to duplicate the tests and assess the results thereof.

Testing shall be done in accordance with **8.18**.

8 Testing

8.1 General

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

All samples shall meet all requirements.

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

For tests involving positive pressure devices, all testing should be carried out on the complete apparatus including facepiece, as submitted by the applicant.

8.2 Conditioning

Two full face masks shall be exposed during successive tests:

- a) for 72 h to a dry atmosphere of $(70 \pm 3) ^\circ\text{C}$;
- b) for 72 h to an atmosphere of $(70 \pm 3) ^\circ\text{C}$ at 95 – 100 % relative humidity; and
- c) for 24 h to a temperature of $(-30 \pm 3) ^\circ\text{C}$.

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

8.3 Visual inspection

All samples are subject to visual inspection as specified elsewhere in this standard.

The visual inspection shall be carried out prior to or during laboratory or practical performance tests.

8.4 Resistance to temperature

Two samples shall be tested: both in the state as received.

The threaded connectors shall be gauged at room temperature.

For class 3 full face masks the gauge test shall be completed within 30 s of removal.

8.5 Flammability

8.5.1 Class 1 full face masks

8.5.1.1 Principle

Three samples shall be tested: one in the state as received and two conditioned in accordance with 8.2 but after returning to ambient temperature.

The facepiece shall be mounted on a metallic dummy head, passed through a specified flame and the effects of the flame on the facepiece observed.

8.5.1.2 Apparatus

A metallic dummy head mounted on a support which enables it to be rotated by a motor to describe a horizontal circle (see Figure 1).

Gas supply rig consisting of a propane storage tank with flow control valve and pressure gauge and flashback arrester.

A gas burner, adjustable in height. The burner is a TEKLU burner or that described in ISO 6941:1984/AMD 1:1992¹⁾.

A mineral insulated thermocouple probe, 1,5 mm in diameter.

8.5.1.3 Procedure

The facepiece shall be fitted to the dummy head and it shall be ensured that a linear speed, measured at the flame position, of (60 ± 5) mm/s can be obtained.

The head, fitted with the facepiece, shall be rotated so that it is over the burner. The position of the burner shall be adjusted until the distance between the top of the burner and the lowest part of the facepiece which is to pass through the flame is (20 ± 2) mm.

The head and facepiece shall be rotated away from the burner.

The gas at the burner shall be ignited. It shall be ensured that the burner air vent is fully closed and the flow control valve shall be adjusted to give a flame height of (40 ± 4) mm above the burner top. These settings shall give a flame temperature of (800 ± 50) °C at a point (20 ± 2) mm above the burner top. This temperature shall be checked with the thermocouple probe.

The facepiece fitted to the dummy head shall be passed once through the flame at (60 ± 5) mm/s. The test shall be repeated to enable an assessment to be made of all materials on the exterior of the facepiece. Any one component/material shall be passed through the flame once only.

The facepiece or component shall be examined after it has passed through the flame and it shall be reported whether or not it continues to burn for more than 5 s.

8.5.2 Class 2 and class 3 full face masks

8.5.2.1 Principle

Three samples shall be tested: one in the state as received and two conditioned in accordance with 8.2 but after returning to ambient temperature.

The facepiece shall be tested for flammability for a short period with a test rig as shown in Figure 2 and Figure 3.