

BS 8478:2011



BSI Standards Publication

Respiratory protective devices – Breathing gases for diving and hyperbaric applications – Requirements and test methods

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Summary of pages

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Foreword

Publishing information

This British Standard is published by BSI and came into effect on 28 February 2011. 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 these committees can be obtained on request to their secretary.

Supersession

This British Standard supersedes BS 8478:2006, which is withdrawn.

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.

This is a full revision of the standard, and introduces the following principal changes.

- a) Requirements for the composition of oxygen compatible air and the composition of nitrogen depleted air have been added.
- b) Requirements for the composition of helium for making breathing gas mixtures has been added.
- c) Requirements for the mixing of gases have been added.
- d) Requirements for freedom from particulate contamination are no longer specified.
- e) The maximum permissible water content in breathing oxygen, oxygen and nitrogen gas mixtures, oxygen and helium gas mixtures and oxygen, helium and nitrogen gas mixtures has been raised from $5 \text{ mg}\cdot\text{m}^{-3}$ to $15 \text{ mg}\cdot\text{m}^{-3}$.
- f) For oxygen and helium gas mixtures, the maximum carbon monoxide content has been reduced from 1 ppm to 0.2 ppm, and the maximum content of "other non-toxic gases" has been reduced from <1% to <0.5%.
- g) The sampling requirements have been changed.
- h) The test method for oil content has been changed so that it no longer requires the use of trichloro-trifluoro-ethane as, under the Montreal Protocol on Substances that Deplete the Ozone Layer [1], the manufacture of this substance is not permitted.
- i) Methods have been added for stain detector tube and stain system analysis for carbon monoxide, carbon dioxide, water and oil content in gases derived from compressed air (see 5.14).

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 as specified in BS EN 12021, for use in diving and hyperbaric applications.

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

- a) breathing oxygen;
- b) oxygen compatible air;
- c) nitrogen depleted air;
- d) oxygen and nitrogen gas mixtures;
- e) oxygen and helium gas mixtures;
- f) oxygen, helium and nitrogen gas mixtures.

The standard also specifies requirements and test methods for the purity of helium for use in making breathing gas mixtures.

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

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

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 EN 1089-3, *Transportable gas cylinders – Gas cylinder identification (excluding LPG) – Part 3: Colour coding*

BS EN ISO 7225, *Gas cylinders – Precautionary labels*

BS EN ISO 13769, *Gas cylinders – Stamp marking*

BS ISO 8573-2, *Compressed air – Part 2: Test methods for oil aerosol content*

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

HEALTH AND SAFETY EXECUTIVE. *Occupational exposure limits for hyperbaric conditions*. Hazard Assessment Document EH 75/2. Sudbury: HSE Books.

3 Terms and definitions

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

3.1 oxygen compatible air

compressed natural breathing air where the level of impurities has been reduced to make it suitable for use in gas mixtures containing oxygen concentrations greater than 22%

NOTE 1 Oxygen compatible air is also known in the diving industry as “oil free air”, “clean air” or “double filtered air”.

NOTE 2 When oxygen compatible air is mixed with oxygen the mixture may be known as "nitrox".

NOTE 3 When oxygen compatible air is mixed with helium the mixture may be known as "trimix".

3.2 nitrogen depleted air

compressed natural breathing air from which some nitrogen has been removed and where the levels of impurities have been reduced, to make it suitable for use in, or as, a gas mixture containing oxygen concentrations greater than 22%

NOTE Nitrogen depleted air may also be known as "nitrox".

3.3 oxygen and nitrogen gas mixture

gas mixture produced by mixing oxygen and nitrogen, capable of supporting human life under appropriate diving or hyperbaric conditions

NOTE 1 This definition does not cover gas mixtures produced using oxygen compatible air or nitrogen depleted air.

NOTE 2 Oxygen and nitrogen gas mixtures may also be known as "nitrox".

3.4 oxygen and helium gas mixture

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

NOTE Oxygen and helium gas mixtures may be known as "heliox".

3.5 oxygen, helium and nitrogen gas mixture

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

NOTE Oxygen, helium and nitrogen gas mixtures may be known as "trimix".

3.6 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 or 5.7. If in the test any constituents of the gas are identified that are not listed in Table 1 to Table 7, 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.

Where the gas is to be used for breathing at ambient pressures greater than 10 bar and/or periods in excess of 8 hours, the calculations given in EH 75/2 to take account of the increased pressure and/or duration shall be applied.

NOTE At ambient pressures greater than 10 bar the level of contaminants needs to be less than one tenth of the workplace exposure limit given in EH 40. Therefore, the calculations given in EH 75/2 need to be applied.