

Specification for

Terminal units, hose assemblies and their connectors for use with medical gas pipeline systems

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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 Rubber Manufacturers' Association
- British Surgical Trades Association Incorporated
- Department of Health and Social Security
- Medical Sterile Products Association
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Foreword

This revision of this British Standard has been prepared under the direction of the Surgical Instruments and Medical Equipment Standards Committee to incorporate the many technical changes which have occurred since it was first published. It supersedes BS 5682:1978, which is withdrawn.

Work on medical gas pipeline systems is also being undertaken within the International Organization for Standardization (ISO), by Technical Committee ISO/TC 121, Anaesthetic equipment and medical breathing machines. International standards are being prepared for non-flammable medical gas pipeline systems and hose assemblies for medical gas systems. The first of these will specify requirements for the installation, construction, function, documentation and testing of non-flammable medical gas pipeline systems to ensure patient safety. The second will specify requirements for hose assemblies fitted with either the diameter index safety system (DISS) connectors used in North America or the non-inter-changeable screw-threaded (NIST) connectors specified in this standard.

In any medical gas system, an incorrect gas connection may create a hazard to the life of the patient. To prevent interchangeability between different services, particular attention has been paid to ensuring that the connectors for each medical gas are gas-specific. NIST connectors are specified for each service, except where their use would be inappropriate, e.g. for connection to air-driven drills, or to equipment coupled to a direct probe to form a single functional unit.

Consideration has been given to incorporating a secondary lock in terminal units to prevent accidental ejection of directly connected equipment, e.g. probe and flowmeter assembly, when the probe release is activated. Evidence indicates, however, that this feature is undesirable as it may give a false impression of effective connection. It is therefore excluded from socket assemblies complying with this standard.

Specifying a standard interface between the pipeline termination assembly and the socket assembly has also been considered but has not been included as there is a lack of evidence that its absence has proved hazardous in practice; it would also place undesirable limitations on design.

It is essential that there is non-interchangeability between assemblies produced by any one manufacturer for different gas services. It is also essential that there is non-interchangeability between assemblies for any one service of any one manufacturer and those of other manufacturers for different services. It is therefore the responsibility of manufacturers intending to produce a new design for terminal units to make themselves aware of existing designs to ensure conformity with these principles.

Consideration has also been given to specifying a different size of hose for each service, but this was rejected because a size differential of at least 4 mm would be required and this would result in most of the hoses being bulky and inconvenient. It was decided that the hazard of hose misconnection could be reduced by the use of different coloured tubing for the supply of oxygen, nitrous oxide and vacuum, all other gases being supplied through black tubing coded by coloured bands (collars) at both ends.

Only certain gas services are included in this standard. Six NIST connectors are specified for these in this standard; other NIST connectors are available for development purposes.

It is recognized that despite the provisions of this standard, a risk of error remains at the connection between the hose and the hose insert of the connector and it is essential that care is taken to ensure correct assembly at this point. A requirement is included that the design of this connection is such that it is only made by special equipment. A performance test is also specified.

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 22, 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.

Section 1. General

1 Scope

This British Standard specifies requirements for the construction and installation of terminal units, hoses, hose assemblies and connectors used with pipeline systems for medical gases, including air at 400 kPa for respiratory purposes and at 700 kPa and above for power source purposes, and vacuum.

Connectors and hose assemblies are specified for the following applications:

- a) between a pipeline terminal unit and medical equipment;
- b) between the permanent pipework and a terminal unit of that system at which the user makes connections and disconnections;
- c) between a terminal unit at the end of the permanent pipework and a second terminal unit;
- d) between an emergency supply and permanent pipework;
- e) between a medical gas pressure regulator and medical equipment if the regulator has a gas-specific outlet connector.

Certain items of pipeline equipment contain integrally installed hose assemblies which cannot be removed or maintained without dismantling the equipment, e.g. in overhead pendant tracks and booms. If these terminate in a NIST connector they are within the scope of this standard.

This standard does not apply to components used for non-clinical purposes, components within medical equipment or on the patient side of the flowmeter, vacuum connections to medical equipment, other than the appropriate NIST connector, or connections to pneumatic power tools.

NOTE 1 Appendix A to Appendix D give information and recommendations on inspection and maintenance of equipment, servicing of hose assemblies, use of probes to BS 5682 in existing terminal units and materials.

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

2 Definitions

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

2.1

hose

a flexible pipe designed for use at pipeline distribution pressure

2.2

hose assembly (low pressure flexible connecting assembly)

an assembly that consists of a hose with permanently attached gas-specific connectors at each end, for use at pipeline distribution pressure

2.3

hose insert (hose tail or hose spigot)

that portion of a connector which is pushed into and secured within the bore (lumen) of the hose

2.4

inlet connection

the point on an item of medical equipment at which the direct probe or the hose from a remote probe is connected

2.5

medical equipment (pipeline-operated)

equipment to which a medical gas pipeline system, operating at pipeline distribution pressure, may be connected, e.g. anaesthetic machines, anaesthetic ventilators and respirable gas mixers

2.6

medical gas pipeline distribution system (pipeline system)

a central supply system with control equipment, a pipeline distribution system and terminal units located where non-flammable medical gases may be required

2.7

NIST connector (non-interchangeable screw-threaded connector)

one of a range of gas-specific connectors, comprising a body, and a nut and nipple

2.8

pipeline distribution pressure

the design operating pressure of a medical gas pipeline system

NOTE The pressure used for medical gas systems in UK hospitals is 400 kPa. Air used for surgical tools and other non-respiratory applications may be supplied at 700 kPa and above. Vacuum distribution systems are operated at not less than 53.3 kPa (400 mm Hg) below standard atmospheric pressure (see BS 4957).

2.9

pipeline termination assembly

the part of a terminal unit that is connected either permanently to the permanent pipework or, in booms and pendants, by a NIST connector to a hose assembly

2.10**probe (quick connector)**

the male component designed for acceptance by, and retention in the socket assembly of, its own particular service only. Non-interchangeability is achieved by differentiation of the indexing collar

2.11**direct probe**

a probe that has either the nut and nipple of a NIST connector as integral parts, or is directly coupled to an item of medical equipment to form a single functional unit which is not intended to be dismantled, except for servicing

2.12**remote probe**

a probe connected to an item of medical equipment by means of an intermediate hose with the hose insert as an integral part of the probe

2.13**service (medical gas service)**

supply of any of the medical gases listed in Table 1

2.14**socket assembly**

the part of a terminal unit that is designed to accept and retain a probe only for its own particular service. It may be either removable from, or an integral part of, the pipeline termination assembly

2.15**terminal unit**

the outlet (inlet for vacuum) in a piped medical gas distribution system, at which the user makes connections and disconnections. It is a complete assembly that is fixed to the permanent pipework or to a flexible pendant. It is designed to accept and retain a gas-specific probe and usually comprises a pipeline termination assembly and a socket assembly

3 General requirements

3.1 Electrical continuity. Hose assemblies and terminal units shall allow the discharge of static electricity between medical equipment and the permanent pipework.

3.2 Wear of components. Components subject to wear shall not be electroplated.

Table 1 — Design requirements for flow and pressure drop across terminal units^a with probe inserted

(1) Service	(2) Pipeline distribution pressure	(3) Terminal unit design flow	(4) Maximum pressure drop across a terminal unit under conditions of pressure and flow given in columns 2 and 3	(5) Maximum pressure drop across a terminal unit and hose or pipework within a boom or pendant, including the NIST connector attached to the permanent pipework
	kPa (bar)	L/min at STP	kPa (bar)	kPa (bar)
Oxygen or nitrous oxide	400 (4.0)	40	3.4 (0.034)	10 (0.10)
Oxygen/nitrous oxide mixture, 50 % V/V	400 (4.0)	275	55 (0.55)	150 (1.50)
Medical air, 400 kPa	400 (4.0)	50	3.4 (0.034)	11 (0.11)
Medical air, 700 kPa ^b	700 (7.0)	250	34 (0.34)	75 (0.75)
Vacuum	53.3 kPa (400 mmHg) below standard atmospheric pressure of 101.3 kPa (760 mmHg)	40	13.3 kPa (100 mmHg)	20 kPa (150 mmHg)

^a These figures do not apply to tests of complete pipeline installations.

^b Requirements for surgical air systems operating at pressures in excess of 700 kPa are under consideration.

Section 2. Terminal units

4 Location

Terminal units shall be capable of being installed in one of the following ways:

- a) as flush-fitting units;
- b) as surface-fitting units;
- c) on booms or pendants;
- d) suspended on a hose;
- e) gang-mounted.

5 Mounting

5.1 Flush-fitting terminal units. Flush-fitting terminal units shall be housed in boxes. The overall depth of each box, excluding the fascia plate, shall not exceed 50 mm. The design of the terminal unit shall allow for variations in plaster thickness.

NOTE The boxes should be corrosion-resistant.

5.2 Surface-fitting terminal units. Each surface-fitting terminal unit shall be installed in a housing.

NOTE Where practicable, wall-mounted, flush-fitting and surface-fitting units should be mounted at a height of approximately 1.3 m from the floor to the centre of the socket.

5.3 Boom- or pendant-mounted terminal units. Terminal units housed within a boom or pendant or attached to a hose suspended from a ceiling rose shall be 1.85 m to 1.95 m from the floor.

NOTE In the case of retractable units, this distance may be greater when measured in the retracted (raised) position.

5.4 Freely-suspended terminal units. Terminal units suspended on a hose shall be buffered to prevent damage to adjacent terminal units, or shall be manufactured from materials which will avoid such damage.

5.5 Gang-mounted terminal units. Where more than one service is provided at one location, the terminal units shall be arranged in the following order from left to right, as seen when facing them: oxygen, nitrous oxide, oxygen/nitrous oxide mixture, medical air 400 kPa (4 bar), medical air 700 kPa (7 bar) and above and vacuum. If a vertical arrangement is used, this sequence shall be followed with oxygen at the top. On a boom, the oxygen shall be nearest the wall or hinge. If a circular arrangement is required, as on a pendant, the sequence shall be followed in a clockwise direction viewed from below.

NOTE Flush or surface-fitted wall-mounted terminal units should be spaced at not less than 100 mm between centres, although a greater distance may be required if the socket is to accommodate items of equipment such as double flowmeters.

6 Design

6.1 Performance. When determined by the method described in Appendix H, the pressure drop across terminal units and across terminal units connected to hose or pipework within a boom or pendant shall be as given in Table 1.

6.2 Probe retention and release. The probe retaining device shall allow single-handed insertion, capture and release of the probe when the terminal unit is rigidly mounted.

6.3 Non-interchangeability. The probe, socket assembly and pipeline termination assembly for each terminal unit shall be designed so as to prevent interchangeability with components of other services. See 6.5.1, 6.5.2 and 6.6.1.

6.4 Connection of the terminal unit to the pipeline installation. This connection shall be either by means of a brazed joint using silver alloy or copper phosphorus brazing alloy complying with BS 1845, or by means of a NIST connector whereby the body forms the pipeline termination, brazed to the pipe in the same way (see 11.3.3).

6.5 Pipeline termination assembly

6.5.1 Components of pipeline termination assembly. If the pipeline termination assembly can be dismantled, components which ensure gas specificity shall be non-interchangeable with those for other services.

6.5.2 Indexing between pipeline termination assembly and socket assembly. The arrangement for attaching a socket assembly to a pipeline termination assembly for one particular service shall be of a design which prevents interchangeability with any termination assemblies for any other service.

NOTE Attention is drawn to the foreword

6.5.3 Isolating valve. Terminal units other than for vacuum shall be provided with an isolating valve to allow maintenance of each socket assembly without having to isolate the pipeline. The isolating valve shall be a component or assembly separate from the self-sealing device specified in 6.6.5.

6.6 Socket assembly

6.6.1 General. The socket assembly shall be accessible for maintenance. If it can be dismantled, components which ensure gas specificity shall be indexed and shall be non-interchangeable with those for any other service. If any component is omitted from the terminal unit, the terminal unit shall either be rendered inoperable or shall maintain its gas specificity.