

Anaesthetic and analgesic machines —

Part 3: Specification for continuous flow anaesthetic machines

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Committees responsible for this British Standard

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- Association of Anaesthetists of Great Britain and Ireland
- Association of Veterinary Anaesthetists of Great Britain and Ireland
- British Anaesthetic and Respiratory Equipment Manufacturers' Association
- British Health-care Trade and Industry Council
- British Rubber Manufacturers' Association
- Department of Health and Social Security
- Institution of Production Engineers
- Medical Sterile Products Association
- National Health Service Regional Engineers' Association

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Foreword

This Part of BS 4272 has been prepared under the direction of the Health Care Standards Committee. It is related to ISO 5358 which was prepared by Technical Committee ISO/TC 121, Anaesthetic and respiratory equipment, and published by the International Organization for Standardization (ISO).

ISO 5358 was not implemented as a British Standard when it was published in 1980 due to difficulties that would have been caused by references to International Standards that were in preparation. When these difficulties were overcome some years later, it was decided that ISO 5358 could still not be implemented directly as it was by then in need of technical revision. A revised edition of ISO 5358 is in preparation within ISO/TC 121 but it was decided to publish a British Standard, in advance of this revision becoming available, as it is now needed for use in procuring equipment within the Health Service.

The principal differences between this Part of BS 4272 and ISO 5358:1980 are as follows:

- a) the scope has been restricted to exclude anaesthetic machines incorporating electrical devices;
- b) requirements are included for pin-indexing of medical gas cylinder connections by reference to BS 1319;
- c) pipeline inlet connections are required to be the body of a non-interchangeable screw-threaded (NIST) connector in accordance with BS 5682;
- d) the stems of flow control valves are required to be captive;
- e) in banks of flowmeters, the flowmeter for oxygen is required to be on the left-hand side;
- f) requirements are included for the maximum electrical resistance of flowmeter tubes of the bobbin type;
- g) test methods have been included for pressure gauge integrity, leakage, cross-contamination, vaporizer accuracy and average delivered concentration of anaesthetic vapour from the vaporizer.

This Part of BS 4272 has been prepared with the aim of reducing the possibilities of mechanical failure or malfunction of anaesthetic machines and of promoting interchangeability of anaesthetic equipment.

The committee responsible for preparing this standard has considered the increasing use of oxygen analyzers in anaesthetic practice and has decided that requirements for oxygen analyzers should not be included. A separate standard, ISO 7767, for these is in preparation and, when published, will be implemented as a Section of BS 5724.

Recent designs of anaesthetic machines include electronic and digital controls, servo-mechanisms, monitoring devices and various means of attachment for user-detachable vaporizers. Insufficient experience was available to include requirements for these when this Part of this standard was prepared but it is hoped to do so in a future revision.

The other Parts of this standard are as follows:

- *Part 1: Anaesthetic machines of the on-demand type supplied with nitrous oxide and oxygen from separate containers;*
- *Part 2: Analgesic machines of the on-demand type supplied with pre-mixed nitrous oxide oxygen from a single container.*

A British Standard does not purport to include all the necessary provisions of a contract. Users of British Standards are responsible for their correct application.

Compliance with a British Standard does not of itself confer immunity from legal obligations.

Summary of pages

This document comprises a front cover, an inside front cover, pages i to iv, pages 1 to 16, an inside back cover and a back cover.

This standard has been updated (see copyright date) and may have had amendments incorporated. This will be indicated in the amendment table on the inside front cover.

1 Scope

This Part of BS 4272 specifies basic design and performance requirements for continuous flow inhalational anaesthetic apparatus (hereinafter referred to as anaesthetic machines) and their components for use with humans.

Recommendations for cleaning and servicing of anaesthetic machines are given in Appendix A.

Draw-over anaesthetic apparatus and anaesthetic machines incorporating electrical devices are outside the scope of this Part of BS 4272.

NOTE 1 A standard specifying particular requirements for safety of anaesthetic machines incorporating electrical devices is in preparation.

NOTE 2 The titles of the publications referred to in this Part of this standard are listed on the inside back cover.

2 Definitions

For the purposes of this Part of this standard, the following definitions apply.

2.1

anaesthetic machine

equipment for dispensing and delivering medical and anaesthetic gases and vapours into a breathing system

2.2

machine gas piping

all pipework, including unions, from the unidirectional valves in the pipeline inlets and from the pressure regulator outlets to the flowmeter controls and auxiliary gas outlets, and also piping leading to and from pneumatic alarm systems, gauges and oxygen flush valves

2.3

machine gas delivery system

the gas/vapour pathway between the flowmeter control valves and the common gas outlet

2.4

gas mixer

a device which receives separate supplies of oxygen and other medical gas(es) and which delivers the mixed gases in controllable or pre-set proportions at a controllable flow

2.5

pipeline distribution pressure

the design operating pressure of a medical gas pipeline system

NOTE The pressure used for medical gas systems in hospitals in the UK is 400 kPa.

2.6

common gas outlet

the port through which the dispensed mixture from the anaesthetic machine is delivered to the breathing system

2.7

breathing system

the gas pathways continuously or intermittently in communication with the patient's respiratory tract during any form of ventilation. Where a shrouded adjustable pressure-limiting (APL) valve is used to collect gases from the source of their emission, the breathing system terminates at that valve

NOTE 1 In practice a breathing system is usually regarded as extending from:

- a) the point of supply of a controlled gas mixture, e.g. the common gas outlet of an anaesthetic machine; or
- b) the fresh gas inlet of a circle system, lung ventilator, T-piece arrangement, etc.; or
- c) the fresh gas inlet of a manually-powered resuscitator.

NOTE 2 Gas pathways exclusively concerned with gas scavenging systems are not to be regarded as part of a breathing system.

2.8

gas-specific

having characteristics which prevent interchangeability and thereby allow assignment to one gas or vacuum service only

2.9

pressure regulator

a device for reducing and controlling gas pressure which is intended to provide a constant delivery pressure over a range of variable inlet pressures and/or flows

3 General

3.1 Protection against mechanical hazards

Anaesthetic machines shall comply with 21.1 and 21.2 and clauses 22, 23, 24, 25 and 28 of BS 5724-1:1979.

3.2 Legibility

All markings pertaining to the operation of anaesthetic machines shall be legible to an operator having visual acuity, corrected if necessary, of at least 1.0 seated or standing 1 m in front of the anaesthetic machine and at an illuminance of 215 lx.

3.3 Mobility

If an anaesthetic machine is mounted on castors, these shall be at least 75 mm in diameter and shall comply with BS 2099.

NOTE Castors may incorporate a lock.

4 Connecting yokes for medical gas cylinders

4.1 All medical gas cylinder inlet connections shall comply with BS 1319. Each connecting yoke shall be permanently and legibly (see **3.2**) marked with the name or chemical symbol of the gas to which it is applicable.

4.2 Mobile anaesthetic machines shall be provided with a means of connecting a reserve oxygen supply to the machine as follows.

- a) Those intended for use with a pipeline supply only shall be fitted with at least one oxygen yoke complying with BS 1319.
- b) Those intended either for use with cylinders only or a combined pipeline and cylinder supply shall be fitted with at least two oxygen yokes complying with BS 1319.

NOTE Fixed machines, generally wall-mounted, may have an oxygen reserve yoke fitted.

4.3 If two or more yokes for the same gas are fitted on the anaesthetic machine, the leakage of gas from an open cylinder in one yoke through another yoke to atmosphere shall not exceed 50 mL/min, corrected to 20 °C and 101.3 kPa, when tested at steady cylinder pressures of 1.4 MPa and 15 MPa.

4.4 Any yoke not connected to a pressure regulator shall be fitted with a unidirectional valve such that reverse flow shall not exceed 50 mL/min at a pressure of 420 kPa in the machine gas piping.

4.5 A sintered bronze filter complying with BS 1752 and having a pore size index no greater than 100 µm shall be provided upstream of each cylinder pressure regulator.

5 Connections for piped medical gas supplies

5.1 If pipeline inlet connections are fitted to an anaesthetic machine, they shall be the body of a non-interchangeable screw-threaded (NIST) connector in accordance with BS 5682.

5.2 Unidirectional valves shall be provided such that the reverse flow of gases from the anaesthetic machine to the pipeline, or to atmosphere if yokes for cylinders are also provided, shall not exceed 50 mL/min, corrected to 20 °C and 101.3 kPa, at a pressure of 420 kPa in the machine gas piping.

6 Cylinder and pipeline gauges and indicators

6.1 Except for cyclopropane, each gas supplied from cylinders to the anaesthetic machine shall be monitored by a pressure gauge or contents indicator. The scale of the gauge or indicator shall extend to a pressure at least 33 % greater than either the filling pressure of the cylinder or the full indication position at 20 ± 2 °C.

6.2 If more than one cylinder yoke is fitted for any gas, a cylinder pressure gauge or contents indicator shall be provided for each yoke.

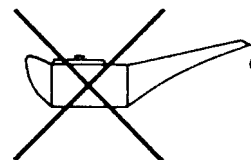
6.3 Gases supplied by pipeline from a central supply shall be monitored by pressure gauges or indicators on the anaesthetic machine. These gauges or indicators shall be connected to the machine gas piping on the supply side of the unidirectional valves (see **5.2**). The scales of the gauges or indicators shall extend to a pressure at least 33 % greater than the pipeline distribution pressure.

6.4 Gauges for use with medical gases on anaesthetic machines shall comply with BS 1780, except for the requirements specified in **5.11**, and with the following.

- a) All components shall be thoroughly cleaned and degreased before assembly.
- b) All gauges shall be free from oil.
- c) When gauges are tested, oil shall not touch or enter them. They shall be tested only with oil-free water or dry clean air or other medium on equipment used for that test only. Other gauges shall not be tested on that equipment due to the risk of oil contamination.

NOTE Factory air supplies are rarely, if ever, free from oil contamination.

- d) Gauges shall be marked on the dial with the words "USE NO OIL" or with the symbol (a deleted oil can) shown below.



- e) The name or chemical symbol of the gas to which each gauge refers shall be marked on or adjacent to the gauge dial. If colour coding is also used it shall be in accordance with BS 1319C.
- f) Gauges shall either comply with **5.11.1** of BS 1780:1985 or be provided with a restrictor in the shank and a blow-out device in the back of the case so that, when tested as described in Appendix B, no parts of the gauge are expelled.
- g) The windows of all gauges shall be made of non-splintering glass or plastics material.