

BRITISH STANDARD

Respiratory protective devices –

Breathing gases for diving and hyperbaric applications

ICS 13.340.30; 97.220.40

BSi
British Standards

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Foreword

Publishing information

This British Standard was published by BSI and came into effect on 29 September 2006. It was prepared by Subcommittee PH/4/7, *Underwater breathing apparatus*, under the authority of Technical Committee PH/4, *Respiratory protection*. A list of organizations represented on this committee can be obtained on request to its secretary.

Information about this document

This standard specifies requirements for the composition and purity of breathing gases, other than compressed air, for diving and hyperbaric applications. Compressed air for breathing apparatus is specified in BS EN 12021.

The toxic and harmful effects of impurities in breathing gases are increased at hyperbaric pressures. The limiting levels of impurities specified in this standard, which are given as values corrected to normal atmospheric pressure, have been reduced to allow for this effect.

Hazard warnings

WARNING. This British Standard calls for the use of substances and/or procedures that can be injurious to health if adequate precautions are not taken. It refers only to technical suitability and does not absolve the user from legal obligations relating to health and safety at any stage.

Use of this document

It has been assumed in the preparation of this British Standard that the execution of its provisions will be entrusted to appropriately qualified and experienced people, for whose use it has been produced.

Presentational conventions

The provisions of this standard are presented in roman (i.e. upright) type. Its requirements are expressed in sentences in which the principal auxiliary verb is “shall”.

Commentary, explanation and general informative material is presented in smaller italic type, and does not constitute a normative element.

Contractual and legal considerations

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.

In particular, attention is drawn to the Control of Substances Hazardous to Health Regulations 2002 (as amended).

1 Scope

This British Standard specifies requirements and test methods for the composition and purity of breathing gases, other than compressed air, for use in diving and hyperbaric applications.

The standard is applicable to the following categories of gas mixtures:

- a) breathing oxygen;
- b) oxygen and nitrogen gas mixtures (known as nitrox);
- c) oxygen and helium gas mixtures (known as heliox);
- d) oxygen, helium and nitrogen gas mixtures (known as trimix).

The standard is not applicable to compressed gases for medical use, or to gases for use in high altitude breathing apparatus.

NOTE 1 The composition and purity of compressed air is specified in BS EN 12021.

NOTE 2 If compressed air for a diving application is intended for creating a nitrox mixture this compressed air (also known as "oxygen compatible air") is considered to be nitrox and is subject to the requirements specified in this standard.

2 Normative references

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.

BS ISO 6145, *Gas analysis – Preparation of calibration gas mixtures using dynamic volumetric methods*

HEALTH AND SAFETY EXECUTIVE. *Workplace exposure limits*. Guidance Note EH 40. Sudbury: HSE Books.

3 Terms and definitions

For the purposes of this British Standard, the following terms and definitions apply.

3.1 oxygen and nitrogen gas mixture (known as nitrox)

gas comprising a specified mixture of oxygen and nitrogen, capable of supporting human life under appropriate diving or hyperbaric conditions

NOTE 1 This includes manufactured gas mixtures made up from combinations of pure oxygen and pure nitrogen, with or without compressed air.

NOTE 2 This definition differs from that in BS EN 13949:2003 in that it covers all oxygen and nitrogen gas mixtures irrespective of oxygen content.

**3.2 oxygen and helium gas mixture
(known as heliox)**

gas comprising a specified mixture of oxygen and helium, capable of supporting human life under appropriate diving or hyperbaric conditions

**3.3 oxygen, helium and nitrogen gas mixture
(known as trimix)**

gas comprising a specified mixture of oxygen, helium and nitrogen, capable of supporting human life under appropriate diving or hyperbaric conditions

NOTE This includes manufactured gas mixtures made up from combinations of pure oxygen, pure helium and pure nitrogen, with or without compressed air.

3.4 bundle of cylinders

assembly of cylinders that are fastened together and that are interconnected by a manifold

4 Requirements

4.1 Freedom from toxic components

The gas shall be tested in accordance with **5.5**. If in the test any constituents of the gas are identified that are not listed in Tables 1 to 4, these constituents shall be checked against the list of substances for which workplace exposure limits are given in HSE Guidance Note EH 40. No constituent listed in EH 40 shall be present at a level in excess of one tenth of the eight hour workplace exposure limit given in EH 40.

4.2 Freedom from particulate contamination

When tested in accordance with one of the methods given in **5.12**, the level of particulates in the gas sample shall not exceed that specified in a) or b) as applicable.

- a) If measurement is made by light/laser obscuration in accordance with **5.12.1**, particles of diameter $\leq 10 \mu\text{m}$ shall not exceed 70 000 particles/ m^3 , and there shall be no particles of diameter $> 10 \mu\text{m}$.
- b) If measurement is made by filtration, in accordance with **5.12.2**, the following limits shall not be exceeded:
 - particles $\leq 1 \mu\text{m}$ to $\leq 3 \mu\text{m}$: maximum 0.6 particles/ cm^3 ;
 - particles $> 3 \mu\text{m}$ to $\leq 10 \mu\text{m}$: maximum 0.1 particles/ cm^3 ;
 - particles $> 10 \mu\text{m}$: maximum 0.04 particles/ cm^3 .

4.3 Freedom from odour

A sample of a gas which has been shown to conform to **4.1** and **4.2** shall be assessed in accordance with **5.3**. If there is any odour classified by any of the assessors as “unsatisfactory” the gas shall be deemed not to conform to the standard.