SLOVENSKI STANDARD
SIST EN 250:2000

01-september-2000

Nadomeġļa:
SIST EN 250:1996

Oprema za dihanje - Potapljaġki dihalni aparat z odprtim krogom na stisnjen zrak - Zahteve, preskuġanje, oznaļevanje

Respiratory equipment - Open-circuit self-contained compressed air diving apparatus - Requirements, testing, marking

Atemgeräte - Autonome Leichttauchgeräte mit Druckluft - Anforderungen, Prüfung, Kennzeichnung

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Appareils respiratoires - Appareils de plongée autonomes a air comprimé et a circuit ouvert - Exigences, essais, marquage

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ICS:

13.340.30	Varovalne dihalne naprave	Respiratory protective devices

SIST EN 250:2000 **en**

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EUROPEAN STANDARD

NORME EUROPÉENNE

EUROPÄISCHE NORM

EN 250

January 2000

ICS 13.340.30

Supersedes EN 250:1993

English version

Respiratory equipment - Open-circuit self-contained compressed air diving apparatus - Requirements, testing, marking

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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.

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

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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 250:1993.

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of an identical text or by endorsement, at the latest by July 2000, and conflicting national standards shall be withdrawn at the latest by July 2000.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.

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Introduction

A given self-contained open-circuit compressed air underwater breathing apparatus 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 are similar to those of the complete apparatus.

1 Scope

This European Standard applies to self-contained open-circuit compressed air underwater breathing apparatus and their sub-assemblies.

The object of the requirements and tests set out in this European Standard is to ensure a minimum level of safe operation for apparatus down to a maximum depth of 50 m.

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	*Respiratory protective devices - Definitions of terms and pictograms*
EN 144-1	*Respiratory protective devices - Gas cylinder valves - Thread connection for insert connector*
EN 148-1	*Respiratory protective devices - Threads for facepieces - Part 1: Standard thread connection*
EN 148-2	*Respiratory protective devices - Threads for facepieces - Part 2: Centre thread connection*
EN 148-3	*Respiratory protective devices - Threads for facepieces - Part 3: Thread connection M 45x3*
EN 12021	*Respiratory protective devices - Compressed air for breathing apparatus*
ISO 263	*ISO inch screw threads - General plan and selection for screws, bolts and nuts - Diameter range 0,06 to 6 in*
ISO 5145	*Cylinder valve outlets for gases and gas mixtures - Selection and dimensioning*
ISO 12209-1	*Gas cylinders - Outlet connections for gas cylinder valves for compressed breathable air - Part 1: Yoke type connections*
ISO 12209-2	Gas cylinders - Outlet connections for gas cylinder valves for compressed breathable air - *Part 2: Threaded connections*
ISO 12209-3	*Gas cylinders - Outlet connections for gas cylinder valves for compressed breathable air - Part 3: Adaptor for 230 bar valves*

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3 Terms and Definitions

For the purposes of this European Standard the terms and definitions given in EN 132 and the following apply.

3.1
self-contained, open-circuit compressed air underwater breathing apparatus (SCUBA)
apparatus which has a portable supply of compressed air carried by the diver, allowing him to breathe under water and exhale into the ambient water.

The SCUBA, when ready to use, consists of a number of compatible sub-assemblies each of which complies with the appropriate requirements of this standard. When connected together, the complete SCUBA is designed to enable the wearer to breathe air on demand from a high pressure cylinder (or cylinders) via a demand regulator connected to a facepiece. The exhaled air passes, without recirculation, from the demand regulator via the exhalation valve to ambient water.

3.2
high pressure
pressure inside inside the air cylinder(s)

3.3
medium pressure
pressure between the pressure reducer and the demand valve

3.4
low pressure
pressure within the facepiece, approximately ambient pressure

3.5
rated working pressure
maximum working pressure of the respective components

3.6
reference pressure
equilibrium pressure which exists in the facepiece when there is no respiratory gas flow

3.7
respiratory pressure
differential pressure in the facepiece relative to the reference pressure measured during inhalation and exhalation

3.8
opening negative pressure (cracking pressure)
respiratory pressure during inhalation required to open the inhalation valve

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3.9
displaced (tidal) volume
volume of breathing gas displaced by the breathing simulator during one half cycle (inhalation or exhalation) measured in litres

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3.10
breathing frequency
setting of the breathing simulator measured in cycles per minute

3.11
respiratory minute volume (RMV)
product of the tidal volume and breathing frequency measured in litres per minute

3.12
pressure volume diagram
diagram generated during one breathing cycle by plotting the respiratory pressure against the displaced volume

3.13
work of breathing
work expended during one breathing cycle measured in J/l. This work is, in general, proportional to the area bounded by the pressure volume diagram. Work associated with positive pressures during inhalation does not count towards the total work of breathing

3.14
facepiece
device for connecting the apparatus to the wearer. It may be a mouthpiece assembly, a diving half mask or a full face mask

3.15
mouthpiece assembly
device usually held by the teeth, sealing against the lips and through which air is inhaled and exhaled

3.16
full face mask
facepiece covering mouth, nose, eyes and chin which may be fitted with either a mouthpiece or an inner mask

3.17
diving half mask
facepiece, covering mouth and chin and retained by straps

3.18
dead space
volume of the cavity formed between the mouth and the inhalation and exhalation parts

3.19
package of air cylinder(s)
consists of one or more air cylinders with cylinder valve(s) and a carrying frame (if applicable)

3.20
demand regulator
contains a pressure reducer and a demand valve fitted to a facepiece

3.21
demand valve
device, that forms part of a demand regulator which reduces the medium pressure air to ambient pressure

3.22
carrying system
carrying frame or holding device for air cylinder(s) with possibility to mount the harness (if applicable)

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3.23
pressure reducer
device, that forms part of a demand regulator which reduces the high pressure air to medium pressure

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4 Description

4.1 General

The SCUBA may consist of subassemblies.

4.2 Sub-assemblies

During use the minimum sub-assemblies elements shall be the elements a) to e).

a) air cylinder(s) with cylinder valve(s);

b) demand regulator;

c) safety device (s);

d) facepiece: mouthpiece assembly or a diving half mask or full face mask;

e) carrying system.

NOTE Each sub-assembly will be provided with information according to clause 8.

5 Requirements

5.1 Design

The SCUBA and sub-assemblies shall be so designed that its components are located so that protection is achieved against mechanical damage caused by external influence and that it is possible to perform the required pre-dive functional checks.

The combination of sub-assemblies shall not adversely affect the safe operation and use of apparatus.

In the case of several interconnected cylinders it shall be ensured that pressure equalisation between opened cylinder valves and/or open reserve valves is not impeded.

The SCUBA and sub-assemblies shall not have any projecting parts or corners and edges which may injure the diver.

All parts which have to be actuated by the diver during use shall be accessible and controllable even when wearing protective gloves (3-finger, 6 mm to 7 mm, padding on either side). They shall be designed such that their setting cannot be altered inadvertently during use.

Testing shall be done in accordance with 6.2 to 6.11.

5.2 Materials

The materials used shall have adequate mechanical strength and feature sufficient resistance to changes caused by the effect of temperature individually and in the assembled, ready-to-use SCUBA.

Materials that may come into contact with the wearer's skin and/or mouth shall not be known to be likely to cause irritation or any other adverse effects to health.

After testing in accordance with 6.2 and 6.11 the SCUBA shall still be fully functional, thus satisfying the specified requirements.

Testing shall be done in accordance with 6.2 and 6.11.

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5.3 Air cylinder(s)

The air cylinder(s) shall comply with the appropriate national or European specifications and shall be approved and tested with respect to the rated working pressure.

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The air cylinder shall be marked with the appropriate neck thread designation according to EN 144-1 where the preferred versions are M 18 x 1,5 and M 25 x 2.

Testing shall be done in accordance with 6.2.

5.4 Cylinder valves

Cylinder valves shall comply with appropriate national or european specifications and shall be approved and tested for use at the rated working pressure.

The threads shall be as specified in EN 144-1 where the preferred versions are M 18 x 1,5 and M 25 x 2.

Safe connection between the cylinder valve(s) and the demand regulator shall be ensured by using one of the connections specified in the following standards ;

a) ISO 5145;

b) ISO 12209-1, ISO 12209-2, ISO 12209-3.

The valve shall be so designed or so located that it cannot be closed inadvertently. This is met e.g. by at least 2 turns from fully open to fully closed position.

The function of the cylinder valve shall not be impaired by the ingress of water.

The cylinder valve shall be protected against the entrainment of dirt, solid particles and water from inside the cylinder for example by means of a protective tube with a length of at least 30 mm and an inside diameter of at least 2,5 mm. If provided, an additional filter shall have a surface area of at least 900 mm^2 and be reliably connected to the protective tube.

Testing shall be done in accordance with 6.2 and 6.11.

The pressure drop measured across the complete cylinder valve assembly with a cylinder pressure of 50 bar shall not exceed 10 bar.

Testing shall be done in accordance with 6.7.

5.5 High pressure parts and connections

Metallic high pressure tubes, valves and couplings shall be tested to prove that they are capable of withstanding a pressure of 50 % above the rated working pressure of the sub-assemblies as specified by the manufacturer.

Non-metallic high pressure tubes, valves and couplings shall be tested to prove that they are capable of withstanding a pressure of twice the rated working pressure of the cylinder.

High pressure outlet(s), if threaded, shall have 7/16-20 UNF in accordance with ISO 263 (see figures 5a and 5b).

It shall not be possible to connect the medium pressure hose assemblies to high pressure outlets.

Testing shall be done in accordance with 6.2 and 6.3.

5.6 Demand regulator

5.6.1 General

The demand regulator shall meet the following requirements when tested at 6 bar absolute pressure:

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a) the work of breathing shall not exceed 3,0 J/l;

b) the peak respiratory pressure during inhalation and exhalation shall be within the range of ± 25 mbar;

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c) the positive work of breathing during inhalation shall not exceed 0,3 J/l;

d) pressure spikes with no measureable positive work of breathing shall not exceed 10 mbar;

e) Pressure peaks with measurable positive work of breathing shall not exceed 5 mbar.

Testing shall be done in accordance with 6.5.

5.6.2 Pressure reducer

On the pressure reducer of the demand regulator any adjustable medium pressure setting shall be reliably secured against accidental alteration and adequately sealed so that any unauthorised adjustment can be detected.

5.6.3 Pressure relief system

5.6.3.1 Upstream demand valve

A demand regulator with an upstream demand valve shall have a relief valve fitted which shall pass an air flow of 400 l/min at a medium pressure not exceeding 30 bar.

The inhalation respiratory pressure shall not exceed -25 mbar and the exhalation respiratory pressure shall not exceed 25 mbar.

Testing shall be done in accordance with 6.4.1 and 6.4.2.

5.6.3.2 Downstream demand valve

The inhalation and exhalation respiratory pressures shall not exceed -25 mbar and 40 mbar respectively when tested in accordance with 6.4.1 and 6.4.3.

5.6.4 Demand valve

The air bubbles emerging shall not impede the diver's vision in the swimming position.

The demand valve shall be such that it can be easily cleaned, assembled and tested for its function. It shall be protected against ingress of dirt and mechanical damage.

The demand valve shall incorporate a device to expel water.

The operation of the demand valve shall not be degraded by free-flow conditions.

Testing shall be done in accordance with 6.2, 6.5 and 6.11.

5.6.5 Exhalation valve

The design and configuration of the exhalation valve shall prevent the ingress of water in all positions.

The operation of the exhalation valve shall not be degraded after being subjected to

a) a constant flow of 300 l/min for a period of 1 min;

b) a static negative pressure of 80 mbar for a period of 10 s (when in the wetted condition).

The leakage of the exhalation valve (when in the wetted condition) shall not exceed 0,25 ml(stp) / min when tested with a negative pressure of 7 mbar (equivalent to 0,5 mbar with a proof volume of 500 ml during 1 min).

Testing shall be done in accordance with 6.2, 6.6 and 6.11.

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5.7 Hose assemblies

5.7.1 General

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The same high pressure or medium pressure hose assembly respectively shall meet the requirements specified in the following sequence: 5.7.2, 5.7.3, 5.7.4 or 5.7.7, respectively.

5.7.2 Tensile load of high and medium pressure hose assemblies

The unpressurized hose assembly shall be subjected to a tensile load of 1000 N for a test period of 10 s to 15 s. Testing shall be done in accordance with 6.3.1.

5.7.3 Flexibility of high and medium pressure hose assemblies

The unpressurized hose assembly shall be capable of being bent to an angle of 180° for 8 h.

Testing shall be done in accordance with 6.3.2.