BCGA CODE OF PRACTICE CP 27

Transportable Vacuum Insulated Containers of not More than 1,000 Litres Volume

Revision 1: 2004

British Compressed Gases Association

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ISSN 0260-4809

PREFACE

The various publications issued by the British Compressed Gases Association have the objective of establishing consistency in design, construction practices and user operational and maintenance procedures, in order to establish high standards of reliability and safety in the interests of employers, employees and the general public.

The Association endeavours to compile these documents using the best sources of information known at the date of issue. The information is used in good faith and belief in its accuracy. The publications are intended for use by technically competent persons and their application does not, therefore, remove the need for technical and managerial judgement in practical situations and with due regard to local circumstances, nor do they confer any immunity or exemption from relevant legal requirements, including by-laws.

The onus of responsibility for their application lies with the user. The Association, its officers, its members and individual members of any Working Parties can accept no legal liability or responsibility whatsoever, howsoever arising, for the consequences of the use or misuse of the publications.

For the assistance of users, references are given, either in the text or Appendices, to publications such as British, European and International Standards and Codes of Practice, and current legislation that may be applicable. The intention of BCGA is that this document should be read and used in the context of these references where the subjects have a bearing on the local application of the processes or operations carried out by the user.

BCGA's publications are reviewed, and revised if necessary, at three-yearly intervals. Readers are advised to check the list of publications on the Association's website www.bcga.co.uk to ensure that the copy in their possession is the current version.

CONTENTS

APPENDICES

TERMINOLOGY AND DEFINITIONS

Shall:	A mandatory requirement for compliance with this Code of Practice.
Should:	A preferred requirement, but is not mandatory for compliance with this Code of Practice.
May:	An option available to the user of this Code of Practice.
Vessel:	The pressure vessel containing the cryogenic liquid.
Outer jacket:	The insulation container.
Liquefied gas:	For the purposes of this document liquefied gas is liquid oxygen, nitrogen, argon, helium, carbon dioxide or nitrous oxide, or mixtures of these gases, stored below ambient temperature.
Pressure system: **Relevant fluid:** **Danger:** **Mobile System:** **User:** **Protective device:** **Competent person:** **Examination:** **Owner:**	These terms relate to mobile systems and are defined in the Pressure Systems Safety Regulations 2000 (1)
Transportable pressure receptacle: **Carriage**	These terms relate to transportable pressure receptacles and are defined in The Carriage of Dangerous Goods (Classification, Packaging and Labelling) and Use of Transportable Pressure Receptacles Regulations 1996 (12) as amended by The Transportable Pressure Vessels Regulations 2001 (20)
Tank:	For the purposes of this document – An assembly complete with a piping system, an inner vessel and outer jacket.
Modification	Any change to the tank
Major repair	Any repair involving hot work or welding on the inner vessel. It does not include heat treatment.

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1 INTRODUCTION

1.1 Gases can be stored and transported either in compressed form within gas cylinders or at reduced temperatures in the liquid phase within liquid containers. This latter technique greatly increases the mass and thus volume of gas that can be stored and transported within a container of given size and weight, thus reducing transport costs and storage equipment size.

1.2 The purpose of this Code of Practice is to provide guidance on the safe operating practice and the application of relevant regulations for UK owners, users, fillers and transporters of small transportable vacuum insulated tanks of liquefied gases.

1.3 Tanks that are transported by road or rail shall meet the requirements of The Carriage of Dangerous Goods (Classification, Packaging and Labelling) and Use of Transportable Pressure Receptacles Regulations 1996 (12). Tanks that are not transported by road or rail (and not intended to be in the future) ie. moved only within users premises, may be treated as mobile pressure systems in accordance with the Pressure Systems Safety Regulations 2000 (1). During the life of this document newly manufactured tanks will become subject to the Transportable Pressure Vessels Regulations 2001 (20). Compliance with these new Regulations is optional for tanks manufactured from 1 July 2001 until 1 July 2003, mandatory thereafter.

1.4 These Regulations have been introduced within the UK under the umbrella of the Health and Safety at Work Act 1974 (2). The intention of the Regulations is to prevent the risk of serious injury from the uncontrolled release of stored energy as a result of failure of a pressure vessel or any pressure system connected to it. It is important to note that the Regulations may not deal with all the hazards arising from the use or transport of a tank and other Regulations may also apply, such as:

The Control of Substances Hazardous to Health Regulations 2002 (3).
The Carriage of Dangerous Goods by Road Regulations 1996 (13).
The Carriage of Dangerous Goods (Driver Training) Regulations 1996 (7).
The Chemical (Hazard Information and Packaging for Supply) Regulations 2002 (4).
The Food Additives Labelling Regulations 1992 (5).
The Personal Protective Equipment at Work Regulations 1992 (6)
The Confined Spaces Regulations 1997 (18).

2 SCOPE

2.1 This Code of Practice applies to transportable, vacuum insulated, tanks of not more than 1,000 litres water capacity, for the following gases:

Nitrogen
Argon
Oxygen
Carbon Dioxide
Helium
Nitrous Oxide

The requirements of the code shall apply to all tanks operating at any pressure that are, or are intended to be, transported by road or rail, though tanks under 0.5 bar that are neither transported, nor intended to be transported, by road or rail are subject to different legal requirements. See 4.1 for clarification.
This code provides guidance for the minimum requirements for:

(a) General safety precautions.
(b) Design and construction.
(c) Operation.
(d) Tank management and filling
(e) Transportation.
(f) In-service examination.
(g) Modifications/repairs.
(h) Records.

This Code of Practice applies to tanks designed to be transported full of product, both within and outside user premises. There are currently three main UK sets of regulations covering the design, construction and use of transportable vacuum insulated tanks:

- The Carriage of Dangerous Goods (Classification, Packaging and Labelling) and Use of Transportable Pressure Receptacles Regulations 1996 (12).

- The Transportable Pressure Vessels Regulations 2001 (20).

- Pressure Systems Safety Regulations 2000 (1).

Where appropriate guidance is given on the different legislation applying to tanks transported by road or rail, and tanks moved within users premises.

2.2 Tanks covered by this Code typically consist of an inner pressure vessel supported within an outer jacket. The inner vessel is insulated from the outer jacket by a vacuum and insulation materials. Pipework from the inner vessel passes through the insulation space to externally mounted valves and fittings.

2.3 This Code does not cover unpressurised containers such as dewars - see BCGA Code of Practice CP30 (21). However, the Sections dealing with safety precautions and operations should be observed in order to ensure safe working practice.

2.4 This Code does not cover any pressure system connected to the tank at the user's premises. For guidance on the application of the Pressure Systems Safety Regulations 2000 (1) to these systems, please refer to BCGA Code of Practice CP23 (10).

3 GENERAL SAFETY PRECAUTIONS

3.1 Asphyxiation/enrichment

Products within the containers, if released, can create an atmosphere either enriched, or deficient, in oxygen.

An oxygen-enriched atmosphere will strongly support combustion, even of substances which will not normally burn in air.

An oxygen deficient atmosphere can cause asphyxiation resulting in loss of consciousness and leading to death. In a seriously deficient atmosphere these effects can be almost instantaneous.

Carbon dioxide is toxic in high concentrations, acting directly on the respiratory centres of the brain, even at concentrations with adequate oxygen levels or life support. The toxic effects are dependent upon concentration and time exposure.

A risk assessment in accordance with the Confined Spaces Regulations 1997 (18) should be made where the use or leakage of these gases could affect the safety and health of persons in a confined space.

3.2 Cryogenic burns

Product may be stored within these containers at very low temperatures, eg liquid helium at –269^{o}C.

Severe damage to the skin may be caused by contact with liquefied gases, receptacles containing them, or with non-insulated pipes (see Appendix 3).

All of the safety aspects of handling liquefied gases cannot be adequately covered in this Code of Practice. The reader is therefore referred to the British Cryoengineering Society Publication, "Cryogenic Safety Manual" (9) for further information.

3.3 Personal safety wear

The Management of Health and Safety at Work Regulations 1999 (14) require suitable and sufficient risk assessments of the risks to health and safety at work and elimination of such risks where possible. Where significant risk is identified which cannot be eliminated or controlled other than by personal protective equipment (PPE), separate documented detailed PPE assessments are required according to the Personal Protective Equipment at Work Regulations 1992 (6).
Non-absorbent insulated gloves, made from a suitable material such as leather, must always be worn when handling anything that is, or has been recently, in contact with the product. The gloves should be a loose-fit so that they can easily be removed. Sleeves should cover the ends of the gloves.

Gauntlet gloves are not recommended because liquid can drip into them.

Suitable eye protection such as goggles, or a face visor, shall be used to protect the eyes and face where spraying or splashing of liquid may occur. Overalls, or a similar type of clothing, should be worn. These should preferably be made without open pockets or turn-ups where liquid could collect. Trousers should be worn outside boots for the same reason.

If clothing becomes contaminated with oxygen the wearer should ventilate it for a minimum of 15 minutes by walking around in a well-ventilated area away from any source of ignition including persons smoking.

3.4 COSHH Regulations

The Control of Substances Hazardous to Health Regulations 2002 (COSHH) (3) require all users of hazardous substances to ensure that no risk to health occurs to their staff or other personnel as a result of the storage, transportation or use of those substances. The supplier of the product shall provide users with full information on its properties. Employers who use these substances shall ensure that all staff involved are fully conversant with the properties of that product and the control measures designed to protect their health and safety.

The HSE publication EH40 (19) lays down occupational exposure limits for substances used at work:

- For carbon dioxide the 8-hour exposure limit is 0.5% (5000 ppm) and the short-term (15 minutes) limit is 1.5%.

- For nitrous oxide the 8-hour exposure limit is 0.01% (100 ppm) with no short-term exposure.

EH 40 does not give specific exposure levels for asphyxiant gases (argon, nitrogen and helium) because they are not substances hazardous to health for the purposes of COSHH. Paragraphs 57 to 61 of EH 40 give guidance on asphyxiants which recommends that suitable measures be taken following risk assessment of any situation where the oxygen content in the workplace varies from the normal.

In practical terms, the industry recommends that any workplace shall be evacuated when the oxygen concentration falls to 18%. Preventative measures should, of course, be initiated before the oxygen concentration reaches this low level.

4 DESIGN AND CONSTRUCTION

4.1 Design, construction, standards approval and certification

Tanks that are intended to be (or may be so at some time in their service life) transported by road or rail shall, until 1 July 2003, meet the requirements of The Carriage of Dangerous Goods (Classification, Packaging and Labelling) and Use of Transportable Pressure Receptacles Regulations 1996 (12), or the Transportable Pressure Vessels Regulations 2001 (20). Tanks manufactured before the 1 July 2001 and which contain a gas at a pressure of less than 0.5 bar above atmospheric pressure, are exempt from all but the marking and labelling requirements of the Carriage of Dangerous Goods (Classification, Packaging and Labelling) and use of Transportable Pressure Receptacles Regulations 1996 (12). Tanks manufactured after 1 July 2003 must comply with the Transportable Pressure Vessels Regulations 2001 (20).

Tanks that are **not** to be transported by road or rail shall be designed, constructed and tested in accordance with a recognised design code for this type of tank and its intended use that meets the requirements of the Pressure Equipment Regulations 1999 (8).

Tanks containing a gas at a pressure of less that 0.5 bar above atmospheric pressure are not covered by the Pressure Equipment Regulations 1999 (8). However, in order to comply with Regulation 4 of The Provision and Use of Work Equipment Regulations 1998 (16), the tank should be properly designed and properly constructed from suitable material so as to prevent danger. This is best guaranteed by adherence to a recognised design standard for this type of tank and its intended use.

A competent person shall certify the container as suitable for the duty within the defined operating limits.

4.2 Materials

All components shall be constructed from materials compatible with the liquefied gas in service, and with the temperature and pressure conditions to which they will be subjected.

All materials of construction for vessels which may be used for oxidising gas service shall be oxygen compatible, including all insulation, gutters, piping, valves, gaskets, seals and instruments.

4.3 Design features

Containers will normally be fitted with pipework, valves, pressure gauges, level gauges, pressure-build and product vaporisers and regulators.
Each tank shall have pressure-relief devices on both the inner vessel and the outer jacket.

Inner vessels shall be fitted with at least two independent relieving devices. Typically, a pressure relief valve backed up by a bursting disc is fitted.

As a minimum:-
During normal tank operation at least one of these devices shall have a capacity and set point that will prevent the pressure within the vessel exceeding the maximum allowable working pressure (a 10% momentary surge is allowable). Also the combination of both relief devices shall be sufficient to prevent the test pressure being exceeded, in the event of loss of vacuum combined with the pressure build-up system failing in the open position.

Consideration shall be given to the risk of fire engulfment of the tank. Where required by the design code, application or legislation, the tank shall have been designed such that in the event of loss of vacuum in the jacket when such loss is combined with fire engulfment, the combined capacity of the pressure-relief devices should permit an outflow of gas such that the pressure in the inner vessel cannot exceed the test pressure.

The relieving devices shall be designed to operate effectively across the full-range of working temperatures.

All pressure-relief devices shall be orientated in such a manner as to prevent the accumulation of water, which could result in incorrect operation.

If a three-way valve is installed to accommodate two pressure relief devices operating either simultaneously or alternatively, then the size of the three-way valve shall be such that the vessel is always adequately protected.

Outer jackets need not be designed to a pressure-vessel design standard, but they shall be capable of withstanding full vacuum.

Outer jackets must be fitted with a device capable of safely relieving pressure increase in the event of a leak from the inner vessel. The device shall be set to open at a pressure of not more than 0.5 bar. The discharge area of the pressure relief device shall not be less than 0.35 mm^2 per litre capacity of the inner vessel but in any case not less than 10mm diameter.

The tank, the internal support system, pipework including, where fitted, pipework guards and transport frame shall be capable of withstanding the forces expected during handling and transportation.

Any external piping, valves, regulators, gauges, etc, shall be fit for purpose and arranged or protected so as to minimise the risk of damage during handling and transportation.

The above requirements are best met by adherence to an appropriate design standard.

Any section of pipework containing liquefied gas which can be isolated shall be protected by a pressure relief device.

The vessel shall be adequately protected against over pressure from the road tanker. Refer to IGC publication 59/98 (22)

4.4 Connections

In certain cases filling the incorrect fluid into a container may create an unsafe condition; therefore liquid-fill connections should be different for the following product categories:

- Nitrogen/argon
- Oxygen/medical oxygen
- Helium
- Carbon dioxide
- Nitrous oxide.

Appendix 4 shows the connections used by BCGA members. If other connections are to be used a check shall be made to ensure cross product contamination cannot occur.

The following methods of securing the filling connection shall be adopted to ensure only authorised changes are made.

- For medical oxygen applications the connection shall be silver brazed, welded or attached by other methods in a manner that prevents removal or would render the connection unusable if removal was attempted or accomplished.

- For industrial applications the connection shall be either attached as detailed for medical oxygen applications or be fitted with a device that deters removal of the fitting and provides indication that removal was attempted or accomplished.

Permanent labels should be secured to the outlet connection pipework or other suitable fixing point close to the liquid and gas outlet operating valves, identifying the gas outlet and liquid withdrawal and/or filling connections.

Consideration should be given to the fitting of suitable devices to prevent back contamination of the tank from the customer process.

Further information on this important aspect of safety can be found in EIGA Safety Information INFO 04/02 (26).

4.5 Cleaning

For tanks and accessories which may be used in oxidising gas service (eg oxygen, nitrous oxide), all surfaces which would come into contact with product shall be cleaned using a recognised procedure such as BS 6869 (11) or IGC doc 33/97/E Cleaning Equipment for Oxygen Service (15). BCGA Technical Report TR3 (17) gives information about cleaning oxygen systems components without the use of chlorinated solvents.

4.6 Markings

In addition to markings required by the design standard and any orientation requirements (such as "this side up"), the following marks shall be included on a corrosion-resistant plate permanently attached to the outer jacket:

- Manufacturer's name
- Serial number
- Test pressure
- Date of initial inspection
- Date of most recent periodic inspection
- Stamp of approved person who carried out the inspections
- Water capacity
- The date of the next periodic inspection
- Design standard
- Design pressure or maximum allowable working pressure
- Design temperature
- Tare weight (where containers are to be filled by weight)

4.7 Manufacturers' inspection and testing

The pressure vessel and associated pipework and fittings shall be inspected and tested in accordance with the appropriate design standard in use.

4.8 Provision of information

The supplier of the tank shall provide sufficient written information concerning the design, construction, examination, maintenance and safe operation.

As a minimum, the manufacturer shall provide:

a) Certification recording the test and conformity with the design standard in use for each container (Section 4.7).

b) A manual covering operation, maintenance and the safe operating limits of the container.

5 OPERATION

5.1 Siting

Consideration shall be given to the consequences of any liquid spillage from tanks and resultant vapour clouds when choosing a location for the tank either during transport or use.

When gas is not being withdrawn, pressure within the tank will gradually increase to the point where the relief valve will lift. Although the rate of gas discharge is small, precautions shall be taken to avoid the build-up of dangerous atmospheres.
Tanks shall be sited in a well-ventilated area where reasonably practical. Where an external location cannot be found, tanks may be installed internally provided that a suitable and sufficient risk assessment has been carried out. This may allow modification of the safety distances given in Appendix 1; in any case one or more of the following measures shall be implemented:

a) the location is within an enclosed space of adequate size such that using the calculation in Appendix 3 of this Code, the release of gas will not result in an atmosphere with an oxygen concentration outside the limits of 18% and 25%, or with a level of nitrous oxide or carbon dioxide concentration above the limits quoted in 3.4 above.

or

b) the relief device outlets vented to a safe area.

or

c) an additional pressure control device (at a setting less than safety valve setting) connected via a ventvalve, with the gas directed to a safe area. The vent valve shall remain open when this measure has been adopted.

Note: b) and c) only provide protection against the accumulation of gas produced by the tank and not through the use of the product.

Consideration should be given for the tank to be vented in an emergency. This may be achieved by the use of the try-cock/vent exhaust in which case they shall be piped away to a fixed safe external location that is visible from the fill connection.

A road tanker, when in position for filling from or discharging to the fill connection, should be in the open air. Tanker operators shall have easy access to and from the fill connection.

The formula in Appendix 3 of this Code should be used to calculate the effects of minor leakages, eg. from try-cock or thermal pressure relief valves.

Consideration shall also be given to the use of gas detectors or oxygen monitors where ventilation arrangements are poor and it is not practical to increase natural ventilation or install forced ventilation.
When installed internally, locations should be chosen in the following order of preference:

a) in a ventilated room sealed from other areas of normal occupancy.

b) at or above ground level adjacent to an outside wall as far as is practicable away from normal work locations.

c) at or above ground level, as far as is practicable away from normal work locations.

d) below ground level as far as is practicable away from normal work locations.

Gas detectors and oxygen monitors

Asphyxiant or oxygen rich atmospheres are created when gas or liquid is released and the local ventilation is not sufficient to prevent a dangerous gas concentration accumulating. The best precaution against this situation arising is to increase the ventilation level. If it is not reasonably practicable to provide additional ventilation, appropriate gas detection or monitoring equipment that incorporates a warning alarm shall be considered. The following provides some guidance on the selection of appropriate equipment.

Before detector/monitoring equipment is specified the intended location shall be assessed to establish persons at risk, what gases present a risk, where the gases may accumulate (taking into consideration the properties of the gas) and an appropriate location for the detector/monitor measurement head.

Oxygen depletion monitors should be considered where there is a risk of oxygen levels depleting below 19.5% in a workplace.

For the reasons noted in Section 3.1, a carbon dioxide detector should be considered where there is a risk of carbon dioxide levels exceeding 1.5% in a workplace, or a nitrous oxide detector where the nitrous oxide level could exceed 0.01%.

Detector displays and warning signs shall be sited so that they are clearly visible to personnel before entering the affected area.

Detection equipment should be installed, maintained and tested in accordance with the manufacturers recommendations.

Guidance on assessing ventilation requirements is given in Appendix 3.

The floor should be level and shall be adequate to take the weight of the full tank. The tank should be located or stored away from workshop traffic, air intakes, drains and other underground openings, in a secure designated area not exposed to excessive sources of heat. This location should be kept clear and access should be

restricted to authorised persons only. The area should be clearly marked and appropriate hazard warning signs displayed. Examples are:

No smoking shall be permitted in the vicinity of the container and the appropriate hazard warning signs displayed.

Oxidising Substance

No naked flames

No Smoking

These signs shall comply with The Health and Safety (Safety Signs and Signals) Regulations 1996 (24) and with BS 5378 “Safety Signs and Colours” Parts 1, 2 and 3 (25).

The safety distances given in Appendix 1 should be considered when locating tanks. The distances are intended to protect the tank installation as well as personnel and the environment. They are considered to give protection against risks involved, according to practical experience, in the normal operation of tanks covered by this Code of Practice.

Safety distances are defined as the distance from the exposure to:

a) any point on the storage system where in normal operation leakage or spillage can occur (eg. hose couplings, including those on extended fill liners, relief valves vents etc.) or

b) the tank outer jacket, or

c) the tank nozzles.

whichever gives the greatest safety distance to the tank.

5.2 Installation/commissioning

The installer or commissioner of the supply system shall be responsible for the following:

- The appropriate pressure and leak tests have been carried out and documented

- A visual check has been made to ensure that back-feed from the system into the container, eg. from high pressure gas cylinders, is not possible.

- A check has been made that liquefied gas cannot become trapped in any part of the system not protected by thermal relief devices or reach parts of the system not designed for low temperature use.

- A check has been made that the correct safety devices are fitted.

- A check has been made that all warning and identification labels are clearly displayed and that they are correct for the product being stored.

- In the case of CO_2 the special considerations concerning potential product contamination shall be taken into account in accordance with the requirements of BCGA Guidance Note GN10 (23).

5.3 Handover

The initial handover shall include:

a) A demonstration of the correct operation of the equipment,

b) A contact address and telephone number, should the user have any questions about the installation.

Handover documents shall include a minimum of:

i) A manual covering operation and care of the container,

ii) A Product Data Sheet, which gives information in accordance with the requirements of the CHIP Regulations (4) and which deals with the prevention of accidents arising from the uncontrolled escape of product from the tank.

5.4 Handling

The weight of medium and large sized containers greater than 25 litres is such that they should not by moved 'by hand'. Some containers are fitted with permanently attached wheels to allow limited movement over flat surfaces. All other containers should be moved using purpose-built trolleys, handcarts or overhead hoists, correctly attached even for very short distances. They shall not be 'walked', rolled or trundled by hand, even on level surfaces.

Tanks may be moved by forklift truck only if suitably secured in a pallet or purpose-designed framework.

All containers shall be kept as near to their correct orientation as possible during transportation and when in use.

Containers shall be kept clean and free from oil and grease at all times.

5.4.1 Handling Tanks in Lifts

Transporting tanks containing liquefied gas in an occupied lift is hazardous and should be avoided whenever possible. The main hazards are the operation of the safety relief device on the liquid withdrawal unit, liquid splashing or boiling liquid vaporising into the lift, creating an oxygen-deficient atmosphere. The majority of lifts have small internal volume and therefore the effects of oxygen deficiency could overcome a person in the lift in a relatively short time.

Spillage of liquid can cause embrittlement and subsequent failure of certain materials, eg. carbon steel, If liquid is spilled onto a lift floor, the lift should subsequently be checked for mechanical damage.

Before a tank containing product is transported in any lift that can carry persons, a detailed risk assessment in accordance with the Management of Health and Safety at Work Regulations (14) and the Confined Spaces Regulations (18) shall be carried out and emergency procedures established.

Key controlled lifts, ie those designated for remote operation, are strongly recommended. Tanks should travel unaccompanied in them.

Where the use of lifts cannot be avoided, one or more of the following (in order of preference) shall be adopted:

- Tanks shall only be filled to 90% of the net capacity to reduce the risk of spillage.
- Tanks fitted with liquid withdrawal devices shall be vented to less than half the relief-valve set pressure.
- Only an operator who has received suitable training shall be allowed in the lift during the transportation of tanks containing product.
- The operator should have a fully functional oxygen depletion monitor that will warm him when the oxygen level has depleted to 19.5%, or 0.5% carbon dioxide in the case of carbon dioxide tanks, or 0.01% in the case of nitrous oxide tanks, allowing immediate evacuation from the lift before a dangerous level is reached.
- The operator shall have control of the lift to enable immediate evacuation at the next available floor, in the event of an escape of product.
- The lift shall be fitted with an emergency alarm/telephone.
- If the lift is equipped with an extraction fan it should be switched on before the operator takes the tank into the lift.
- Do not transport in the lift a tank that is venting gas; this especially applies to tanks that have just previously been filled.
- Do not vent tanks whilst in a lift.
- Do not transport a leaking or defective tank in a lift.
- Do not transport in a lift a tank that has ice forming on the outside.

- Do not transport an overfilled tank in the lift.

The transportation of tanks in lifts containing product should be supervised/monitored outside the lift by a Competent Person who is aware of the potential hazards and of the action to take in an emergency.

5.5 Emergency Procedures

Emergency procedures should be prepared to cover fire and other hazardous events such as uncontrolled release of product. The procedures should be readily available to all personnel involved, regularly practised and periodically checked to ensure that they are up to date. Examples of emergency actions are given below.

5.6 Uncontrolled escape of product

a) Raise the alarm.

b) Isolate the source of product escape if possible; if not, ensure that all personnel leave the area.

c) Notify the appropriate emergency services (if necessary).

d) Isolate the area and place warning signs.

e) Increase ventilation to the area where possible.

f) For oxygen tanks, shut down all sources of ignition in the area,

g) Refer to the supplier's materials safety data sheet for emergency information.

h) If any doubt exists as to whether the atmosphere is fit to re-enter, the use of an appropriate gas detector should be considered.

5.7 Fire

a) Raise the alarm.

b) Evacuate all persons from the immediate area.

c) Notify the fire brigade.

d) Isolate the area and place warning signs.

e) If possible and without risk move tank away from the fire.

f) From a safe position, keep tank cool by spraying with water.

g) Do not spray water directly on valves or safety equipment.

h) Refer to supplier materials safety data sheet for additional emergency information.

6 TANK MANAGEMENT AND FILLING

6.1 Placing into service (first filling)

When a container is to be filled for the first time, the following checks shall be made, in addition to those required in Section 6.2:

a) check that all appropriate documentation for the particular container and accessories is available,

b) check that valves, relief devices and accessories are appropriate for the intended service, comply with the process-flow diagram and are appropriately marked,

c) check that all valves are easy to operate.

The container shall be cooled down according to the manufacturer's recommendations. Steps should be taken to avoid uncontrolled pressure rise due to rapid liquid evaporation.

Measuring and control devices shall be checked for correct operation and adjusted where appropriate.

A check should be made for leaks on all pipework and fittings.

6.2 Pre-fill checks

Check that the container has been subjected to an in-service examination, see Section 8 of this Code of Practice, and is within test.

Check that the tank and accessories are clean and free from damage.

Check that the correct labels are clearly displayed and appropriate for the products (Section 7.1).

Check the pressure indicator is correct for the intended service.

Check that the tank has a legible data-plate attached.

Check that the fill-connection is appropriate for the product being filled and free from dirt, oil and grease.

Check manual valves operate correctly.

Check appropriate safety relief devices are fitted, in test and free from ice or other obstructions.

6.3 Typical filling procedures

Tanks may be operated in the following ways:

a) Filled at the gas supply company site and transported, full, to the user.

b) Filled at the user site, from a tanker operated by a gas supply company.

c) Filled at the user site by the user from a local bulk supply. Where this operation is carried out, filling procedures should be detailed in the user documentation and carried out by trained personnel only.

The following basic procedures should be carried out for all filling operations:

a) Tanks shall not be overfilled. Overfilling reduces holding time and results in premature safety-valve lifting. Overfilling may be prevented by either:

i) Filling to trycock, where fitted, or
ii) Filling to predetermined gross weight.

b) Tanks filled indoors shall have their vent directed to a safe location.

c) The fill-hose should be purged.

d) The container should be filled through the fill or liquid-valve.

e) After filling, fill-hoses shall be isolated and vented before disconnection. The container, pipework, valves and fittings should be checked for leakage and that the pressure and level-gauges function.

f) Any dust caps, etc, shall be refitted.

6.4 Change of service

When a tank has to be transferred from one product service to another, the following steps shall be taken before filling with the new product. These steps shall be made in accordance with a written procedure and the operating company shall retain a record:

- Check that the tank is designed for the intended service (special attention shall be given to this point if the tank is intended for oxidising fluids)

- Depressurisation, emptying and disconnecting the container shall be carried out in accordance with Section 6.5

- If it is suspected that the container may have been contaminated, it shall be cleaned using a suitable cleaning procedure such as BS 6869 (11)

- Check that the container connections are correct for the new product and change if necessary
- The tank shall be labelled appropriately for the new product and filled in accordance with Section 6.1

- Change of service to an oxidising product should be avoided wherever possible due to the difficulties in ensuring that the internal pipework, etc is not contaminated

- If the tank is to be used for oxidising fluids, a Competent Person shall review the previous service and use of the container to define cleaning and purging requirements. Following completion of these requirements, the competent person shall verify that the procedures have been carried out correctly before filling the tank

- Consideration of compatibility issues, particularly concerning oxidising gas service

- Checking of all documentation to ensure that conversion is safe and properly recorded

- The conversion of tanks into medical service shall only be carried out after a formal risk assessment.

  The following steps shall be considered:

a) Purge the tank piping and accessories with an inert gas until the outlet temperature is close to ambient temperature; the purge gas inlet temperature shall not exceed the maximum operating temperature of the vessel.

b) Check the tank/piping/accessories to ensure that hydrocarbon contamination is not present.

6.5 Taking out of service

Where a tank is to be taken out of service (eg for storage, change service, repair, maintenance, scrapping, etc), the tank shall be depressurised and emptied. These steps shall be made in accordance with a written procedure and the operating company shall retain a record.

When depressurising and emptying, the valve(s) used shall be checked for obstruction and, if necessary, the pressure and weight shall be monitored to ensure that all product has been removed – for example, liquid CO_2 will solidify at low pressures.

If the tank is to be scrapped, it shall be purged with air and labelled accordingly.

If the tank is to be taken into service again later, or for repair involving hot work, the following additional points shall be considered:

a) Purging the container, piping and accessories with an inert gas,

b) The fitting of protective caps or covers to open connections prior to transportation or storage,

c) Maintenance of positive pressure of less than 0.5 bar of dry, inert gas in the container which shall be labelled accordingly.

7 TRANSPORTATION OUTSIDE USER PREMISES

7.1 Labelling – Transport and Supply Regulations

The tank shall be labelled for supply in accordance with Regulation 9 of the Chemical (Hazards Information and Packaging) Regulations (4), and for transport in accordance with Regulation 8 of the Carriage of Dangerous Goods (Classification, Packaging and Labelling) and Use of Transportable Pressure Receptacles Regulations (12). Regulation 9 of these latter regulations details how to combine supply and transport labelling.

The label shall show:

a) The name, address and telephone number of the gas supplier,

b) The name of the product. *

c) The risk phrases. *

d) The safety phrases. *

e) The EEC number. *

f) The words “EEC Label” where required. *

g) The UN number (preceded by the letters “UN”). *

h) The danger sign. *

i) Any subsidiary hazard sign. *

j) Emergency shut-down procedure.

* See the Product Table on page 21 for details.

The label showing the information a) to g) shall have the following minimum dimensions:

Capacity of vessel	Dimensions of label
Not exceeding 50 litres	at least 74mm x 105mm
Not exceeding 500 litres	at least 105mm x 148mm
Exceeding 500 litres	at least 148mm x 210mm

* PRODUCT TABLE

Product Name	Risk Phrases	Safety Phrases	EEC No	UN No	Danger Sign	Subsidiary hazard sign	EEC Label
Argon, Refrigerated Liquid	RAs,RFb	9,23,36	231-147-0	1951	2.2	-	-
Carbon Dioxide Refrigerated Liquid	RAs,RFb	9,23,36	204-696-9	2187	2.2	-	-
Helium, Refrigerated Liquid	RAs,RFb	9,23,36	231-168-5	1962	2.2	-	-
Nitrogen, Refrigerated Liquid	RAs,RFb	9,23,36	231-783-9	1977	2.2	-	-
Nitrous Oxide, Refrigerated Liquid	8A,RFb	9,17,36	233-032-0	2201	2.2	Oxidising agent	-
Oxygen, Refrigerated Liquid	8A,RFb	9,17,36	231-956-9	1703	2.2	Oxidising agent	Yes

Risk phrases

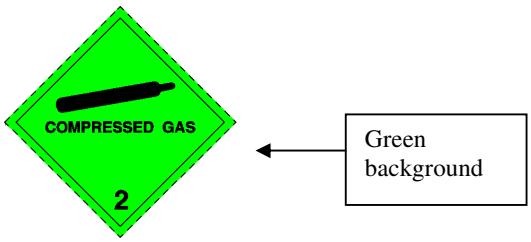
RAs	Asphyxiant in high concentration.
RFb	May cause frostbite.
8A	Contact with combustible material may cause fire.

Safety phrases

9	Keep container in well-ventilated place.
23	Do not breathe gas.
36	Wear suitable protective clothing.
17	Keep away from combustible materials; use no oil or grease.

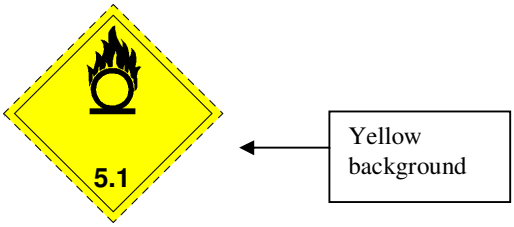
DANGER SIGN

2.2



SUBSIDIARY HAZARD SIGN

Oxidising agent



These signs shall stand out from their background and have a side-length of at least 100mm.

7.2 Labelling – Food Regulations

Where the gas in the tank is used either as packaging or propellant gas for foodstuffs or beverages, the container shall also be labelled in accordance with the Food Additives Labelling Regulations 1992 (5). These require the following information additional to the above:

1) The product name shall be followed by the appropriate "E" number as detailed below:

Product	**'E' Number**
Carbon dioxide	E290
Nitrogen	E941
Argon	E938
Oxygen	E948
Helium	E939
Nitrous oxide	E942

2) The statement "for use in food", or another statement referring more specifically for the use in food for which the packaging or propellant gas is used.

3) A mark identifying the batch or lot from which the gas came. The letter "L" shall precede this mark, unless it is clearly distinguishable from other markings.

7.3 General

Tanks shall be secured effectively in the correct orientation during transit.

Tanks shall be off-loaded from the vehicle using appropriate handling equipment.

Tanks holding even small quantities of product shall not be transported in enclosed vehicles unless the vehicle is constructed for the purpose.

The transport shall comply with the requirements of the Carriage of Dangerous Goods by Road Regulations (13).

To assist in determining the legal requirements refer to HSE publication entitled 'Are you involved in the carriage of dangerous goods by road or rail', or the BCGA guide entitled 'Carriage of Gas Cylinders in Cars, Vans, and other Vehicles Guidance for Drivers at Work 1996'.

8 IN-SERVICE EXAMINATION AND MAINTENANCE

8.1 Tanks that are, or are intended to be, transported by road or rail

An in-service examination shall be carried out as specified by the Carriage of Dangerous Goods (Classification, Packaging and Labelling) and Use of Transportable Pressure Receptacles Regulations 1996 (12), or the Transportable Pressure Vessels Regulations 2001 (20) as appropriate.
An inspection body, or in the case of tanks covered by the Transportable Pressure Vessels Regulations 2001 (20) a Notified or Approved body, should perform the inspection at intervals not exceeding 10 years and should cover as a minimum:-

a) Equipment and safety device check:
Safety valves shall be lift tested either in situ or off the vessel
Bursting discs, where fitted, shall be checked for correct installation and rating
If satisfactory they do not require replacement
All other equipment shall be checked for satisfactory functioning

b) Visual external examination:
Check for signs of damage
Check content and legibility of data plate and other markings

c) Leak test:
Gas test using an inert gas or the working medium at 90% of the allowable working pressure.

d) In case of doubt regarding the integrity of the vacuum interspace, an evaporation test or vacuum measurement should be carried out.

e) In addition, at intervals not exceeding 5 years:

- The safety valves shall be lift tested
- The bursting discs shall be visually inspected

NB Tanks manufactured before the 1st July 2001 which contain a gas at a pressure of less than 0.5 bar above atmospheric pressure are not currently required to be examined in accordance with the above in-service examination but it is strongly recommended that they are similarly examined.

8.2 Tanks <u>not</u> intended for (or not currently being used for) transport by road or rail

An in-service examination shall be carried out in accordance with The Pressure Systems Safety Regulations 2000 (1). These regulations require that:

"The user of an installed system and the owner of a mobile system shall not operate the system, or allow it to be operated, unless he has a written scheme for the periodic examination, drawn up and executed by a competent person, for the following parts of the system:-

a) All protective devices;

b) Every pressure vessel and every pipeline in which (in either case) a defect may give rise to danger; and

c) Those parts of the pipework in which a defect may give rise to danger."

As a minimum, it is recommended that the procedure given in Section 8.3 below, forms the basis of the Written Scheme and that an examination to that Written Scheme is carried out at intervals not exceeding 5 years. Further guidance on Written Schemes of Examination is given in the BCGA Code of Practice CP23 "Application of the Pressure Systems Safety Regulations 2000 to Industrial and Medical Pressure Systems Installed at user Premises." (10).

8.3 In-service examination in accordance with the Written Scheme

a) Visually check that the container is legibly and durably marked with safe-operating limits and that the mark is clearly visible.

b) Check the outer jacket for signs of damage, corrosion and vacuum/insulation failure.

c) Visually check all pipework for signs of damage.

d) Carry out evaporation or vacuum tests where the integrity of the vacuum inter-space is in doubt.

e) Re-certify the protective devices by in-situ testing or by fitting certified replacements.

f) Visually check the condition of any vacuum jacket burst-disc or plug.

g) The owner shall maintain a record of the examination.

Following the examination, the Competent Person shall identify whether any remedial action is required.

8.4 Maintenance

The requirements of Sections 8.1 – 8.3 are in addition to the maintenance required to sustain the tank in a safe condition, which remains the responsibility of the owner. This maintenance may include the following check/tests:

a) Check the pressure-build and gas-use regulators for correct settings and functions.

b) Check the valves for smooth operation.

c) Check the condition and function of the liquid-level and pressure indicators.

d) Leak-test the vessel and all valves, fittings and pipework using an inert gas or the working medium.

e) Check the condition and content of all labels.

f) Remedial action shall take place where required.

9 MODIFICATIONS AND MAJOR REPAIRS

A “modification” means any change to the inner vessel and its primary protective devices.

A “major repair” means any repair involving hot-work or welding on the inner vessel. It does not include heat treatment.

No modifications or major repairs may be carried out which put the tank outside the scope of the design standard specification to which it was originally designed and constructed. Approval of modifications or repairs shall be in accordance with those for the original construction.

10 RECORDS

10.1 Original verification

The owner of the container shall hold a copy of the manufacturer’s certificate of conformity to the design code, standard or specification for each container.

Where containers are hired to third parties, the owner shall also retain copies of the design code, standard or specification used for the manufacture of the container.

10.2 In-service examination records

The owner of the tank shall retain records of periodic examination carried out on the tank.

10.3 Change of service records

The owner of the tank shall retain records of any change of service.

11 LIST OF REFERENCE DOCUMENTS

SI 2000: 128	The Pressure Systems Safety Regulations 2000.
	.
	Health and Safety at Work Act 1974 – HMSO No 010 543 7743.
SI 2002: 2677	Control of Substances Hazardous to Health Regulations 2002.
SI 2002: 1689	Chemical Hazard Information and Packaging Regulations 2002.
SI 1992: 1978	The Food Additives Labelling Regulations 1992.
SI 1992: 2966	The Personal Protective Equipment at Work Regulations 1992.
SI 1996: 2094	The Carriage of Dangerous Goods (Driver Training) Regulations 1996.
SI 1999: 2001	The Pressure Equipment Regulations 1999.
	Cryogenic Safety Manual – British Cryoengineering Society, ISBN 08543 2605-7.
BCGA CP23	Application of the Pressure Systems Safety Regulations 2000 to Industrial and Medical Pressure Systems Installed at user Premises.
BS 6869	Code of Practice for procedures for ensuring the cleanliness of industrial process, measurement and control equipment in oxygen service.
SI 1996: 2092	The Carriage of Dangerous Goods (Classification, Packaging and Labelling) and Use of Transportable Pressure Receptacles Regulations 1996.
SI 1996: 2095	The Carriage of Dangerous Goods by Road Regulations 1996.
SI 1999: 3242	The Management of Health and Safety at Work Regulations 1999.
IGC Doc 33/97*	Cleaning of Equipment for Oxygen Service.
SI 1998: 2306	The Provision and Use of Work Equipment Regulations 1998.
BCGA Technical Report TR3	Replacement substances for the cleaning of oxygen system components.
SI 1997: 1713	The Confined Spaces Regulations 1997.
HSE/EH40	Occupational Exposure Limits.
SI 2001: 1426	The Transportable Pressure Vessels Regulations 2001.
BCGA CP 30	The Safe Use of Liquid Nitrogen Dewars up to 50 Litres.

IGC Document 59/98*	The Prevention of Excessive Pressure in Cryogenic tanks during Filling.
BCGA GN10	Implementation of EIGA Carbon Dioxide Standards.
SI 1996: 341	The Health & Safety (Safety Signs and Signals) Regulations 1996.
BS 5378	Safety Signs and Colours, Parts 1, 2 and 3.
EIGA INFO 04/02*	Safety Features of Portable Cryogenic Liquid Containers for Industrial and Medical Gases.

* A European Industrial Gases Association (EIGA) publication available from:

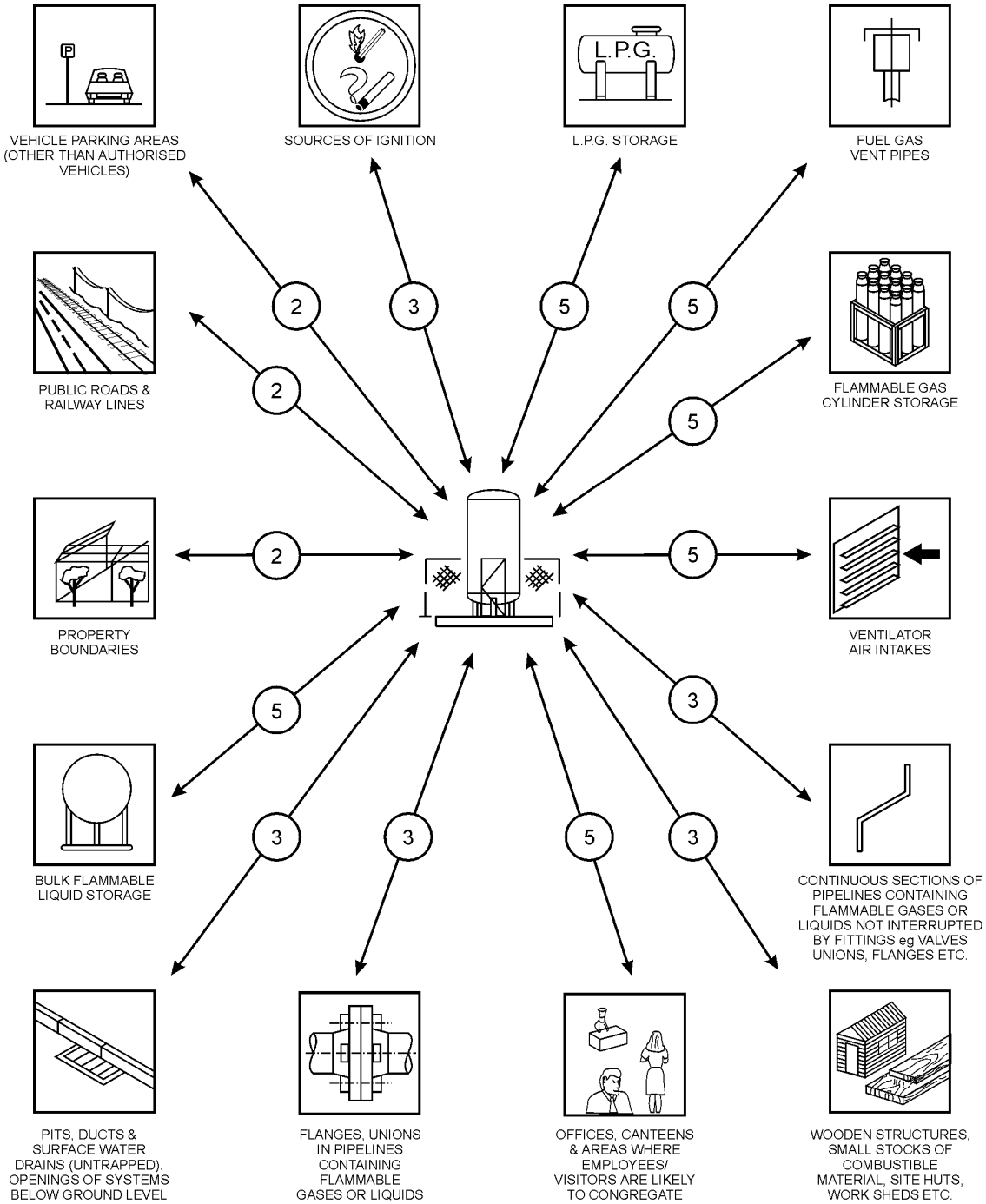
Publications du Soudage et de ses Applications (PSA)
B.P. 50362
F-95942 Roissy CDG Cedex, France
Tel 00 33 (1) 49 90 36 00 Fax 00 33 (1) 49 90 36 50

Publications, including revisions, from 2000 onwards are obtainable from EIGA
Website: www.eiga.org
E-mail: info@eiga.org

APPENDIX 1
Sheet 1 of 3

SAFETY DISTANCES IN METRES

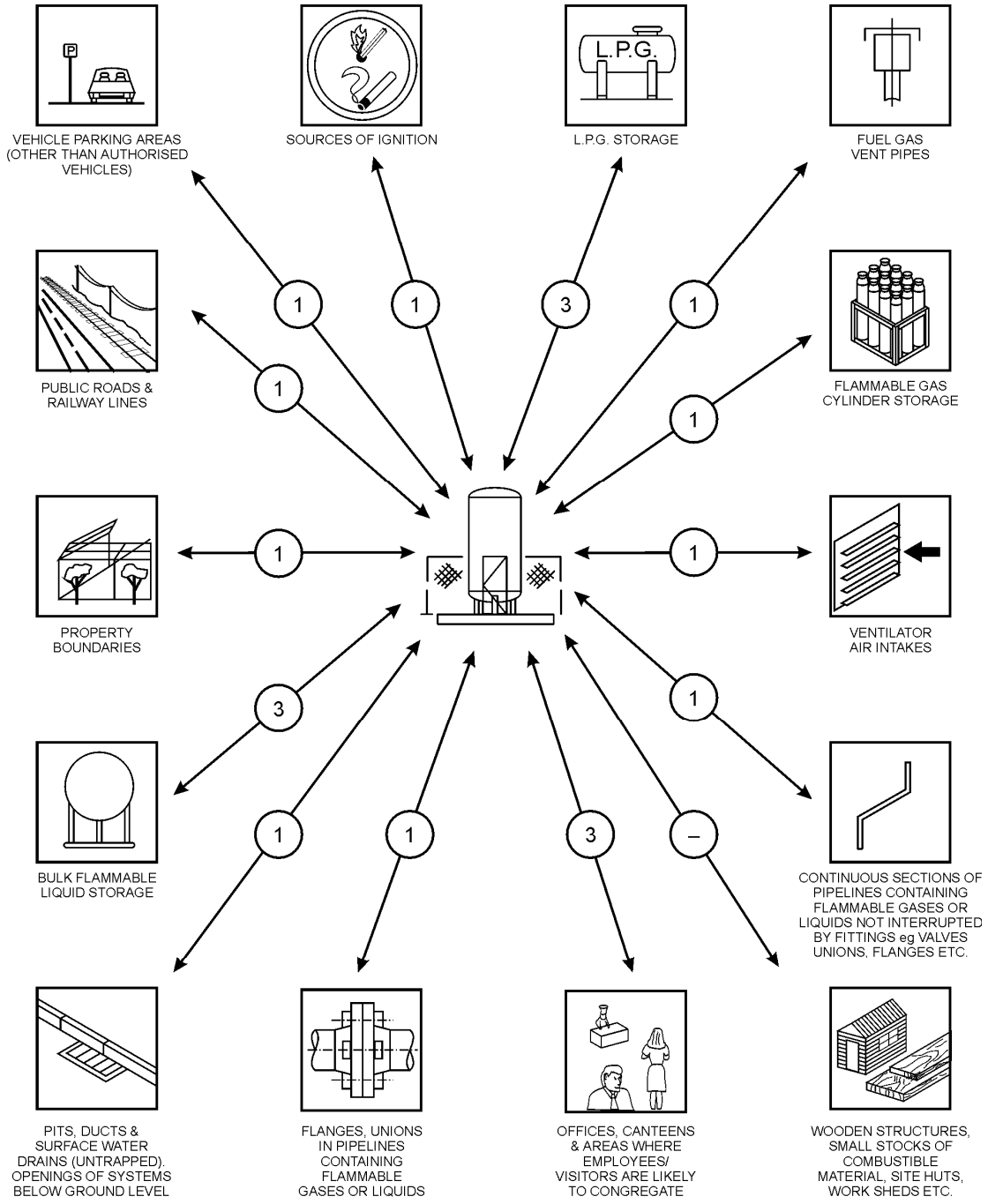
Distance (metres) between oxygen or nitrous oxide storage tank(s) up to 1,000 litre capacity and typical hazards.



APPENDIX 1
Sheet 2 of 3

SAFETY DISTANCES IN METRES

Distance (metres) between nitrogen, argon, helium and carbon dioxide storage tanks up to 1,000 litre water capacity and typical hazards.



APPENDIX 1
Sheet 3 of 3

NOTE (1) The safety distances are measured from the exposure to:
a) Any point on the storage system where, in normal operation, leakage or spillage can occur, or;
b) The tank outer jacket, or;
c) The vessel nozzles,
whichever gives the greatest safety distance from the tank.

NOTE (2) For offices, canteens, etc. the distances are measured to the nearest opening in the building e.g. windows and doors.

NOTE (3) Ventilator intakes should be at least 1 metre above ground level if within 5 metres of the tank.

NOTE (4) Any door within 1 metre of the tank should be of a self closing type.

NOTE (5) Where tanks are stored or located inside buildings refer to section 5.1.

APPENDIX 2
Sheet 1 of 2

"BURNS" DUE TO VERY COLD LIQUEFIED GASES

The temperature of liquefied gases varies. The approximate boiling points, i.e. the temperatures at which the liquefied gas vaporises at atmospheric pressure of some common industrial gases are as follows:

Helium	–268°C
Nitrogen	–195°C
Argon	–185°C
Oxygen	–183°C
Ethylene	–103°C
Carbon dioxide *	–78°C
Propane	–42°C

* At atmospheric pressure, carbon dioxide is a solid which sublimes directly to gas.

General Effect on Tissue

The effect of extreme cold on tissue is to destroy it, a similar end result to that of heat exposure, and in like fashion the amount of cold and the duration of contact is crucial.

The destruction of tissue is not so immediately obvious as in the case of burns, since pain is absent in the frozen stage, and the tissue, although rigid, keeps its normal shape and is not obviously destroyed. Pain and destruction become more apparent as thawing occurs. Those who have had mild frostbite of fingers or toes will have some idea of the pain on re-warming.

Prevention of contact with very cold fluids and surfaces is quite vital and those who work in this field must be aware of the hazard.

Skin Effects

Liquid, vapour, or low-temperature gas can produce effects of the skin, which will vary in severity with temperature and the length of exposure. Naked or insufficiently protected parts of the body coming into contact with un-insulated pipes or vessels may stick fast by virtue of the freezing of moisture and flesh may be torn in removal. The wearing of wet clothing should be avoided.

Continued exposure of naked flesh to cold atmospheres can result in frostbite. Usually there is sufficient warning by local pain whilst the freezing action is taking place. Re-warming with lukewarm water at 42° to 44° C (107° to 111°F) is generally a sufficient safeguard against injury.

Effect of Cold on Lungs

Whilst transient and short exposure produces discomfort in breathing, prolonged inhalation of vapour or cold gas, whether respirable or not, can produce serious effects on the lungs.

APPENDIX 2
Sheet 2 of 2

FIRST AID TREATMENT OF CRYOGENIC BURNS

Flush the affected areas of skin with copious quantities of tepid water, but do not apply any form of direct heat, eg hot water, room heaters etc. Move casualty to a warm place (about 22°C; 295K). If medical attention is not immediately available, arrange for the casualty to be transported to hospital without delay.

While waiting for transport:

- Loosen any restrictive clothing.
- Continue to flush the affected areas of skin with copious quantities of tepid water.
- Protect frozen parts with bulky, dry, sterile dressings. Do not apply too tightly so as to cause restriction of blood circulation.
- Keep the patient warm and at rest.
- Ensure ambulance crew or hospital is advised of details of accident and first aid treatment already administered.
- Smoking and alcoholic beverages reduce the blood supply to the affected part and should be avoided.

The above text has been reproduced with the permission of the British Cryoengineering Society from its "Cryogenics Safety Manual", Reference No. ISBN 0-8453-26057. (9)

Appendix 3
Sheet 1 of 3

GUIDANCE FOR ASSESSMENT OF VENTILATION REQUIREMENTS

The type of ventilation depends on a multitude of factors such as type of location, gas type, possible leaks, etc.

Ventilation can be natural or provided by forced-ventilation. The design criterion is the number of air-changes per hour.

In locations above ground-level with no special ventilation openings, natural ventilation provides, typically, 1 change per hour. This is not the case for buildings with windows sealed with tight-seals. For underground rooms with small windows 0.4 changes per hour can be considered as an average value.

For handling (storing, filling, withdrawal, etc) transportable cryogenic vessels with non-flammable, non-toxic contents in locations above ground-level, natural ventilation is generally sufficient, provided that the room is large enough or that the outdoor area is not enclosed by walls, etc.

An indoor location should have ventilation openings with a total area of 1% of the ground area. The openings should be positioned diagonally across the room. The density of the gas should also be taken into consideration, the main opening at the highest point of the location for gases lighter than air or at ground level for gases heavier than air.

For more than 2 changes per hour a forced ventilation system is necessary. Different regulations may recommend, or require for different situations, a specific number of air changes per hour, eg 5, 10, 20, etc.

In typical situations the number of air changes required can be calculated assuming a certain spillage or leakage rate from a machine in use. A homogeneous distribution of gas is assumed and the following formula is used:

$$C_t = \frac{L\,(1-e^{-nt})}{V_r n}$$

where

C_t	=	gas concentration at time t
L	=	gas release m³/h
V_r	=	room volume m³
n	=	air changes per hour
t	=	time gas has flowed in hours

and for long periods (t tending to infinity):

$$C_\infty = \frac{L}{V_r n}$$ approximately

Alternatively it may be appropriate to consider the "worst case" scenario where the entire contents of the vessel are lost to the room immediately. The resulting O_2 concentration in the room may then be calculated from the following formula:

$$C_{ox} = \frac{100 \times V_o}{V_r}$$

where C_{ox} = resulting oxygen concentration %
V_o = volume of oxygen in the room m^3
V_r = volume of the room m^3

where for argon, nitrogen and other inert gases:

$V_0 = 0.21 (V_r - V_g)$ = resulting oxygen content (m^3)

and for oxygen:

$V_0 = 0.21 (V_r - V_g) + V_g$

V_g = maximum gas release which is the liquid volume capacity (m^3) of the vessel V x gas expansion factor f_g.

f_g for :

nitrogen	= 683
oxygen	= 842
argon	= 824
carbon dioxide	= 543
helium	= 739
nitrous oxide	= 665

CALCULATION FOR SITING TANKS IN BUILDINGS

This appendix considers the "worst case" scenario where the entire contents of the vessel are lost to the room immediately. The resulting O_2 concentration in the room may then be calculated from the following formula:

$$C_{ox} = \frac{100 \times V_o}{V_r}$$ = resulting oxygen concentration %

where for asphyxiant gases:

$V_o = 0.21 (V_r - V_g)$ m^3 of O_2

and for oxygen:

$V_o = 0.21 (V_r - V_g) + V_g$ m^3 of O_2

Appendix 3
Sheet 3 of 3

V_g = maximum gas release m^3

= liquid volume capacity of the vessel (m^3) x gas expansion factor f_g,

f_g	being for nitrogen:	683
	oxygen:	842
	argon:	824
	carbon dioxide:	543
	helium:	739
	nitrous oxide:	665

Worked Example

To calculate the O_2 concentration resulting from spilling 50 litres of liquid oxygen into a room of 300 m^3 volume:

V_r = Room volume = 300 m^3

V_g = Gas release from vaporised liquid = $\frac{50}{1000}$ x 842 = 42 m^3

$V_o = 0.21 (V_r - V_g) + V_g$

$V_o = 0.21 \times (300 - 42) + 42 = 96.2\ m^3$

$C_{ox} = \frac{100 \times V_o}{V_r} = \frac{100 \times 96.2}{300} = 32.1\%$

Appendix 4
Page 1 of 1

UK Mini Tank Connections

		Air Products	BOC	CryoService	Energas	Hydro	Linde	Messer
Nitrogen	Fill	CGA 295	CGA 295 or ½"BSPM	¾" BSPM	CGA 295	SAE J514 - 3/4 JIC	CGA 295	-
	Vent	CGA 295	CGA 295	Straight tube	CGA 295	SAE J514 - 3/4 JIC	CGA 295	-
	Gas Use	BS 341 - 3	BS 341 - 3	Permanently connected tube or BS 341 - 3	BS 341 - 3	SAE J514 - 3/4 JIC	BS 341 - 3	-
Argon	Fill	¾" BSPM	CGA 295	7/8" BSPM	CGA 295	-	CGA 295	-
	Vent	¾" BSPM	CGA 295	Straight tube	CGA 295	-	CGA 295	-
	Gas Use	BS 341 - 3	BS 341 - 3	Permanently connected tube or BS 341 - 3	BS 341 - 3	-	BS 341 - 3	-
Oxygen (Industrial)	Fill	CGA 440	CGA 440	CGA 440	CGA 440	-	-	-
	Vent	CGA 440	CGA 440	Straight tube	CGA 440	-	-	-
	Gas Use	BS 341 - 3	BS 341 - 3	Permanently connected tube or BS 341 - 3	BS 341 - 3	-	-	-
Oxygen (Medical)	Fill	CGA 440	CGA 440	CGA 440	-	-	-	-
	Vent	CGA 440	CGA 440	Straight tube	-	-	-	-
	Gas Use	ISO 5145	M24 ISO	Permanently connected tube		-	-	-
Carbon Dioxide	Fill	ISO32x3.5	BS 341 - 8	Parker coupling	-	SAE J514 - 3/4 JIC	-	-
	Vent	ISO32x3.5	CGA 295	Straight tube	-	SAE J514 - 3/4 JIC	-	-
	Gas Use	BS 341 - 8	BS 341 - 8	Permanently connected tube	-	SAE J514 - 3/4 JIC	-	-

HISTORY AND OBJECTIVES OF BCGA

The British Compressed Gases Association was established in August l971 as the successor to the British Acetylene Association, formed in l901. Its Members consist of producers, suppliers of gases equipment and container manufacturers and users operating in the compressed gas field.

The main objective of the Association is the advancement of technology and safe practice in the manufacture, handling and use of all gases and the design and manufacture of all containers, apparatus, appliances, plant, etc. BCGA also provides advice and makes representations, insofar as these relate to particular problems of the compressed gases industry, on behalf of its Members to all regulatory bodies, including the UK Government, concerning legislation both existing and proposed.

Policy is determined by a Council elected from Member Companies, with detailed technical studies being undertaken by a Technical Committee and its specialist Sub-Committees appointed for this purpose.

Further details of the Association may be obtained from:

BRITISH COMPRESSED GASES ASSOCIATION
4a Mallard Way, Pride Park, Derby,
DE24 8GX
Tel 01332 225120
Website : www.bcga.co.uk