BRITISH STANDARD AEROSPACE SERIES

BS 3N 3:2000
(superseding BS 2N 3 : 1990)

Breathing oxygen for airborne applications

Committees responsible for this British Standard

The preparation of this British Standard was entrusted to Technical Committee ACE/38, Aircraft oxygen equipment, upon which the following bodies were represented:

British Airways
British Compressed Gases Association
Civil Aviation Authority (Airworthiness Division)
Health and Safety Executive
Ministry of Defence
Society of British Aerospace Companies Ltd.
South Bank University

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The following BSI references relate to the work on this standard:
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Contents

Foreword

This British Standard has been prepared by Technical Committee ACE/38. It supersedes BS 2N 3:1990 which is withdrawn. This revision introduces requirements for liquid oxygen in addition to gaseous oxygen and is based largely on Def Stan 16-1/3 (16 October 1992) [1].

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Summary of pages

This document comprises a front cover, an inside front cover, pages i and ii, pages 1 and 2, an inside back cover and a back cover.

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1 Scope

This British Standard specifies the characteristics of liquid and gaseous oxygen supplied for the replenishment of airborne oxygen systems.

2 Definitions

2.1

liquid oxygen (LOX)

pale blue liquid with a temperature of approximately −183 °C at 101.3 kPa (760 mm Hg) ambient pressure and having a density of 1.14 kg/l

2.2

normal temperature and pressure (NTP)

ambient temperature of 15 °C and atmospheric pressure of 101.3 kPa (760 mm Hg)

2.3

gasification, gasify

process of producing gaseous oxygen, for analysis, from a LOX sample without atmospheric contamination

3 Gaseous breathing oxygen

3.1 Production

The gas shall be evaporated from liquid oxygen produced by the fractional distillation of liquid air.

3.2 Odour

The oxygen shall be odourless (see **4.2.3** for method of test for liquid oxygen).

3.3 Purity

The minimum purity of oxygen delivered to the system shall be 99.5 % by volume.

NOTE Gases supplied for breathing should not contain any contaminants, whether specified in this document or not, at a concentration which is likely to cause toxic or harmful effects to the user. The limit of concentration for any contaminant should be derived from the occupational exposure levels (OEL) set by the HSE [2], taking into account the effects of pressure and exposure time.

3.4 Water content

The water content of the oxygen shall not exceed 5 $mg \cdot m^{-3}$ calculated at NTP. This corresponds to a dew point of −63.3 °C at an ambient pressure of 101.3 kPa (760 mm Hg) which is equivalent to a saturation temperature of −40.0 °C (or lower) at a pressure of 2.1 MPa.

3.5 Contaminants

3.5.1 The maximum concentration of contaminants shall conform to those specified in Table 1. Nitrogen and inert gases shall not be considered to be contaminants. There shall be no oil, mist or aerosol.

3.5.2 If the presence of contaminants other than those in Table 1 are detected, this shall be reported. If any such contaminant can be identified, its concentration shall not exceed 0.1 ppm (by volume) except where the note to **3.3** applies.

Table 1 — Maximum concentration of contaminants in gaseous breathing oxygen

Constituent	Maximum concentration, ppm (by volume)
Carbon dioxide	10.0
Carbon monoxide	1.0
Methane	50.0
Acetylene	0.05
Ethylene	0.2
Ethane and higher hydrocarbons	3.0 (ethane equivalent)
Nitrous oxide	2.0
Refrigerants	1.0
Solvents	0.1
Other	(see **3.5.2**)

3.6 Solids content

The oxygen shall contain no particles with any dimension longer than 100 μm. The total mass of solids shall not exceed 1 $mg \cdot m^{-3}$ of gaseous oxygen at NTP.

3.7 Marking

Cylinders and other containers filled with gaseous oxygen conforming to this British Standard shall be clearly marked as follows:

"**Aviator's breathing oxygen**"; or

"**O_2 AV**".

4 Liquid oxygen (LOX)

4.1 Sampling

NOTE 1 Samples of LOX may be taken at any time from the production plant or any portion of a consignment. If any sample from the production plant is found not to conform to the requirements of this British Standard, all deliveries may be rejected, including those in transit. If any sample from a consignment is found not to conform to this British Standard, the whole consignment may be rejected.

NOTE 2 Due to the cryogenic nature of LOX, special precautions should be observed. Particular attention should be paid to the following:

a) wear protective equipment, including face and eye shields;

b) protect connecting hoses from moisture and other contaminants when not in use;

c) ensure the sample container, associated hoses and pipes are thoroughly clean and dry before use by heating and/or purging with warm, dry, oil-free nitrogen or oxygen;

d) always flush the hoses, pipes and containers with LOX then discard any LOX collected before taking the sample for analysis.

4.2 Purity

4.2.1 When examined in a clear Dewar flask, the LOX sample shall be free from any suspended matter and visible impurities.

4.2.2 After gasification, the minimum purity of oxygen shall be 99.5 % by volume.

4.2.3 The method of test for odour shall be as follows.

Pour approximately 100 ml of the LOX into a clean 400 ml beaker, rotate it gently to cool the beaker and pour off the LOX. Cover the bottom of the beaker with a piece of filter paper and add 200 ml of the LOX, then cover the beaker with a watch glass to prevent atmospheric constituents being absorbed by the LOX. Allow the LOX to evaporate to dryness in a volume free from air currents and extraneous odours. Remove the watch glass and check the odour of the beaker contents at regular intervals until all the frost on the outside of the beaker has melted (any odour will be most noticeable when the beaker has warmed nearly to room temperature). When tested in accordance with this test no odour shall be detected (see **3.2**).

4.3 Water content

When gasified, the water content of the oxygen shall conform to **3.4**. Any saturation temperature apparatus used to measure water content shall have a reproducibility of 1 °C at −40.0 °C.

4.4 Contaminants

4.4.1 After gasification of the LOX sample, the maximum concentration of contaminants shall conform to those specified in Table 2. Nitrogen and inert gases shall not be considered to be contaminants.

4.4.2 If the presence of contaminants other than those specified in Table 2 are detected, this shall be reported. If any such contaminant can be identified, its concentration shall not exceed 0.1 ppm (by volume) except where the note of **3.3** applies.

Table 2 — Maximum concentration of contaminants in gasified LOX

Constituent	Maximum concentration, ppm (by volume)
Carbon dioxide	5.0
Methane	50.0
Acetylene	0.05
Ethylene	0.2
Ethane and higher hydrocarbons	3.0 (ethane equivalent)
Nitrous oxide	2.0
Refrigerants	1.0
Solvents	0.1
Other	(see **4.4.2**)

Bibliography

Other documents

[1] Def Stan 16-1/Issue 3: 1992 Oxygen; Liquid and gaseous (breathing) for aircraft systems.
[2] HSE Guidance Note EH40, Health and Safety Executive, HSE Books, PO Box 1999, Sudbury, Suffolk, CO10 2WA.

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