Scottish Health Technical Memorandum 2022

Piped medical gases in ambulance vehicles

Supplement 2

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Executive summary

This Supplement of SHTM 2022 sets out the requirements for the provision and installation of piped medical gases in ambulances. The guidance given in SHTM 2022 should generally be followed for these systems, except where modified in this Supplement.

Managers will need to take account of other guidance published by the Departments of Health in order to assess the system for technical shortcomings.

Usually the ambulance vehicle would have a medical gas pipework installation with oxygen being supplied from cylinders to a medical gas terminal unit located beside each paramedic seat. The gas supply from oxygen cylinders will require pressure regulation to enable a continuous gas delivery at each terminal unit. It is recommended that if two cylinders are provided, a changeover device be used.

Nitrous oxide and nitrous oxide/oxygen mixtures may be used, but these are normally supplied by a cylinder.

The pipeline installation between cylinder(s) and terminal units should be made by low-pressure flexible connecting assemblies, suitably fixed and secured to the ambulance vehicle structure.

The oxygen supply system and associated pipework should comply with the appropriate requirements of the Pressure Systems Safety Regulations 2000, and will need to be commissioned before use and routinely maintained and tested.

To prevent the accumulation of medical gases within the ambulance, the vehicle should be adequately ventilated.

Where it is necessary to store medical gases used in ambulances, suitable accommodation should be provided. This is detailed in Appendix 1.

Guidance on the transportation, storage and handling of medical gas cylinders in ambulances, ambulance premises and private vehicles is provided in Appendix 2.

Contents

1. Scope

1.1 Guidance in this Supplement to SHTM 2022 covers:

a. piped medical gases in ambulances;

b. transportation, storage and handling of medical gas cylinders in ambulances, private vehicles, and ambulance premises.

1.2 The guidance given should be followed for all new installations, and for refurbishment or upgrading of existing installations.

NOTE: Installations in ambulances are pressure systems, as defined in the 'Pressure Systems Safety Regulations 2000', and should comply with the appropriate requirements.

1.3 It is not necessary to apply the guidance retrospectively unless patient or staff safety would be compromised. In this case, the guidance given in this Supplement should be followed.

1.4 Existing installations should be assessed for compliance with this Supplement. A plan for upgrading the existing system should be prepared, taking account of the priority for patient safety. Operators of vehicles will need to carry out a risk assessment to establish the extent of any remedial action required.

2. General principles

2.1 Where it is required to install a piped medical gas supply system within a patient compartment in the vehicle, the guidance contained in this Supplement and BS 5682, where appropriate, should be used.

Provision of gases

2.2 In general it is necessary to install pipework for oxygen only. It is possible that nitrous oxide and nitrous oxide/oxygen mixtures may be used in some situations, but in such cases it is more cost-effective to rely on individual cylinders.

NOTE: Entonox is a mixture of 50% nitrous oxide and 50% oxygen used as a self-administered analgesic through a demand regulator. Entonox is a registered trade mark of BOC.

2.3 The oxygen supply should comprise a source with a capacity of at least 2000 litres of gas. This can be achieved either by two size F medical oxygen cylinders (giving a maximum capacity of 2720 litres) or by using an RF medical oxygen cylinder with a capacity of 2300 litres.

2.4 Size F cylinders are fitted with a BS 341 ¾" BS P bull-nose outlet, spindle-operated valve incorporating a minimum pressure retention (MPR) device.

2.5 Size RF cylinders are fitted with an integral pressure reducing handwheel valve with a BS 5682 quick-release outlet and live contents gauge.

Provision of terminal units

2.6 Terminal units should be fixed rigidly to the superstructure/internal cladding of the vehicle so that they can be operated safely without undue flexure. One or two terminal units should be provided adjacent to each paramedic seat so that the gas flow gauge is visible, and the gas flow rate can be adjusted easily.

2.7 Terminal units should comply with the latest edition of BS 5682.

Cylinder supply and pressure regulation

2.8 Supply cylinders should be fitted securely to withstand acceleration and deceleration of the vehicle; the system should be designed to retain the cylinders safely in the event of vehicle roll-over.

2.9 Where a detachable pressure regulator is fitted it should incorporate a gauge showing cylinder pressure. The regulating valve should also incorporate a self-closing pressure relief valve, the outlet of which should be vented to atmosphere and designed to vent at a nominal 7.0 bar. The gauge should be visible to the crew during administration of gas to the patient.

NOTE: The provision of a line pressure gauge is not necessary on a small installation (usually less than 5 m). If provided as a client option, a line pressure gauge could be installed in the pipeline system (where it would be most visible) during or after installation. The pipeline system design pressure should be in excess of the pressure regulator relief valve setting (7.0 bar).

2.10 Each terminal unit should provide for continuous oxygen delivery at a flowrate of 40 litres/minute with a nominal supply pressure at the terminal unit of 3.9 ± 0.14 bar.

2.11 Where a pressure regulator is fitted directly to the cylinder, all internal pipework should only be subjected to the terminal supply pressure of 3.9 ± 0.14 bar.

2.12 The pressure regulator should be capable of being connected to the cylinder by hand, and the outlet connection to the service line should incorporate the body of a non-interchangeable screw thread (NIST) connector or a quick-release connector in accordance with BS 5682.

2.13 To optimise the use of gas, it is recommended that a changeover device is provided for two cylinders. This device should incorporate a line pressure gauge and changeover lever with clearly visible indication of which cylinder is in use. Connections to the device should be in accordance with the requirements of BS 5682. The changeover device should be attached securely to a bulkhead within the vehicle adjacent to the cylinders.

Pipeline installation

2.14 The interconnecting pipework between the cylinder regulator outlet and terminal units should be carried out using low-pressure flexible connecting assemblies in accordance with BS 5682 including all the appropriate connectors, and using hose material, coloured white and suitably cleaned and degreased for oxygen service.

2.15 All pipework should be surface-mounted or readily accessible for inspection, adequately and securely clipped to the vehicle walls with an air gap to minimise noise and vibration. Ideally the pipework should be double-clipped, that is, clips should be fixed to the vehicle structure independent of the means of supporting the hose. The use of a nylon “P” clip which completely contains the hose has, however, proved reliable in use.

NOTE: Rigid pipework is susceptible to fatigue, and low-pressure connecting assemblies are preferred.

2.16 Where any pipework passes through bulkhead or locker faces, grommets should be fitted, or the edges of the hole should be double-rolled to prevent chafing. The use of plastic spiro-wrap has also been effective in practice. Where grommets are used they should not be split. The finished hole diameter should be adequate for the removal of end fittings, for example NIST connector nuts.

2.17 Where “T-pieces” are used to connect hose branches to terminal units, they should have hose-tail connections in accordance with BS 5682.

2.18 All ferrules used in the attachment of hose to hose-tails should meet the requirements of BS 5682. Special-purpose tools should be used to ensure the integrity of the connection and that the ferrules cannot be removed without destruction.

2.19 Hoses should be connected to cylinder regulator outlets either by the nut and nipple of a NIST connector or by a probe, in accordance with BS 5682.

2.20 Users are recommended to return flexible hose assemblies incorporating crimped ferrule connection to the original supplier for replacement or repair. Where this would result in unacceptable delays, however, replacement or repair may be carried out on site by authorised, trained and certificated personnel. Special-purpose tools only should be used, and the appropriate quality assurance documentation should be completed. Only contract suppliers registered to ISO 9000 should be used.

3. Commissioning installations

3.1 On completion, the system should be pressurised and leak tested to 10.5 bar. The system should be charged with medical compressed air and over a 15 minute test period, no pressure drop should be apparent.

3.2 Check satisfactory operation of the pressure relief valve, where fitted. Where pressure relief valves are an integral part of the pressure regulator, tests should be carried out initially during production testing of the regulator and a suitable certificate provided. The test should be repeated following major service or repairs to the regulator.

3.3 After satisfactory completion of leak testing the system should be subjected to a flow test using medical quality compressed air. Each terminal unit should be capable of delivering 40 litres/minute.

NOTE: This flow is not required in use, but is an indication that there are no obstructions in the system. No total flow test is required.

3.4 After satisfactory testing the system should be thoroughly purged using medical quality compressed air and then flushed with medical quality oxygen.

3.5 Each system should have a final pressure test carried out by the manufacturer or installer as appropriate. The system should be certificated by the manufacturer or installer prior to delivery to the customer, in accordance with quality assurance procedures. Such certification should include details of pressure tests carried out.

4. Routine testing and general safety

Routine testing

4.1 The entire system should be tested in accordance with paragraphs 3.1 and 3.2 above at 12-monthly intervals or following any repair to the system.

4.2 After satisfactory testing, the system should be thoroughly purged with medical oxygen.

General safety

Cylinder handling

4.3 This is described in Appendix 2.

Ventilation

4.4 The design of the vehicle should ensure an adequate level of ventilation to prevent the accumulation of medical gases within the ambulance.

Routine maintenance

4.5 Cylinder regulators should be visually inspected for damage to seals, and checked for leaks using an appropriate leak detector whenever fitted, or every three months. General leak checks should be carried out each time new cylinders are fitted.

4.6 The pipeline installation should be inspected every three months for evidence of damage, abrasion, leakage at joints, signs of deterioration, and soiling. Damaged products or pipeline installations should be isolated and repaired only by authorised personnel. In the event of soiling, pipework should be cleaned using a detergent and mild disinfectant. Care is needed to avoid contamination of the pipeline system.

4.7 Terminal units should be inspected every three months for leakage and any elastomeric components, for example seals and valve seats, should be replaced every 12 months.

4.8 Defective components associated with medical gas installations should be withdrawn from service with minimum delay and replaced.

5. Pressure Systems Safety Regulations 2000

5.1 The Pressure Systems Safety Regulations require a written scheme of inspection to be prepared by a Competent Person, as defined in the Regulations. To meet the requirements of this, it will generally be sufficient to record the results of the routine testing and maintenance operations. This should be carried out and witnessed by an appropriately qualified person in accordance with the approved quality assurance systems.

6. Vacuum systems

6.1 There are simple systems on the market for providing vacuum using the DC vehicle power system. Such systems should be provided with indication of level of vacuum, and a means of adjustment, with on/off indication. In common with permanent fixed installations in healthcare premises, this should be used in association with a suction jar assembly (with shut-off float switch) and a bacterial filter. When installing such a system, it is essential to ensure an adequate vehicle battery capacity. The system should be supplied from the auxiliary circuit.

Appendix 1: Accommodation for medical gas cylinders

1.0 General

1.1 Accommodation for medical gas cylinders (main stores and ready use stores) should comply with the following design guidelines:

a. ventilation: all cylinder stores should be well ventilated;

b. labelling: all cylinder stores should be clearly labelled as appropriate with the type of cylinders contained;

c. emergency action: details of emergency action procedures and location of keys, together with no smoking and other warning signs, should be clearly posted on the front of the cylinder store;

d. access: clear and secure access to all cylinder stores is required, including adequate space for vehicular access and cylinder loading/unloading;

e. fire protection: all cylinder stores should be free from naked flames and all sources of ignition, and should be designated “no smoking” areas. Appropriate fire extinguishing equipment should be readily available;

f. cylinder stores should only contain medical gases cylinders.

1.2 Further details are given in SHTM 2022 Part 1, ‘Design, installation, validation and verification’, and Part 2 ‘Operational management’.

2.0 Design and construction of cylinder stores

General

2.1 Cylinder stores should be covered and adequately ventilated. Stores should not be located in close proximity to any installation which may present a fire risk or other hazard.

2.2 The floor and hard standing should be smooth finish, and constructed of concrete or other non-combustible, non-porous material. A concrete finish is preferred and is likely to have a longer life. The floor should be laid to a fall to prevent the accumulation of water.

2.3 The store should have adequate means of access to facilitate movement of cylinders on trolleys. The cylinder bays should be arranged to allow trolleys to be safely manoeuvred and cylinders to be loaded and unloaded.

2.4 Separate, clearly identified bays should be provided for full and empty cylinders.

2.5 Separate areas for different gases should be provided, but it is not necessary to construct a physical barrier unless it is convenient to do so. Adequate means of securing large cylinders to prevent falling should be provided. Small cylinders should be secured in racks in accordance with BS EN 850.

2.6 The doors should be large enough to facilitate cylinder loading/unloading and should be on an external wall. The emergency exit should be provided with a panic-release lock. Doors should open outwards.

2.7 If the travel distance from the access doors to any part of the store exceeds 15 m, additional emergency exits should be provided. The advice of the local fire safety officer should be sought.

Hazchem/warning signs

2.8 Safety warning signs and notices should be used where appropriate and posted in prominent positions. They should be sited and designed in accordance with the requirements of the 'Health and Safety (Safety Signs and Signals) Regulations'. BS 5378 'Safety Signs and Colours' Parts 1 and 3, BS 5499 'Fire Safety Signs, Notices and Graphic Symbols' Part 1.

Location

2.9 Cylinder stores should be located at ground level, not underground for example in a basement.

2.10 Cylinder stores should be located as close a possible to the delivery point. Wherever possible there should be only one delivery supply point for each site.

2.11 No parking should be permitted within the delivery and storage area, other than for loading and unloading cylinders.

2.12 The location of the cylinder store should be marked clearly on the site plan for ease of identification in the event of an emergency.

Appendix 2: Cylinder handling

1.0 General

1.1 Cylinders can be heavy and bulky and should therefore be handled with care only by personnel who have been trained in cylinder handling and who understand the potential hazards.

1.2 Cylinders should not be dropped, knocked, used as “rollers” or be permitted to strike each other violently.

1.3 Cylinders should not be lifted by their caps or valves unless specifically designed for that purpose.

1.4 A suitable trolley should be used for transporting cylinders whenever they are moved.

1.5 Cylinders and valves should be kept free from oil and grease. Cylinders should not be marked with chalk, crayon, paint or other materials, nor by the application of adhesive tapes etc. A tie-on label indicating the content state may be attached to the cylinder.

1.6 Smoking and naked lights should be prohibited in the vicinity of all cylinders.

1.7 Cylinders should always be secured during transportation and in use.

1.8 Safety devices, including pressure relief devices, valves and connections, should not be altered or by-passed.

1.9 Repairs, alterations or modifications should not be undertaken on any part of a medical gas system, including pressure reducing regulators, except by appropriately trained personnel with adequate service facilities including maintenance manuals and recommended spares.

1.10 Markings used for identification of cylinder contents, pressure testing of cylinders, tare weights etc should not be defaced or removed. This also applies to labels and tags.

1.11 Cylinders should not be painted or otherwise obscured in a manner which would prevent identification of their contents, and care should be taken to preserve their labels and surface finish.

1.12 Cylinders used for industrial purposes should not be used for medicinal applications and should not be stored in the same store as medical gases cylinders. Similarly, medical gases should not be used for non-medical applications.

1.13 Cylinder valves should not be dismantled or tampered with.

1.14 Cylinder valves should always be closed after use and when cylinders are empty. Keys for this purpose should be readily available. Any gas trapped within the regulator/equipment should be safely vented to atmosphere and the equipment valves re-closed.

1.15 Cylinder trolleys should comply with BS 2718. Where different types of conveyance are used to transport several cylinders together, they should be clean, the cylinder supporting surfaces should be free from grease and oil, and they should be reserved for the transportation of medical gas cylinders.

1.16 Precautions should be taken to prevent cylinders falling from trolleys, trucks or vehicles.

1.17 In some circumstances it may be necessary to transport cylinders with equipment attached. Unless it is essential for a patient to continue receiving a supply of gas, the cylinder valve should be closed, and any gas contained in the equipment or regulator should be safely vented to atmosphere before transporting the cylinder.

2.0 Decanting

2.1 Decanting of medical gas cylinders is not recommended and in any case should not be carried out unless an appropriate manufacturer's licence is obtained from the Medicines Control Agency (MCA).

3.0 Preparation of cylinders for use

3.1 The following preparations should be made before use:

a. the cylinder should be checked for the name of the gas and the cylinder label;

b. the tamper-evident seal should be removed and any plastic outlet cap removed from the outlet and left fitted to the valve for re-fitting after use;

c. cylinder and equipment connection interfaces and their washers or 'O'-ring seals should be inspected to make sure that they are in good condition. Damaged sealing washers and 'O'-rings should be replaced. Not more than one sealing washer should be used at each interface;

d. cylinders should only be used in conjunction with equipment designed for their use;

e. cylinder paintwork and identification labels should not be removed or obscured;

f. lubricants, sealing or joining compounds should not be used when connecting cylinders to pressure reducing regulators. The cylinder valve, regulator and associated equipment should always be clean and free from oil and grease;

g. the connection between the cylinder valve and equipment should be checked for leaks using an approved leak detector. When tightening connections to stop gas leaks, excessive force should not be used;

h. prior to opening the cylinder valve, ensure the equipment flow control valves are closed;

i. using a recommended cylinder spindle key, or handwheel where fitted, the cylinder valve should be slowly opened to its fullest extent by turning the valve spindle anticlockwise;

j. when the cylinder is not being used the cylinder valve should be closed;

k. portable Entonox cylinders should ideally be stored above 10°C prior to use; where the temperature falls below 0°C it is possible for the constituent gases to separate. If cylinders are stored at temperatures lower than 0°C for long periods prior to use, they should be inverted at least three times to ensure the correct specification. In no circumstances should cylinders be immersed in water prior to use.

4.0 Cylinder preparation for return to store

4.1 After use:

a. the cylinder valve should be closed, any gas contained in the equipment and regulator should be safely vented to atmosphere, and the equipment/regulator flow controls valve should be closed;

b. empty cylinders or those no longer required for use should be returned to store as soon as possible and appropriately identified as “EMPTY” or part used. Protective covers where supplied should be replaced.

5.0 Equipment for use with medical gas cylinders

Gas supply cylinder fittings

5.1 The inlet fittings on regulators and equipment used for connection to medical gas cylinders should be in accordance with BS 341 and/or ISO 407.

Administration equipment

5.2 The following procedures should be implemented:

a. lung ventilators, oxygen therapy apparatus and other equipment for use with cylinders should be so designed as to render the entire assembly

stable during storage, transportation and use. If castors are used they should conform to BS 2099;

b. all mobile equipment should be suitably buffered to reduce damage to the fabric of the ambulance (see BS 4322);

c. where a pressure relief valve is fitted to protect downstream systems, it should be indelibly marked with its relief pressure value. Regulators should be indelibly marked with the maximum outlet pressure range. Pressure gauges should be in accordance with BS EN 837-1;

d. needle valves or similar devices should NOT be used in place of pressure reducing regulators, as excessive pressure may develop downstream of such devices and result in possible injury to personnel and damage to equipment.

6.0 Precautions against leakage of gas

6.1 Only approved leak detectors should be used for detecting leaks.

6.2 If a leak is identified between the cylinder valve and equipment:

a. close the cylinder valve and vent any gas through the equipment. Carefully tighten the connecting nut. If the leak persists, turn off the cylinder valve, vent any gas safely to atmosphere and detach the equipment from the cylinder;

b. where the connection incorporates a seal, this should be replaced and the cylinder reconnected to the equipment following the procedure outlined above. If a leak persists, the cylinder should be returned to the supplier and/or the equipment examined for damage and replaced as necessary.

6.3 Excessive force should not be used when connecting cylinders or closing valves, as this may damage threads and valve seats. The need for excessive force may indicate a faulty valve seat; this should be reported to the supplier and the cylinder removed from use and identified as faulty by tying a label to the cylinder.

6.4 Sealing or joining compounds should not be used to remedy leaks. Any leakage which cannot be rectified in the equipment should be returned/notified to the manufacturer as appropriate.

6.5 Cylinders with damaged or very stiff valves should be labelled appropriately and returned to the supplier.

6.6 Defective pressure reducing regulators, gauges and equipment may be hazardous in use. A system should be established to ensure that defective items are withdrawn from use and repaired or condemned as necessary.

NOTE: Equipment should be subject to planned preventative maintenance.

6.7 No attempt should be made to repair, alter or modify any cylinder or its valve.

NOTE: Defective equipment should be notified in accordance with the defect reporting system.

7.0 Precautions against fire or heat

7.1 Fires are caused by a combination of the following: combustible or flammable materials; an atmosphere containing oxygen, nitrous oxide or other oxidising agents; and a source of ignition.

7.2 Combustible materials may be unavoidably present when medical gases are being used. Ignition sources, however, are avoidable.

7.3 Examples of combustible materials which may be found near patients include hair oils, some nail-varnish removers, oil-based lubricants, skin lotions, cosmetic tissues, clothing, bed linen, rubber and plastic articles, alcohols, acetone, certain disinfectants and skin preparation solutions.

7.4 Examples of sources of ignition include:

a. open flames; burning tobacco; sparks (which may also be produced by some children's toys); high frequency, short wave and laser equipment; hair dryers; arcing and excessive temperatures in electrical equipment. The discharge of a cardiac defibrillator may also serve as a source of ignition;

b. electrical equipment not specially designed for use in an oxygen-enriched atmosphere may be a source of ignition;

c. some non-electrical equipment may also be a source of ignition; for example, a static discharge, which may be created by friction, will constitute an ignition source if easily ignited substances such as alcohols, acetone, some nail-varnish removers, oils, gases or lotions are present.

7.5 Further guidance can be obtained from the fire prevention officer, the fire safety officer and the local fire brigade depot.

7.6 Mixtures of breathing gases will support combustion. In an oxygen or nitrous oxide-enriched atmosphere, materials not normally considered to be combustible may become combustible, and materials that are combustible and flammable in air ignite more easily and burn more vigorously. Clothing may become saturated with oxygen or nitrous oxide and constitute a fire risk. Clothing and uniforms exposed to these gases will be free from the enrichment of the gases after about five minutes in ordinary air. Blankets or other similar articles need to be turned over several times in ordinary air to achieve the same result.

7.7 Oil and grease in the presence of high-pressure oxygen and nitrous oxide are liable to spontaneous combustion and should not be used as a lubricant on any gas cylinder or equipment. In particular the cylinder valve, couplings, regulators, tools, hands and clothing should be kept free from these substances.

8.0 Chemical hazards

8.1 Cylinders and their associated equipment should be protected from contact with oil, grease, bituminous products, acids and other corrosive substances.

8.2 A hazardous situation could arise if cylinders are subjected to extremes of temperature. Cylinders should be kept away from sources of heat, including steam pipes and hot, sunny positions.

8.3 When equipment is coupled to a cylinder, the cylinder valve should initially be opened as slowly as possible, as rapid opening can cause a sudden adiabatic increase in downstream gas pressure. The consequent temperature rise may result in ignition of combustible material in contact with the hot gas downstream, including the regulator valve seat.

8.4 Incidents have occurred resulting in ignition within the cylinder valve or regulator which has been attributable to friction generated by particulate matter such as dust or dirt within the system when the cylinder valve is opened. Cylinders should only be used if they are fitted with a tamper-evident seal and outlet protector to prevent ingress of foreign material.

9.0 Cylinders involved in incidents

9.1 Following a fire or incident, no attempt should be made to examine, use a cylinder and/or tamper with its valve until the Department of Health and the supplier have been consulted. The procedure outlined in MEL(1995)74 should be followed.

10.0 Stock control and receipt of cylinders into stock

10.1 A written protocol should be prepared to cover ordering, receipt, stock control and return of medical gas cylinders.

11.0 Transport of cylinders in ambulances and other vehicles

General

11.1 There are no specific regulations covering the carriage of medical gases in small cylinders. There are, however, regulations covering the transport of other gases, and the requirements of these regulations should generally be followed where applicable.

11.2 The guidance given here is also applicable to health professionals who need to transport medical gas cylinders (medical oxygen and Entonox cylinders) in private vehicles, including, for example, midwives or pharmacists.

NOTE: It is not recommended that cylinders of nitrous oxide or carbon dioxide be transported horizontally; these are not generally carried in ambulances.

11.3 It is safe to carry medical gas cylinders in vehicles provided proper care is taken. This applies to both full and empty cylinders.

Transport Emergency Card (TREM card)

11.4 Although there are no specific regulations which require a Transport Emergency Card (Road) Card (TREM card) to be carried for medical gases, it is recommended that a TREM card is carried for all medical gases in accordance with the suppliers' recommendations.

11.5 An example of a TREM card for oxygen is shown in Figure 1. Further details are available from the supplier.

Recommendations for transport of medical gas cylinders

11.6 The driver should be aware of the properties of the gases which are being transported – this information is available on the Medical Gas Data sheets provided by the gas supplier.

11.7 The cylinder should be checked for the correct product label and for any visible signs of damage prior to loading.

11.8 Smoking should not be allowed in vehicles transporting medical gas cylinders.

11.9 The vehicle should have good ventilation – if necessary the windows should be opened.

11.10 If leakage is suspected, the vehicle should be stopped, the window opened and the supplier contacted for advice.

11.11 If the vehicle is involved in a road traffic accident, the emergency services should be advised that cylinders are being carried, and informed of the gases they contain.

11.12 Cylinders of medical gases may be transported either vertically or horizontally.

11.13 Cylinders should not be transported with equipment in place unless the equipment is specifically designed for that purpose.

11.14 Cylinders should be secured properly so that they cannot move in transit.

11.15 Cylinders containing liquefied gases (including nitrous oxide) should not be left in a vehicle subject to extremes of temperature in summer, and should be kept out of direct sunlight.

NOTE: It is not recommended that cylinders of nitrous oxide or carbon dioxide be transported horizontally; these are not generally carried in ambulances.

11.16 The TREM card should always be carried in the vehicle, together with the Medical Gas Data sheets, whether or not cylinders are being transported. The vehicle should be provided with a convenient means of storing the TREM card.

Figure 1: Typical Transport Emergency Card

BOC GASES
Medical

MEDICAL GAS CYLINDERS – VEHICLE SAFETY CARD

Recommendations to Customers collecting or transporting Medical Oxygen and Entonox Cylinders in Private Vehicles

This guidance is intended for those BOC customers who transport medical gas cylinders in private vehicles e.g. midwives, pharmacists, patients etc.

It is safe to carry medical gas cylinders in vehicles provided proper care is taken. This applies to both full and empty gas cylinders.

All medical gas cylinders are labelled in accordance with the Chemicals (Hazard Information and Packaging) Regulations, 1993. BOC also provid3es free of charge, Medical Gas Data Sheets, "Gas Safe – in the Hospital" and "Gas Safe – in the Pharmacy and Surgery" safety booklets to assist customers.

There are no specific regulations covering the carriage of medical gases in small cylinders, although it makes sense to apply the requirements of the regulations covering the transport of other gases, to medical gases. One of the requirements is to carry a transport emergency card (TREM) which is shown on the reverse of this card.

Although the information on the TREM card is specific to oxygen the information is applicable to Entonox (50/50 nitrous oxide/oxygen mixture).

RECOMMENDATIONS TO CUSTOMERS COLLECTNG MEDICAL GAS CYLINDERS

1. Be aware of the properties of the gases being carried. Check against the relevant Medical Gas Data Sheet.
2. Check that the cylinder has the correct product label.
3. All cylinders are checked by BOC after filling for leak tightness. Immediately before loading the cylinder into your vehicle check again that there are no obvious signs of leakage of gas e.g. hissing sound.
4. Do not smoke whilst carrying cylinders inside vehicles.
5. If cylinders have to be carried in closed vehicles ensure good ventilation at all times.
6. Do not use cylinders in a closed vehicle.
7. If at any time you suspect a cylinder is leaking, park the vehicle in a safe place, stop vehicle engine, provide ventilation by opening windows and ring BOC for advice.
8. If you are involved in a road accident and the emergency services are called, advise them that cylinders are being carried and of the gases they contain.
9. Cylinders of medical gases can be either transported either horizontally or vertically.
10. Never transport cylinders with equipment attached unless the equipment is designed specifically for the purpose.
11. Secure cylinders properly so that they cannot move in transit.
12. Cylinders of liquefied gases should not be left in a vehicle subject to extremes of temperature in the summer and must be kept out of direct sunlight.
13. Carry this card with the appropriate BOC Medical Gas Data Sheets in the vehicle when carrying cylinders.

Transport Emergency Card (Road)

Cargo	OXYGEN
Product	Colourless, odourless compressed or liquefied gas.
Nature of Hazard	May react with combustible substances creating fire or explosion hazard. The gas increases fire risk, e.g. clothing etc. ignites more readily and burns furiously. Reacts with oil and greases, may cause explosion and/or fire. Heating of container will cause pressure rise with risk of bursting. Contact with liquefied gas can cause skin burns and severe damage to eyes.
Protective Devices	Safety goggles or spectacles giving protection to eyes. Suitable gloves. Protective footwear.
Emergency Action	• Notify Police and Fire Services immediately. • Stop vehicle engine. • No naked lights, no smoking. • Keep public away from danger area.
Spillage	• Shut off leaks if possible. • Consider evacuation of the area.
Fire	• Keep container cool by spraying with water if exposed to fire – risk of bursting. • Keep upwind.
First Aid	• Seek urgent medical attention in cases of skin or eye contact with liquid.
Emergency Contact	• local BOC branch.

This card has been prepared by the British Compressed Gases Association from the best information available to meet the requirements of the Chemicals (Hazard Information and Packaging) Regulations, 1993 but no responsibility is accepted of whatsoever kind for damage or alleged damage arising or otherwise occurring in or about premises, areas or vehicles to which this card has been applied.

G4176/MGM/BB/10.94/2M(25)

References

NOTE:
Where there is a requirement to address a listed reference, care should be taken to ensure that all amendments following the date of issue are included.

Publication ID	***Title***	***Publisher***	***Date***	***Notes***
Acts and Regulations				
	The Building (Scotland) Act	HMSO	1959	
	Clean Air Act	HMSO	1993	
	Electricity Act	HMSO	1989	
	Health and Medicines Act	HMSO	1998	
	Health and Safety at Work etc Act	HMSO	1974	
	Medicines Act	HMSO	1968	
	Public Health Act	HMSO	1961	
	The Public Health (Scotland) Act	HMSO	1897	
	Registered Establishments (Scotland) Act	HMSO	1998	
	Sewage (Scotland) Act	HMSO	1968	
	The Water (Scotland) Act	HMSO	1980	
	Water Industry Act	HMSO	1991	
	Water Resources Act	HMSO	1991	
SI 2179 & 187	The Building Standards (Scotland) Regulations (as amended)	HMSO	1990	
	The Building Standards (Scotland) Regulations: Technical Standards Guidance	HMSO	1998	
SI 1460	Chemicals (Hazard Information and Packaging for Supply) Regulations (CHIP2)	HMSO	1997	
SI 3140	Construction (Design and Management) Regulations	HMSO	1994	
SI 437	Control of Substances Hazardous to Health Regulations (COSHH)	HMSO	1999	
SI 3260	Electrical Equipment (Safety) Regulations	HMSO	1994	
SI 635	Electricity at Work Regulations	HMSO	1989	
SI 1057	Electricity Supply Regulations (as amended)	HMSO	1988 (amd 1994)	

Publication ID	Title	Publisher	Date	Notes
SI 2372	Electromagnetic Compatibility Regulations (as amended)	HMSO	1992	
SI 2451	Gas Safety (Installation and Use) Regulations	HMSO	1998	
SI 917	Health & Safety (First Aid) Regulations	HMSO	1981	
SI 682	Health & Safety (Information for Employees) Regulations	HMSO	1989	
SI 2792	Health and Safety (Display Screen Equipment) Regulation	HMSO	1992	
SI 341	Health and Safety (Safety Signs and Signals) Regulations	HMSO	1996	
SI 1380	Health and Safety (Training for Employment) Regulations	HMSO	1990	
SI 917	Highly Flammable Liquids and Liquefied Petroleum Gases Regulations	HMSO	1972	
SI 2307	Lifting Operations and Lifting Equipment Regulations (LOLER)	HMSO	1998	
SI 3242	Management of Health and Safety at Work Regulations	HMSO	1999	
SI 2793	Manual Handling Operations Regulations	HMSO	1992	
SI 1790	Noise at Work Regulations	HMSO	1989	
SI 3139	Personal Protective Equipment (EC Directive) Regulations (as amended)	HMSO	1992	
SI 2966	Personal Protective Equipment at Work (PPE) Regulations	HMSO	1992	
SI 128	Pressure Systems Safety Regulations (PSSR)	HMSO	2000	
SI 2306	Provision and Use of Work Equipment Regulations (PUWER)	HMSO	1998	
SI 3163	Reporting of Injuries, Diseases and Dangerous Occurrences Regulations (RIDDOR)	HMSO	1995	
SI 3004	Workplace (Health, Safety and Welfare) Regulations	HMSO	1992	
British Standards				
BS 88	**Cartridge fuses, for voltages up to and including 1000 V a.c. and 1500 V d.c.** **Part 2.2:** Specification for fuses for use by authorised persons (mainly for industrial application). Additional requirements for fuses with fuse-links for bolted connections.	BSI Standards	1988	

Publication ID	*Title*	*Publisher*	*Date*	*Notes*
BS 89	**Direct acting indicating analogue electrical measuring instruments and their accessories.** **Part 2:** Specificaton for special requirements for ammeters and voltmeters	BSI Standards	1990	
BS 341	**Transportable gas containers valves**	BSI Standards	1962/ 1991	
BS 476-4	**Fire tests on building materials and structures. Non-combustibility test for materials**	BSI Standards	1970	
BS 1710	**Specification for identification of pipelines and services**	BSI Standards	1984	
BS 2099	**Specification for castors for hospital equipment**	BSI Standards	1989	
BS 2718	**Specification for gas cylinder trolleys**	BSI Standards	1979	
BS 3928	**Method for sodium flame test for air filters (other than for air supply to I/C engines and compressors)**	BSI Standards	1969	
BS 4272	**Anaesthetic and analgesic machines** **Part 3:** Specification for continuous flow anaesthetic machines	BSI Standards	1989	
BS 4322	**Recommendations for buffering on hospital vehicles such as trolleys**	BSI Standards	1968	
BS 5045	**Transportable gas containers** **All Parts**	BSI Standards		
BS 5169	**Specification for fusion welded steel air receivers**	BSI Standards	1992	
BS 5378	**Safety signs and colours**	BSI Standards	1980	
BS 5499	**Fire safety signs and graphic symbols**	BSI Standards	1990	
BS 5682	**Specification for probes (quick connectors) for use with medical gas pipeline systems**	BSI Standards	1998	

Publication ID	*Title*	*Publisher*	*Date*	*Notes*
BS 5724	**Medical electrical equipment** **Part 1:** General requirements for safety **Part 2:** Particular requirements for safety **Section 2.12:** Specification for lung ventilators **Section 2.13:** Specification for anaesthetic machines	BSI Standards	1990	
BS 6281	**Devices without moving parts for the prevention of contamination of water by backflow**	BSI Standards	1992	
BS 6387	**Specification for performance requirements for cables required to maintain circuit integrity under fire conditions**	BSI Standards	1994	
BS 6651	**Code of practice for protection of structures against lightning**	BSI Standards	1999	
BS 6759	**Safety valves** **Part 2:** Specification for safety valves for compressed air or inert gases	BSI Standards	1984	
BS 7181	**Specification for storage cisterns up to 500l actual capacity for water supply for domestic purposes**	BSI Standards	1989	
BS 7671	**Requirements for electrical installations. IEE Wiring regulations sixteenth edition**	BSI Standards	2001	
BS EN 132	**Respiratory protective devices. Definitions of terms and pictograms**	BSI Standards	1999	
BS EN 740	**Anaesthetic workstations and their modules. Particular requirements**	BSI Standards	1999	
BS EN 737-1	**Medical gas pipeline systems. Terminal units for compressed medical gases and vacuum**	BSI Standards	1998	
BS EN 737-2	**Medical gas pipeline systems. Anaesthetic gas scavenging disposal systems. Basic requirements**	BSI Standards	1998	
BS EN 737-3	**Medical gas pipeline systems. Pipelines for compressed medical gases and vacuum**	BSI Standards	2000	

Publication ID	*Title*	*Publisher*	*Date*	*Notes*
BS EN 737-4	**Medical gas pipeline systems. Terminal units for anaesthetic gas scavenging systems**	BSI Standards	1998	
BS EN 837-1	**Pressure gauges. Bourdon tube pressure gauges. Dimensions, metrology, requirements and testing**	BSI Standards	1998	
BS EN 837-2	**Pressure gauges. Selection and installation recommendations for pressure gauges**	BSI Standards	1998	
BS EN 837-3	**Pressure gauges. Diaphragm and capsule pressure gauges. Dimensions, metrology, requirements and testing**	BSI Standards	1998	
BS EN 850	**Transportable gas cylinders. Pin-index, yoke-type valve outlet connections for medical use**	BSI Standards	1997	
BS EN 1044	**Brazing. Filler metals**	BSI Standards	1999	
BS EN 1057	**Copper and copper alloys. Seamless, round copper tubes for water and gas in sanitary and heating applications**	BSI Standards	1996	
BS EN 1089-3	**Transportable gas cylinders. Gas cylinder identification (excluding LPG). Colour coding**	BSI Standards	1997	
BS EN 1251-3	**Cryogenic vessels – transportable vacuum insulated vessels of not more than 1000 litres volume – operational requirements**	BSI Standards	2000	
BS EN 1254-1	**Copper and copper alloys. Plumbing fittings. Fittings with ends for capillary soldering or capillary brazing to copper tubes**	BSI Standards	1998	
BS EN 1254-2	**Copper and copper alloys. Plumbing fittings. Fittings with compression ends for use with copper tubes**	BSI Standards	1998	
BS EN 1978	**Copper and copper alloys. Copper cathodes**	BSI Standards	1998	
BS EN 1979	**Copper and copper alloys. Cast unwrought copper products**	BSI Standards	1998	
BS EN 60079-14	**Electrical apparatus for explosive gas atmospheres. Electrical installations in hazardous areas (other than mines)**	BSI Standards	1996	
BS EN 60529	**Specifications for degrees of protection provided by enclosures (IP)**	BSI Standards	1992	

Publication ID	*Title*	*Publisher*	*Date*	*Notes*
BS EN 60601-1	**Medical electrical equipment. General requirements for safety**	BSI Standards	1990	
BS EN 60898	**Specification for circuit breakers for over current protection for household and similar installations**	BSI Standards	1991	
BS EN 60947	**Specification for low-voltage switchgear and controlgear**	BSI Standards	1998	
BS EN 60947-2	**Circuit-breakers**	BSI Standards	1996	
BS EN ISO 9000	**Quality management and quality assurance standards**	BSI Standards		
BS ISO 11195	**Gas mixers for medical use – stand-alone gas mixers**	BSI Standards	1995	
Scottish Health Technical Guidance				
SHTM 2007	Electrical services: supply and distribution	P&EFEx	2001	CD-ROM
SHTM 2011	Emergency electrical services	P&EFEx	2001	CD-ROM
SHTM 2014	Abatement of electrical interference	P&EFEx	2001	CD-ROM
SHTM 2015	Bedhead services	P&EFEx	2001	CD-ROM
SHTM 2022	Medical gas pipeline systems	P&EFEx	2001	CD-ROM
SHTM 2025	Ventilation in healthcare premises	P&EFEx	2001	CD-ROM
SHGN	Static discharges	P&EFEx	2001	CD-ROM
SHPN 1	Health service building in Scotland	HMSO	1991	
SHPN 2	Hospital briefing and operational policy	HMSO	1993	
SHTN 1	Post commissioning documentation for health buildings in Scotland	HMSO	1993	
SHTN 4	General Purposes Estates and Functions Model Safety Permit-to-Work Systems	EEF	1997	
	NHS in Scotland – PROCODE	P&EFEx	2001	Version 1.1
NHS in Scotland Firecode				
SHTM 81	Fire precautions in new hospitals	P&EFEx	1999	CD-ROM
SHTM 82	Alarm and detection systems	P&EFEx	1999	CD-ROM
SHTM 83	Fire safety in healthcare premises: general fire precautions	P&EFEx	1999	CD-ROM
SHTM 84	Fire safety in NHS residential care properties	P&EFEx	1999	CD-ROM
SHTM 85	Fire precautions in existing hospitals	P&EFEx	1999	CD-ROM
SHTM 86	Fire risk assessment in hospitals	P&EFEx	1999	CD-ROM
SHTM 87	Textiles and furniture	P&EFEx	1999	CD-ROM

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SFPN 3	Escape bed lifts	P&EFEx	1999	CD-ROM
SFPN 4	Hospital main kitchens	P&EFEx	1999	CD-ROM
SFPN 5	Commercial enterprises on hospital premises	P&EFEx	1999	CD-ROM
SFPN 6	Arson prevention and control in NHS healthcare premises	P&EFEx	1999	CD-ROM
SFPN 7	Fire precautions in patient hotels	P&EFEx	1999	CD-ROM
SFPN 10	Laboratories on hospital premises	P&EFEx	1999	CD-ROM
UK Health Technical Guidance				
EH 40	HSE Occupational Exposure limits	HSE	Annual	
C54	The keeping of LPG in cylinders and similar containers	HSE		
MES	Model Engineering Specifications	NHS Estates	1997	As required
Miscellaneous References				
	Model Water Byelaws: Dept. of the Environment	HMSO	1986	
	Occupations exposure standards for anaesthetic agents (EL(96)33).	Dept. of Health	1996	
	Advice on the implementation of the Health and Safety Commission's occupational exposure standards for anaesthetic agents	Dept. of Health	1996	
	Anaesthetic agents: controlling exposure under COSHH	Health Service Advisory Committee		
	Code of practice 19: Bulk liquid oxygen storage at users' premises (Revision 2) British Compressed Gases Association		1996	
	Medical gas pipe systems. Design and installation of (QAS 3720.1/206)	BSI/Dept. of Health	1988	
	Guidance notes for users of liquid cylinders of low pressure cryogenic liquid supply vessels for liquid oxygen, nitrogen or argon with capacity of under 450 litres (G4521)	BOC Gas	1996	
	Home Office Fire Prevention Guide No. 4: Safe use and storage of liquefied petroleum gas in residential premises.			

Publication ID	***Title***	***Publisher***	***Date***	***Notes***
	BDA Advice sheet A3 health and safety law for dental practice	BDA	1993	
EL(96)33	Occupational exposure standards for anaesthetic agents	Dept. of Health	1996	
EH49/96	Occupational exposure limits.	HSE	1996	