GUIDANCE NOTE 30

THE SAFE USE OF GASES IN THE BEVERAGE DISPENSE INDUSTRY

REVISION 1: 2017

British Compressed Gases Association

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BRITISH COMPRESSED GASES ASSOCIATION
Registered office: 4a Mallard Way, Pride Park, Derby, UK. DE24 8GX
Company Number: 71798, England

Website:
www.bcga.co.uk

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PREFACE

The British Compressed Gases Association (BCGA) was established in l971, formed out of the British Acetylene Association, which existed since l901. BCGA members include gas producers, suppliers of gas handling equipment and users operating in the compressed gas field.

The main objectives of the Association are to further technology, to enhance safe practice, and to prioritise environmental protection in the supply and use of industrial gases, and we produce a host of publications to this end. BCGA also provides advice and makes representations on behalf of its Members to regulatory bodies, including the UK Government.

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.

BCGA makes strenuous efforts to ensure the accuracy and current relevance of its publications, which are intended for use by technically competent persons. However this does not remove the need for technical and managerial judgement in practical situations. Nor do they confer any immunity or exemption from relevant legal requirements, including by-laws.

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 but no representation or warranty can be given that these references are complete or current.

BCGA publications are reviewed, and revised if necessary, at five-yearly intervals, or sooner where the need is recognised. Readers are advised to check the Association's website to ensure that the copy in their possession is the current version.

This document has been prepared by BCGA Technical Sub-Committee 5. This document replaces BCGA Guidance Note 30: 2014. It was approved for publication at BCGA Technical Committee 155. This document was first published on 05/01/2017. For comments on this document contact the Association via the website www.bcga.co.uk.

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* Throughout this publication the numbers in brackets refer to references in Section 17. Documents referenced are the edition current at the time of publication, unless otherwise stated.

TERMINOLOGY AND DEFINITIONS

Beverage	Any potable drink, mainly (but not necessarily exclusively) in liquid form.
Bursting disc	A relief device designed to operate in the event of over-pressure, and thereby protect a specific pressure system or part of a system. Bursting discs are set to operate (i.e. burst) at a specific set pressure, within a closely-defined tolerance. Unlike a pressure relief valve, a bursting disc cannot re-seat after operation – the stored contents will be released.
Cask	Container for holding unpressurised chilled and filtered beverage products.
Cellar	Liquid food store, with or without temperature or other environmental controls. A gas store may be included within the cellar.
Confined space	A confined space, as defined under The *Confined Spaces Regulations* (4). These Regulations require an assessment to be carried out; cellars are highly likely to be defined as Confined Spaces. The free volume of air within the space, the ventilation and the potential for gas release are all relevant factors to consider in assessing whether or not a confined space exists.
Corrosion	The deterioration of materials (for example, cylinder, valves, pipework etc.) by an electro-chemical reaction, when in contact with water or other fluids (for example, carbon dioxide and water).
Faucet *(tap, spigot)*	The beer faucet is the point of dispense: where draft beer meets the outside atmosphere. Alternatively the faucet may be called the 'tap' or 'spigot'.
Fob / FOB	Foam on beer (FOB). The beer head is the frothy foam on top of beer that is produced by bubbles of gas, typically carbon dioxide, rising to the surface. The elements that stabilise the head are wort protein and hop residue. The carbon dioxide that forms the bubbles in the head is produced during fermentation. Fobbing occurs when the last remains within a cask or keg are dispensed at the faucet, or where there is a problem with temperature or pressure.
Fob detector	A device, containing a non-return valve, which stops the line filling up with fob when the keg runs out.
Food	Any substance or product intended to be or reasonably expected to be ingested by humans.
Keg	Pressure container for holding chilled and filtered beverage products.
Keg coupler	A device for connecting the keg to the dispense system.
May	Indicates an option available to the user of this Guidance Note.

Mixed gas	Carbon dioxide and nitrogen mixed in various ratios to maintain or enhance sensory aspects of the product.
Nitrogen Reservoirs or Receivers	Vessels (often former gas cylinders), used in combination with an on-site nitrogen gas generator, to store gaseous nitrogen prior to the gas being used in dispense applications. Several receivers may be installed, inter-connected, to provide a large reservoir or volume of storage.
Non-return valve *(NRV, Reflux, Flap valve)*	A valve designed for placement in a pipe system such that it readily permits flow of fluid in the desired direction, but prevents, discourages or obstructs flow in the opposite direction. The non-return valve may be called a NRV, reflux or flap valve (especially on liquid systems).
Premises operator	The operator of the beverage sector premises, cellar, drinks and gas systems. The premises operator may be the effective employer of those working on the premises. In many cases this Premises Operator is the publican, landlord, user, manager (or pub operating company general manager) and / or licensee. The Premises Operator may also be known as the 'user' in some cases.
Pressure regulator	A pressure control device that reduces and smooths out variation in pressure of the gas from higher (for example, cylinder, vessel, etc.) pressure to a constant lower pressure suitable for the safe operation of the downstream system and equipment.
Pressure relief valve	A device which automatically vents gas from a pressure system in order to prevent over pressure in that system. The pressure relief valve should automatically reseat when the condition(s) causing the over-pressure is corrected and when the pressure itself reduces.
Residual pressure device	A device that prevents ingress of contaminants by maintaining a positive differential pressure between the pressure within the cylinder and the valve outlet. It is incorporated into the cylinder valve.
Risk assessment	A formal written assessment of risk, conducted by one or more competent persons in order to identify hazards and evaluate the extent of risk. Its purpose is to eliminate or reduce the risk to as low a level as is reasonably practicable, for example, by identifying suitable controls.
Shall	Indicates a mandatory requirement for compliance with this Guidance Note and may also indicate a mandatory requirement within UK law.
Should	Indicates a preferred requirement but is not mandatory for compliance with this Guidance Note.
Stop valve	An isolation valve. All secondary regulators or inline 'T' pieces in a ring main have an isolation valve installed to enable a part of the pressure system to be isolated, whilst allowing the rest of the pressure system to operate normally.

GUIDANCE NOTE 30

THE SAFE USE OF GASES IN THE BEVERAGE DISPENSE INDUSTRY

1. INTRODUCTION

Gases are used widely in the beverage dispense sector, for example:

- To help retain the carbon dioxide in a beverage;
- To carbonate beverages;
- To displace beverage product from a keg;
- To replace volume in a keg, so as to maintain a safe keg positive pressure;
- To aid the whipping of cream for hot beverages (for example, coffee);
- As a bulk gas source (in liquefied form) for various applications;
- To operate and power (power pneumatics) cellar equipment;
- To chill beverages (in liquefied form), including the production of vapour effects;
- To calibrate technical equipment such as gas monitors;
- To inflate party balloons and for other novelty / ancillary purposes;
- For heating, cooking and space-heating (for example, patio heaters) purposes.

The gases most commonly used are nitrogen (N_2), carbon dioxide (CO_2) and various mixtures of N_2 and CO_2, although other gases and mixtures may be used for some specialist purposes. N_2 and CO_2 are used as they maintain the correct conditions within the keg and within the dispensed beverage. The gases preserve the desired equilibrium of the beverage by ensuring the correct level of CO_2 is present (i.e. has the correct concentration of CO_2 in the liquid).

Compressed air may be used for non-drinks-contact pneumatic power, for example, as an operating media for gas pumps. Compressed air should not be used in contact with drinks.

Other specialist gases may be used for other specific purposes.

Typically, gases are stored either within or near a cellar or in a dedicated gas store, refer to Section 14.

Companies that supply gases for food use, such as for beverage dispense, shall be compliant with the relevant aspects of The Food Safety Act (2) and any other applicable legislation, including specific food legislation. Premises Operators shall ensure that only the appropriate grades of gases are used for food products. The British Compressed Gases Association (BCGA) Guidance

Note (GN) 14 (39), *Production, storage, transport and supply of gases for use in food*, provides details on the regulations relating to the use of gases for use in food.

Good quality dispense gas is essential for serving the beverage product in the way the supplier intends. Dispense gas is normally supplied in a container, i.e. a cylinder, liquid cylinder or vessel. The container should be in good condition, it shall be safe to use and shall be labelled with the product contents and grade (i.e. food grade). The gas shall be within its 'use by' date, and the cylinder should be within its Periodic Inspection and Test date.

Alternative methods of gas supply, such as the use of on-site nitrogen gas generators may also be used.

To assist Premises Operators when procuring beverage gases, the Brewing, Food and Beverage Industry Suppliers' Association (BFBi) operate a '*Gas Suppliers Accreditation Scheme*', and manage a '*Register of Gas Fillers, Suppliers & Installers*'. This scheme is designed to provide assurance to Premises Operators that the beverage gas they buy is from an accredited and reputable supplier and that it is fit for purpose.

Suitable insurance arrangements shall be made by Premises Operators. Premises Operators shall make their insurer aware of the presence on site of compressed (and / or liquefied) gases.

This Guidance Note has been prepared by the BCGA in consultation with the British Beer & Pub Association (BBPA) and the BFBi in order to provide guidance to suppliers, operators, users and others concerned with gases in the beverage dispense sector.

Further guidance on beverage dispense gas cylinders can be found in BCGA Leaflet 10 (45), *Profit through quality. Good gas, good business*, and the BBPA guidance, *Instructions for the safe operation of gas pressure systems used in the dispensing of beers and lagers* (46).

2. SCOPE

This Guidance Note addresses the safety, quality and operational issues for gases and systems delivered to, stored, installed and used in Premises Operator's installations. The safety standards described are the minimum required for safe working practice.

It specifically addresses the importance of the skill and competence of Premises Operators, their supervisors, operatives and managerial staff.

3. THE USE OF GASES FOR BEVERAGE DISPENSE

Gases have hazardous properties (refer to Section 4) and therefore they are supplied and stored in containers (refer to Section 5) specifically designed to keep them safe. Premises Operators should only accept and use, new or replacement gas containers from *bona fide* gas suppliers. Specific guidance on selecting beverage dispense gas cylinders can be found in BCGA Leaflet 10 (45).

Good quality dispense gas is essential for serving beverage products in the way the supplier intends i.e. in optimum condition.

Premises Operators shall ensure that the gases are stored, handled, connected and used in such a way as to ensure their 'as supplied' quality integrity is maintained.

The following gases are used for direct beverage dispense:

3.1 Carbon dioxide

CO_2 is the principle gas used in beverage dispense. CO_2 readily dissolves in water by a process called carbonation. The CO_2 is the component of a drink that gives it fizz and some added taste (bittering), it also provides effervescence that helps 'lift' the beer's aromas into the drinker's nose and palate as well as giving beer its characteristic head.

NOTE: CO_2 is a natural by-product of fermentation in beer; for cask beers there may still be CO_2 production during storage.

Typically CO_2 is provided for beverage use as a liquefied gas in a cylinder. There are two types of cylinder; gas use or liquid use. A gas use cylinder takes gas from the top of the cylinder to the outlet valve. A liquid use cylinder incorporates a dip pipe that takes liquid from the bottom of the cylinder to the outlet valve. However there are an increasing number of premises that use static liquid storage bulk tanks or vessels which are filled on the Premises Operator's site.

3.2 Nitrogen

N_2 is often supplied as part of a mixture with CO_2 for beverage dispense. It is not readily absorbed by the beverage, but can be if the top pressure is incorrect or the temperature is low.

N_2 may be used for power pneumatics (as with compressed air, refer to Section 3.3), provided care is taken that waste nitrogen is appropriately managed. Waste or spent nitrogen from power pneumatics (gas pumps) shall be vented to a safe, external, well-ventilated location. N_2 used for power-pneumatics is not to be in contact with the beverage.

3.3 Air

Air has two applications. It may be used to operate some cellar equipment (power pneumatics, for example, for gas pumps), and can be used to maintain the pressure in a keg in non-drink-contact applications.

The use of air is not permitted where it could contact food or drinks. This is because:

- air affects the taste of some products;

- the oxygen content of air can cause oxidation and staling of some beverage products, even after short-term exposure;

- air is generally supplied to a standard that does not meet the required specification for food, i.e. food grade; if it is not ‘food grade’ it is unsuitable for use with beverages.

3.4 Mixed gas

Mixed gas is a blend of CO_2 and N_2 used in beverage dispense. The gases work together such that the CO_2 maintains gas equilibrium in the liquid whilst the higher top pressure of the N_2 reduces the need for pump assistance during dispense.

Generally there are three mixed gas types used in the UK market, depending upon the type of beverage being dispensed. Your beverage supplier will tell you which to use for a particular product:

- 30 / 70 – containing 30 % CO_2 and 70 % N_2.

- 50 / 50 – containing 50 % CO_2 and 50 % N_2.

- 60 / 40 – containing 60 % CO_2 and 40 % N_2.

4. KEY PROPERTIES OF GASES USED FOR BEVERAGE DISPENSE

The air that we breathe is primarily composed of two gases, N_2 at 78 % and oxygen (O_2) at 21 %. Changes to the air that we normally breathe can result in a potentially hazardous atmosphere. The human senses cannot always detect changes to the atmosphere and are not a valid indicator.

Changes to the composition of the air will occur from the release of gas(es) into the local environment. Examples include evaporation, leakage and process exhaust. The changes will be more pronounced in an enclosed space and where there is inadequate ventilation.

O_2 is the only gas that supports life. The release of any gas will displace the existing atmosphere in an enclosed workplace, which in turn will (other than for released air and O_2) reduce the volume of oxygen available to breathe. If the oxygen concentration in the atmosphere decreases there is an increased risk of asphyxiation. Refer to Table 1.

A space which may contain a reduced O_2 atmosphere meets the criteria of a confined space within the meaning of the *Confined Spaces Regulations* (4). These Regulations require that employers (Premises Operators) carry out a specific risk assessment and put in place appropriate control measures to protect those accessing or working in the area, or who might otherwise be affected. Most cellars meet the criteria for a confined space and so will require a specific confined space risk assessment. Refer to Section 14.2.

O_2 concentration Volume %	Effects and symptoms
20.9	Normal level of oxygen in the atmosphere
19.5	Minimum safe level of oxygen
< 18	Potentially dangerous.
< 10	Risk of unconsciousness followed by brain damage or death due to asphyxia is greatly increased.
< 6	Immediate loss of consciousness occurs.
0	Inhalation of only 2 breaths of a gas containing no oxygen causes immediate loss of consciousness and death within 2 minutes

Table 1: The typical effects of inhaling reduced concentrations of O_2

Whilst a reduction in O_2 is the principle risk within a typical beverage gas cellar, the other properties of the gas(es) also have to be taken into consideration.

When a change to the atmosphere occurs, incidents can happen unexpectedly, and may be serious, and sometimes fatal. All personnel accessing such an workplace should be aware of the hazard(s) associated with a change in the atmosphere and be given the necessary information, instruction and training. Refer to Section 12.

Further information may be obtained from BCGA GN 11 (38), *The management of risk when using gases in enclosed workplaces.*

4.1 Carbon dioxide

CO_2 is classified as a non-toxic and non-flammable gas, it is colourless and odourless with a characteristic taste and pungency at higher concentrations.

The normal concentration of carbon dioxide in the air that we breathe is approximately 400 ppm (0.04 % by volume). If the concentration of the carbon dioxide in the ambient air is increased, the pulmonary gas exchange in the lungs is compromised. In simple terms, as its concentration in the ambient air increases, lower quantities of carbon dioxide leave the blood stream and/or alveoli and therefore there is less room for oxygen. Without sufficient oxygen one cannot live. This effect is called intoxication.

Carbon dioxide intoxication is independent of the effects of oxygen deficiency (i.e. asphyxiation) therefore the oxygen content in the air is not an effective indication of the danger of intoxication. For example, a potentially fatal CO_2 concentration of 14 % can theoretically exist with a normal O_2 content. For this reason O_2 depletion monitors alone **do not** provide protection for monitoring atmospheres where CO_2 may be present.

Separate gas detectors for CO_2 enrichment and O_2 depletion are required, refer to Section 14.1.

The effects of inhaling varying concentrations of carbon dioxide are given in Table 2, but it should be appreciated that the reactions of some individuals can be very different from those shown.

CO_2 concentration Volume %	**Typical effects and symptoms**
0.04	Normal level of carbon dioxide in the atmosphere
0.5	Minimum safe level of carbon dioxide. Maximum allowed exposure over an 8 hour period *
1 – 1.5	Slight and unnoticeable increase in breathing rate. 1.5 = maximum allowed exposure in a 15 minute period *
3	Breathing becomes laboured, rate increases. Hearing ability reduced, headache experienced with increase in blood pressure and pulse rate.
4 - 5	Breathing laboured at a greater rate. Symptoms as above, with signs of intoxication becoming more evident with longer exposure and a slight choking feeling.
5 - 10	Characteristic pungent odour noticeable. Breathing very laboured, leading to physical exhaustion. Headache, visual disturbance, ringing in the ears, confusion probably leading to loss of consciousness within minutes.
10 - 100	In concentrations above 10 %, unconsciousness will occur in under one minute and unless prompt action is taken, further exposure to these high levels will eventually result in death.

Table 2: The typical effects of inhaling carbon dioxide

NOTE*: Refer to the Health and Safety Executive (HSE) EH 40 (15), *Workplace Exposure Limits*.

Further information on the physiological effects of CO_2 is provided in the European Industrial Gases Association (EIGA) Safety Information Sheet 24 (29), *Carbon Dioxide Physiological Hazards "not just an asphyxiant"*.

The BFBi publish a poster highlighting the hazards of a gas leak and the risk of an asphyxiating atmosphere, which is available via the BFBi website.

4.2 Nitrogen

N_2 is classified as a non-toxic, non-flammable gas which is chemically un-reactive. It is odourless and does not support life. It is usually slightly lighter than atmospheric air, depending upon its temperature.

Liquefied N_2 may have other effects, due to its extremely low temperature (nominally -196 °C), i.e. it is a cryogenic substance. Pipework and components require appropriate insulation, otherwise they may suffer from extensive condensation and the formation of ice. Liquefaction of air, creating Liquid O_2 run-off, can also occur; this is due to the differential in boiling points between N_2 and O_2 (O_2 boils at the slightly higher temperature of approximately -183 °C). Oxygen enrichment of the atmosphere, even by a few percent, considerably increases the risk of fire and also increases the rate of propagation of a fire. Streams of liquid oxygen are a significant safety hazard and, where they may foreseeably occur, shall be managed appropriately.

The extreme cold creates a hazard from direct contact; cold burns to human tissue, and embrittlement of equipment. It also has a high liquid to gas ratio, and any release of the liquid will result in vapour clouds forming which will lay close to the ground.

Enrichment of an atmosphere with N_2 results in an O_2 deficiency, which will cause asphyxia if breathed. The typical effects of inhaling reduced concentrations of O_2 are described in Table 1.

N_2 enrichment is detected through the provision of O_2 depletion monitors. Refer to Section 14.1.

4.3 Air

Air is classified as a non-toxic, non-flammable gas, however it will support combustion. Air's ability to support combustion may be increased at higher pressures. Air is odourless and colourless. The oxygen component of air is necessary to support life.

Where air blowers or compressors are used, the precise quality of and constituents of the air delivered may be dependent upon the source of the air and its cleanliness, on the mechanical details of the blower or compressor, and on any lubricants used.

4.4 Mixed gases

These gases shall be treated as if they exhibit the properties of all the component gases within the mixture, unless their hazard classification demonstrates otherwise.

5. EQUIPMENT USED FOR DRINKS DISPENSE

A cellar (and sometimes nearby areas) will often incorporate a range of gas equipment for dispense and storage of beverages. Some premises may have separate gas stores.

The significant components associated with gas systems may include:

- Gas cylinders. There may be a variety of cylinders supplying food grade N_2, CO_2, and mixed gas. Air may also be supplied as an industrial gas to power cellar equipment. Gas cylinders require care when handling, refer to Section 11, and when not being moved shall be secured to prevent toppling. They contain gas under pressure, and each gas will have its own hazardous properties, refer to Section 4. Gas cylinders should be fitted with valves and appropriate accessories compatible with the system to which they are to connect, refer to Section 13. In most cases valves will be protected by a valve guard. Section 7 provides information on the identification of gas cylinders.

Specific guidance on selecting beverage dispense gas cylinders can be found in BCGA Leaflet 10 (45).

- Bulk liquid storage vessels. These are becoming more common, particularly for CO_2. They should be sited in an external (outdoor) location and filled either directly from a tanker or via a fill-line. Suitable access for tanker deliveries is required. BCGA CP 26 (31), *Bulk liquid carbon dioxide storage at users' premises*, and BCGA CP 36 (33), *Cryogenic liquid storage at users' premises*, provides further information, including in cases where indoor vessel installations are being considered. Liquid supplies introduce an additional hazard in respect of extremely low (cryogenic) temperatures, down to -196 °C. Appropriate engineering and operational provisions are required to safeguard against cold-burns to persons, and other low temperature hazards.

- On-site nitrogen gas generation. On-site N_2 generators are used to extract N_2 from atmospheric air. N_2 can be separated from air by means of either a membrane or through the pressure swing adsorption process. Once separated from air, the N_2 is stored in one or more low- or medium-pressure N_2 storage vessels on site. Refer to Section 5.2. N_2 can be supplied at a variety of pressures into the beverage gas system. N_2 generators can also offer a N_2 supply for use with gas pumps and / or a blanket pressure for cask ales. Due to the higher pressure requirement of the CO_2 supply to the gas blender, many N_2 generators also contain connection points for medium pressure CO_2 for soft drink systems and / or for low pressure CO_2 for products that use 100% CO_2. Gas generators in operation may produce a local oxygen enrichment effect, which may be significant in confined spaces.

- Air compressors. Compressed air is often used to operate gas pumps (refer below) in preference to other compressed gases or N_2 supplied from cylinders or a generator. Air compressors are often selected because the use of compressed air for gas pumps is usually a safer option in terms of asphyxiation risk as the air discharged from the gas pump does not reduce O_2 levels in the cellar or pump room. Alternatively, where N_2 or CO_2 is used to operate gas pumps, this could result in depletion of the cellar or pump room (or nearby area) O_2 level unless appropriate controls are in place (i.e. discharge to a safe, external, well-ventilated location).

- Gas pumps. Pumps may be required where there is a long pipe run from the cellar to the faucet (tap) at the bar. Pumps can be powered by pressurised CO_2, air, N_2 or mixed gas. With the exception of compressed air, the exhaust from gas pumps shall be vented to a safe, external, well-ventilated location. All exhaust gases and potential for leakage should be taken into consideration within the risk assessment, refer to Section 14.2.

Where an 'emergency' gas supply is added to a system (for example, for a back-up supply in case of a compressor failure) then the gas exhausts shall be vented to a safe, external, well-ventilated location. Regardless of any 'emergency', the requirements of this document still apply.

A variety of generic keg and gas dispense system arrangements are shown in Appendix 1.

5.1 Dispense systems

Gas systems, including those used in the beverage sector, are classified as pressure systems. They will require routine inspection, maintenance and examination (refer to Section 6) and are only to be operated by personnel who have been given the appropriate information, instruction and training (refer to Section 12).

All electrical installations shall, as a minimum, conform to BS 7671 (24), *Requirements for electrical installations. IET wiring regulations*.

Historically gas supplies have been from a single gas cylinder, but multiple cylinder systems now predominate, with bulk liquid storage vessels, gas generators and liquid cylinders becoming more common. Connected to each cylinder or vessel (the source of pressure) will be either an individual main pressure regulator, or a suitably rated hose leading to a manifold main pressure regulator. The main pressure regulator may be incorporated into a gas-mixing panel, or for liquid supplies may be a stand-alone device.

NOTE: In beverage gas systems the main pressure regulator is sometimes referred to as the high pressure regulator, the primary supply regulator, the primary valve, the primary regulator valve or the primary reducing valve.

Gas pressure. The main pressure regulator reduces the pressure of the gas from cylinder or vessel / vaporiser pressure to a constant (regulated) lower pressure required for the safe operation of the downstream gas and beverage systems. A typical CO_2 system will operate at a maximum pressure of 2.4 bar (35 psi) and those for mixed gas will operate at a maximum pressure of 3.1 bar (45 psi). Soft drink dispense systems can operate at pressures up to 6.9 bar (100 psi). Non-beverage systems may operate at higher pressures.

The pressure system shall include an adequate number, size and type of pressure relief valve(s) to vent excess pressure, including in the event of regulator failure. Liquefied gas systems will require liquid-lock relief valves. Relief valve selection and sizing is a specialist engineering activity and shall only be undertaken by suitably qualified and competent specialists.

Premises Operators shall check the safe working pressure of their kegs, and shall ensure their gas dispense system is suitable and compatible with the keg(s). The safe working pressure rating of kegs is usually 4.14 bar (60 psi), but some designs may only be rated for lower pressures, for example, 3.1 bar (45 psi).

Premises Owners shall not add to or modify a system (for example, additional gas pumps) without the consent of the pressure system owner, without reviewing the risk assessments and without reviewing the inspection, maintenance and examination requirements, refer to Section 6.

In the event a premises is sold and ownership changes, and if the dispense system is sold on as a working system, then the new Premises Operator is to is to ensure that the dispense system is operating safely and correctly. The Premises Operator will:

- review all existing risk assessments;
- ensure an inspection, maintenance and examination programme is in place;
- check that it is delivering dispense gas at the right quality; and
- ensure that the Premises Operator and his staff have received the necessary instruction, information and training to manage and operate the system.

5.2 Nitrogen receivers

N_2 receivers are often included as a component part of a N_2 gas generation system. Whilst these receivers may be confused with cylinders (and indeed, may be visually very similar), most will be managed as static pressure vessels rather than as transportable pressure containers (cylinders), refer to Section 6.

The following is recommended in managing these receivers:

- All receivers should have the appropriate product label attached.
- The minimum N_2 reservoir capacity only should be installed – unnecessary volume shall be avoided.
- When conducting a confined space risk assessment, the total combined volume of all installed receivers shall be calculated, taking account of the pressure (the gas supplier can assist with this), refer to Section 14.2.

6. INSPECTION, MAINTENANCE AND EXAMINATION REQUIREMENTS

6.1 Gas cylinders

The vast majority of beverage gas cylinders in circulation in the UK are the property of the gas suppliers. They are supplied to gas users under a rental agreement. On delivery the Premises Operator should carry out a receipt check, and then routine checks on their condition whilst on the premises, refer to Section 14.6.

If the Premises Operator identifies a problem with a cylinder it should not be used, it should be quarantined and reported to the gas supplier. The gas supplier can either provide appropriate advice to deal with the problem, or will arrange to remove the cylinder from the premises, refer to Section 15.

6.2 Vessels and beverage gas dispense pressure systems

The *Health and Safety at Work etc. Act* (1), places duties on organisations and employers to protect the health and safety of employees and / or members of the public. The duties include the provision and maintenance of plant and systems of work that are, so far as is reasonably practicable, safe and without risks to health. This includes the use of pressure equipment.

On installation the pressure equipment shall comply with the requirements of the *Pressure Equipment Regulations* (6). Some of the equipment used for an installation may be CE marked.

All equipment, including gas pressure equipment, is subject to the *Provision and Use of Work Equipment Regulations (PUWER)* (5) which requires that work equipment should not result in health and safety risks, regardless of its age, condition or origin. The PUWER (5) requires that the employer (Premises Operator) selects suitable equipment and carries out appropriate maintenance, inspection, identifies any specific risks and provides suitable information, instructions and training. The HSE provide further guidance within HSE L22 (16), *Safe use of work equipment. Provision and Use of Work Equipment Regulations 1998. Approved Code of Practice and guidance*.

Gas pressure equipment operating above 0.5 bar is regulated by the Pressure Systems Safety Regulations (PSSR) (7). The PSSR (7) requires such equipment to be examined and maintained. It should be noted that the overall intention of the PSSR (7) is to prevent serious injury from the hazard of stored energy, as a result of the failure of a pressure system or one of its component parts. The HSE provide guidance on the PSSR (7) in document HSE L122 (19), *Safety of pressure systems. Pressure Systems Safety Regulations 2000. Approved Code of Practice and guidance*.

The PSSR (7) do not consider the hazardous properties of the contents released following system failure, although these hazards will be subject to other regulatory requirements.

PSSR (7) requires the system User (Premises Operator) to have a Written Scheme of Examination in place for each pressure system used on their premises. The Written Scheme of Examination shall be drawn up by a competent person, and the examination(s) conducted in accordance with the Written Scheme of Examination shall be conducted by a competent person. All inspection dates for pressure systems shall be clearly identified.

It is a legal requirement that the pressure system is operated within its specified limits and that all duty holders are competent to perform their duties in respect of the regulations. Refer to Section 12.

For leased equipment, PSSR (7) allows some of the specified duties to be transferred to the pressure system Owner under a written agreement (a Schedule 2, paragraph 1A agreement, made in accordance with PSSR (7), Regulation 3(5)).

For information on the application of the PSSR (7) to dispense gas systems refer to BBPA guidance providing *Instructions for the safe operation of gas pressure systems used in the dispensing of beers and lagers* (46).

BCGA provide further general information in BCGA CP 39 (34), *In-service requirements of pressure equipment (gas storage and gas distribution systems*).

The *Dangerous Substances and Explosive Atmosphere Regulations (DSEAR)* (10), identifies that gases that are under pressure (for example, gas in a cylinder) may present a risk of explosion if not correctly handled in the workplace and includes a requirement to assess the risks from compressed gases and to put in place suitable control and mitigation measures.

To comply with all these Regulations the Premises Operator shall ensure there is an appropriate on-going examination, maintenance and inspection regime in place to keep the beverage gas dispense pressure equipment in a safe operating condition throughout its in-service life. This to include regular checks as part of the routine management of the cellar and / or gas store to ensure the pressure system remains in good repair, is operating safely and is appropriately maintained, for example, by checking relief valve date tags, refer to Section 14.6.

The British Soft Drinks Association (BSDA) provide a guide to the legal responsibilities of companies for the safe design, installation and maintenance of dispense systems in their document, *Code of Practice for the Dispense of Soft Drinks by Pressure Systems* (51).

The BFBi provide advice and guidance on pressure systems and the actions required if changing suppliers in their document *BFBi Gas suppliers equipment code of practice* (49).

7. GAS CYLINDER SAFETY AND PRODUCT IDENTIFICATION

All gas cylinders will be marked and labelled with the product they contain and with appropriate food safety information, refer to Section 7.1. To assist in cylinder identification a system of colour coding is applied to each cylinder, refer to Section 7.2. The gas supplier will provide a Safety Data Sheet for each product and can provide additional advice, refer to Section 7.3.

To ensure gas cylinders remain safe they are required to undergo periodic inspection and test, refer to Section 7.4.

BCGA Technical Information Sheet (TIS) 6 (41), *Cylinder identification. Colour coding and labelling requirements*, provides comprehensive information on UK practice for cylinder colour coding and labelling.

7.1 Cylinder labels

A cylinder label shall be used as the primary means of identifying the contents of gas cylinders.

Provision of the correct product label is a legal requirement. The label shall be attached by the filler of the gas cylinder and should be positioned on the shoulder area of the cylinder. The label information shall include:

- Product identity.
- Suppliers telephone number.
- Supplier’s name and address.

- Hazard and precautionary statements (also refer to Section 7.3)

- Signal words.

- Hazard warning diamond(s).

All gases provided for food purposes (including for drinks dispense) shall have a product traceability label attached to the cylinder, valve or valve guard. Usually this is a small label with a series of numbers and letters, and / or a barcode. This allows the supplier to trace the cylinder contents, in the event of any quality concerns. New traceability labels are attached every time a cylinder is filled, to reflect the actual gas production batch used.

NOTE: Take care not to confuse the traceability label with other labels, used, for example, for cylinder tracking purposes, which may take a similar form (i.e. barcode).

Cylinders without a product or a traceability label shall not be used for drinks dispense.

BCGA GN 14 (39) provides guidance on the regulations applicable to food gases.

7.2 Colour coding of cylinders

Colour coding is a secondary method used to identify the properties of a gas inside a cylinder. Colour coding is applied to the shoulder, or curved part, at the top of the cylinder. Colour coding is not mandatory and there may be a variety of colours in use. Refer to BCGA TIS 6 (41).

NOTE: Labels, in accordance with Section 7.1, are the primary and legally-controlled way to identify the contents of a gas cylinder.

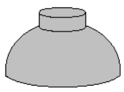
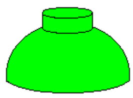
Gas	**Cylinder**	**Colour**	
Carbon dioxide	Body		Not specified
	Shoulder		Dusty Grey - RAL 7037
Nitrogen	Body		Not specified
	Shoulder		Jet Black - RAL 9005
Carbon dioxide & Nitrogen	Body		Not specified
	Shoulder		Yellow Green - RAL 6018

Table 3: Gas cylinders. Recommended colour codes.

7.3 Safety Data Sheets

It is a legal requirement that the gas supplier provides a Safety Data Sheet to the customer whenever a product is supplied to that customer for the first time. Safety Data Sheets provide information on the product and give information on handling, storage and emergency measures in case of accident. They should be referred to when carrying out the risk assessment, refer to Section 14.2.

Premises Operators have responsibility to ensure that all relevant persons (for example, those handling or who may come into contact with the product) have the relevant current Safety Data Sheet(s) available to them. In addition, it is good practice to ensure that the Safety Data Sheets are provided to employees during their induction and competence development programmes (refer to Section 12).

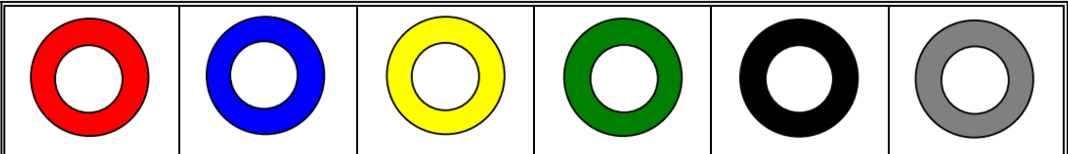
NOTE: Safety Data Sheets are provided in compliance with the European Regulations on *the Classification, Labelling and Packaging of substances and mixtures* (CLP) (14) and REACH, *Registration, Evaluation, Authorisation and restriction of Chemicals* (13).

7.4 Cylinder inspection and test

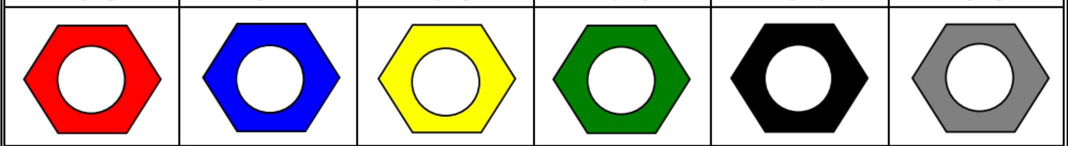
The *Carriage of Dangerous Goods and Use of Transportable Pressure Equipment Regulations* (12) requires that transportable gas cylinders are periodically inspected and tested to ensure they continue to be safe. These inspections and tests shall be carried out by a government appointed inspection body. The date(s) of successful inspections and tests shall be stamp-marked on the cylinder together with the stamp of the tester.

To provide a ready indication of its next periodic inspection and test date, a cylinder test ring(s) is usually fitted to the gas cylinder as part of each periodic test. The test rings, consist of one or more plastic tabs, located between the cylinder and the valve. Rings are colour coded and shaped to specifically indicate the year when the next periodic inspection and test is due. The ring(s) may also give an indication of the month of the next due test. Only cylinder rings that are unbroken and intact are valid.

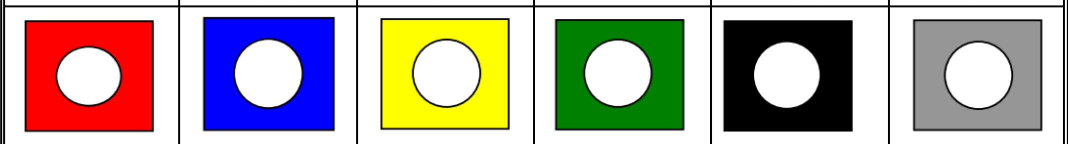
NOTE: Standards such as BS EN 1968 (22), *Transportable gas cylinders. Periodic inspection and testing of seamless steel gas cylinders*, permit other methods of identification, for example, labels.



2013	**2014**	**2015**	**2016**	**2017**	**2018**



2019	**2020**	**2021**	**2022**	**2023**	**2024**



2025	**2026**	**2027**	**2028**	**2029**	**2030**

Table 4: Cylinder test rings

NOTE: Some companies may use the test ring philosophy for other time-sensitive inspections of pressure equipment, such as relief valves.

The sequence of colour and shape of the cylinder test rings is repeated on an 18-year cycle, hence 2031 is a repeat of 2013. Table 4 provides a guide to the colour and shape of cylinder test rings in the UK.

Cylinders can be used but not refilled if the test date has passed. For information on filling a cylinder refer to Section 9.

8. IDENTIFICATION AND DIFFERENTIATION OF BEER GAS SYSTEMS

Individual beer gas systems (piping and tubing, downstream of the main pressure regulator) are identified by a colour identification code. Different arrangements apply to soft drinks systems. These colours will also be displayed on the gas cylinder close to the valve outlet, for example, on the valve outlet cap, valve hand-wheel, collar or by using a special label. Connecting pipework should also be colour coded. Colour coding of beverage gas systems is used as an aid to identification but should be accompanied by labelling and operating documentation and should be overviewed by competent operators.

The common gases and mixtures colour codes in the UK beer market as shown in Table 5.

NOTE: Only applicable to beers, not other beverages, for example, soft drinks.

Gas	**Colour**
Air (for equipment use)	Blue
CO_2 100 %	Grey
N_2 100 %	Black
30 % CO_2 / 70 % N_2	Green
50 % CO_2 / 50 % N_2	Purple
60 % CO_2 / 40 % N_2	White
Exhaust from gas pumps	Natural

Table 5: Beer gas system identification colours in the UK.

There are mutually different cylinder valve connections for CO_2 and for mixed gases. However the connections for the mixed gases are all the same, regardless of the different mix ratios, and care shall be taken by the Premises Operator to ensure the correct mixture is connected.

The colours described in Table 5 are in addition to and separate from the colour coding of cylinders (refer to Section 7.2), or valve guard colours indicating cylinder ownership.

The requirement for, location of and extent of colour-coding should be agreed between the supplier / installer and customer.

9. THE SAFE FILLING OF GAS CYLINDERS

Gas cylinders shall only be filled and refilled at suitably accredited installations. This helps ensure that filling and refilling is conducted only by suitable, reputable and accredited filling organisations, with competent staff using appropriate procedures.

The filler of the gas cylinder is not allowed to re-fill a cylinder unless it is within the date of its inspection and test on the day of filling. For information on inspection and testing refer to Section 7.4.

For detailed information on filling beverage gas cylinders refer to BCGA CP 32 (32), *The safe filling of beverage gas cylinders*.

10. PRODUCT QUALITY

The Food Safety Act (2) and its subsidiary regulations apply to everyone involved in supplying and using gases for beverage dispense. BCGA GN 14 (39) provides guidance on the supply of gases for use in food.

All beverage gases shall conform to an appropriate specification for use in foods. This is commonly referred to as 'food grade gas.' Reputable gas suppliers will have quality systems in place to manage compliance of the supplied gas products to the required specification.

Carbon dioxide. EIGA Document 70 (26), *Carbon dioxide source qualification quality standards and verification*, provides recommendations on good practice and guidance on the key characteristics of the quality and purity of CO_2 for use in foods and beverages.

Nitrogen. The International Society of Beverage Technologists (ISBT) document on *Beverage Grade Nitrogen (Cryogenic Source) Quality Guidelines and Analytical Methods Reference* (50) defines the purity grades of nitrogen appropriate for use in applicable beverages.

11. THE SAFE HANDLING OF GAS CYLINDERS

11.1 Personal protective equipment

Personal Protective Equipment (PPE) may only be considered as a health and safety control to achieve an acceptable level of residual risk management after all other levels of control higher on the controls hierarchy have been exhausted. A risk assessment shall determine the requirement for the use of hazard controls, including PPE.

Where PPE is required, a PPE Assessment shall be carried out by the Premises Operator, and shall be periodically reviewed. The requirements of the *Control of Substances*

Hazardous to Health (COSHH) Regulations (9), any relevant equipment publications, manufacturers information and the gas product Safety Data Sheet, shall be taken into account when conducting (or reviewing) this assessment. The PPE shall be selected for a particular task and location and shall be appropriate and chosen to effectively reduce the overall risk for the person or persons concerned. PPE shall be provided by the Premises Operator, in accordance with the *Personal Protective Equipment Regulations* (8). Different PPE requirements may apply for differing products or equipment, to different tasks and possibly to different persons.

HSE L25 (17), *Personal Protective Equipment at Work*, provides guidance on the *Personal Protective Equipment Regulations* (8). EIGA Document 136 (28), *Selection of personal protective equipment*, provides guidance for selecting and using PPE at work.

Subject to risk assessment, it is common practice that appropriate eye protection, for example, safety glasses, should be used when a pressure release hazard exists (for example, when connecting, de-pressurising or disconnecting gas cylinders or hoses, when inspecting or checking for leaks, etc.).

For cylinder handling and for low temperature (cryogenic) conditions, the use of suitable protective gloves or gauntlets may be required. Safety shoes or boots with specific metatarsal protection, are likely to be the most suitable, based on gas industry experience for personnel who handle and manoeuvre cylinders. Low temperature (cryogenic) conditions may also require specific eye or face protection and suitable long sleeved/legged protective clothing.

In certain locations, or site conditions, other additional PPE may be required, in accordance with the Premises Operator's or other's PPE risk assessment, for example, hard hats, hearing protection, eye or face protection, etc.

11.2 Cylinder handling

Gas cylinders can be awkward objects to handle safely. The *Manual Handling Operations Regulations* (3) require that an assessment of manual handling operations is conducted. This will generally be the responsibility of the Premises Operator. Following the assessment(s), competence development (for example, training, informing and instructing) of personnel should take place, refer to Section 12. Where the assessment indicates that the work exceeds manual handling guideline limits, the operation should be revised, mechanised or handling aids shall be provided. BCGA GN 3 (36), *Safe cylinder handling and the application of the manual handling operations regulations to gas cylinders*, defines the principles of safe practice for handling and moving gas cylinders and provides a basic understanding of the *Manual Handling Operations Regulations* (3) as it relates to gas cylinders. BCGA TIS 17 (43), *Model risk assessment for manual handling activities in the industrial gas industry*, can be used to assist in developing a site risk assessment.

The following points shall be noted in relation to manual handling of cylinders:

(i) A cylinder shall not be moved with the valve open, or with gas-use equipment attached (hoses, regulators, etc.).

(ii) When carrying out manual handling operations, appropriate PPE, for example, gloves and foot protection, is very likely to be required. Refer to Section 11.1.

(iii) Suitable (for example, purpose-designed trolleys or other low-effort mechanical aids) should be considered for moving cylinders, wherever practicable.

(iv) For moving over even, well-made hard floors, over short distances, the ‘churning’ method may be considered, where competent personnel are available.

(v) When lifting cylinders, suitably rated cradles, platforms or pallets / Manifolded Cylinder Pallets (MCP) frames may be used. Refer to BS 7121-1 (23), *Code of Practice for the Safe Use of Cranes. General*, and EIGA SI 25 (30), *Crane transport of cylinder packages*.

(vi) Valve protection devices (for example, valve guards) are not usually suitable for lifting or for attaching lifting attachments. Unless these devices are specifically marked as suitable, <u>they shall not be used for lifting</u>.

(vii) Cylinders shall not be rolled horizontally along the ground. This may damage or even open the valve, it could damage the paintwork or cylinder surface and may also damage identifying marks, labels and symbols.

(viii) Cylinders shall not be dropped into cellars, or bounced up or down stairs. Impact loads on and to cylinders shall be avoided at all times.

(ix) Cylinders shall not be used for secondary non-gas-supply uses, such as work-supports, load-bearing blocks, props, wedges, weights, barriers, spacers or rollers.

(x) Cylinders should be restrained and secured in a safe place, refer to Sections 13 and 14, at all times when not being moved.

11.3. Vessel handling

Vessels and associated equipment (pipes, hoses, vaporisers, accessories, etc.) shall only be handled by trained, competent personnel, such as specialist gas company operatives or those employed by the system owner. Unauthorised handling, moving and lifting shall not be allowed.

12. COMPETENCE DEVELOPMENT INCLUDING TRAINING

All persons who are required to engage with the on-site gas systems shall be provided with a suitable competence development programme (an appropriate combination of information, instruction, training and on-going supervision) by the Premises Operator.

The competence development programme shall comprehensively address the hazards of the role(s). Whilst this document is directed at those hazards specifically associated with gases and their systems and containers (cylinders, vessels, etc.), the Premises Operator shall consider each role-holder’s duties holistically such that competence development is provided for the safe completion of the necessary range of tasks required of each of the Premises Operator's employees.

It is the duty of the employer (Premises Operator for the purposes of this document) to ensure that persons working on their behalf are suitably competent. It is recommended that the competence development programme is carried out under a formalised system where an acceptable level of competency for specific tasks shall be achieved before an individual is allowed to perform that task unsupervised.

Confined spaces and gas monitor use should be considered for specific training sessions.

Records shall be kept of the competence development activities provided, and of the competence level(s) achieved, and of any repeat or refresher sessions. The programme shall make provision for such repeat and refresher sessions, along with any necessary competence re-assessment.

When a Premises Operator or a new premises owner takes over a beverage dispense installation, a check should be made (by the Premises Operator or premises owner) of the competence and training status of personnel. Refresher or supplementary training shall be provided as required to fill any competence gaps. The Premises Operator or Owner should, if required, seek re-training support from the gas supplier, where this would be useful.

Recommendations for the training of personnel are described in EIGA Document 23 (25), *Safety training of employees*. BCGA GN 23 (40), *Identifying gas safety training requirements in the workplace*, provides information on the topics which should be covered when considering gases safety training and competence development.

The overall competence development programme should include the addressing of the following topics, where the item is relevant to each person, or class of person and to the task(s) they are required to perform:

(i) Familiarity with the range of containers likely to be encountered by the role-holder.

(ii) The relevant aspects of the pressure system(s).

(iii) Manual handling of gas cylinders and other relevant items. Refer to Section 11.

(iv) Understanding of the hazards and properties of in-scope gases. Refer to Section 4.

(v) Where relevant, access to, and work in, confined spaces. Refer to Section 14.

(vi) Safe storage of gases. Refer to Section 14.

(vii) Cylinder / liquid cylinder/ vessel changeover procedures, including leak testing requirements. Refer to Section 13.

(viii) The critical importance of ventilation and atmosphere monitoring systems, including gas detectors. To include the actions to take to ensure safe entry to confined spaces, maintenance / checking of systems, verifying status, how to respond to alarms, etc. Specifically signs of O_2 depletion / CO_2 enrichment. Refer to Section 14.

(ix) Instruction on the actions to take in the event of an emergency. Refer to Section 16.

(x) Clear instruction on the actions (and precautions) required if contemplating the rescue of persons from confined spaces or where high concentrations of an asphyxiant gas may be present.

NOTE: There have been many fatalities to those who attempted to rescue persons in such spaces. Any rescue attempt should only be considered where there is an emergency plan and by following the appropriate procedures and controls that are in place. Refer to Section 16.

13. THE SAFE USE OF GAS CONTAINERS

The Premises Operator shall ensure that a check takes place prior to connecting a pressure container (for example, a gas cylinder) to a system. This shall include a check of:

- the contents label, to ensure the product is clearly identified and that it is the correct product;

- the colour coding system;

- the cylinder, that it is physically the correct size for the coupler, connections and / or manifold, and is of similar dimensions and appearance to the removed cylinder(s);

- the cylinder, to ensure it appears in a serviceable condition, i.e. no excessive rust, dents, gouges, bulges, or defacing of any kind;

- the traceability label(s), that it is present, legible, clearly visible and acceptable;

- the cylinder valve; on delivery the valve should have a seal fitted;

- the cylinder valve, that it is in a serviceable condition with no evidence of tampering with the residual pressure device;

- the cylinder or vessel and its contents, to ensure they are 'in date' at point of delivery. On cylinders, check there a current cylinder test ring fitted between the valve and the cylinder;

- the connectors, unions, nuts and any hoses, that have no obvious defects;

- the pressure in the container, to ensure it is suitable for the downstream pressure system.

Before connecting a pressure container, a visual check for any obvious problems shall be made. The container (for example, cylinder) shall always be connected to the downstream system via a suitable main pressure regulator. On some systems this may be via a suitably rated high pressure hose.

WARNING: Never connect a gas cylinder or vessel directly to a keg, or to any other beverage container.

Exercise extreme care if connecting liquid supplies to drinks dispense systems and equipment, especially for the first time. Liquid withdrawal cylinders, liquid cylinders and bulk cryogenic vessels supply very low temperature (cryogenic) product which might damage or destroy dispense equipment and will be a very high safety risk for users, unless the equipment is suitably designed and rated.

NOTE:

CO_2 cylinders that are fitted with dip tubes, and that are designed to allow liquid off-take, may be identified by a white line (longitudinal stripe) on the side of the cylinder, and / or an 'indicator' ring under the valve, for example with "DP" or "Dip Tube" embossed into it.

Figure 1

Only one cylinder or one side of a multiple manifold at a time shall be in use on a beverage gas dispense system. Multiple cylinders shall only be connected simultaneously to a pressure system where the pressure system is specifically designed for the flows involved. Such pressure systems should incorporate a changeover valve that allows only a single cylinder or one side of a multiple manifold to be selected for use at any one time.

Where a vessel or gas cylinder valve assembly (or adjacent coupler, manifold or hose) has a residual pressure device and/or a non-return valve fitted, no person other than the equipment owner, with formal Engineering Management of Change approval, shall modify, interfere with or remove these devices. A residual pressure device retains a positive gas pressure inside the cylinder. This retained pressure resists the possible ingress of air or other fluid into the cylinder should the valve be left open. The non-return feature helps prevent back flow from the customer's process (or from neighboring equipment) whenever the cylinder or vessel is at a lower pressure than the application to which it is connected. The use of residual pressure device will have been assessed by the cylinder owner (usually the gas supplier) and will form part of the engineering specification for the system. Under no circumstances shall the components be dismantled or modified by the user or Premises Operator.

In the UK, beverage gases utilise valve outlets in accordance with BS 341 (21), *Transportable gas container valves. Valve outlet connections*. The valve outlet used for CO_2 cylinders is BS 341 (21) No. 8. The valve outlet for mixed gas cylinders is BS 341 (21) No. 3. Adaptors shall never be used to convert from one outlet thread to another.

When a vessel or gas cylinder is connected into a pressure system for use it shall be:

(i) Placed in the correct orientation (usually upright / vertical except in the case of some horizontal-axis bulk liquid tanks) and secured.

(ii) Connected to the downstream system via a main pressure regulator with suitable pressure protection (except where the regulator itself is designated as a Primary Protective Device under PSSR (7), when no additional pressure-protection is provided and instead the regulator is exchanged for new at each Written Scheme of Examination). On some systems the main pressure regulator may be connected via a high pressure hose, compatible with the maximum pressure of the vessel or gas cylinder and other system components.

(iii) Kept away from sources of heat. Refer to Section 14.

For additional advice on the safe use of gas cylinders refer to BBPA guidance providing *Instructions for the safe operation of gas pressure systems used in the dispensing of beers and lagers* (46).

For generic procedures for the change-over of gas cylinders refer to Sections 13.1 and 13.2.

13.1 Changing a CO_2 gas cylinder

(i) Close the valve on top of the empty dispense gas cylinder.

(ii) Taking account of any asphyxiation / confined space considerations, if safe, release the gas pressure that may be trapped in this part of the system (between the cylinder and main pressure regulator). This may be, for example, by the use of a bleed valve or a ring-pull type of relief valve fitted to the main pressure regulator.

(iii) Disconnect the gas cylinder from the main pressure regulator or high pressure hose, by unfastening the nut on the gas cylinder outlet. Use a correctly sized spanner.

NOTE: If the main pressure regulator was coupled directly to the cylinder, it should be placed in a safe place. It shall not to be dropped or left hanging, unsupported, on the gas hose.

(iv) Release the gas cylinder securing device and remove the empty cylinder to the storage area. Store the empty cylinder securely. Refer to Section 14.

(v) Collect the replacement cylinder. Conduct the pre-connection checks detailed at the start of Section 13.

(v) Place the cylinder in an upright position into its location and make it secure.

(vi) Remove the gas supplier’s protective seal from the cylinder outlet.

(vii) Carry out a visual inspection of the gas outlet. Ensure it is clear of any contaminants. Any visible material or moisture should be removed by cleaning with a clean, dry, lint-free cotton cloth. Do not apply any oils, abrasives or greases.

NOTE: When cylinders are received from reputable suppliers and are subsequently stored and handled in line with the supplier's advice with valve outlet protection fitted, there should be no need for any valve clearing to be carried out.

(viii) Refit the main pressure regulator or high pressure hose, making sure the sealing washer is correctly fitted and any anti-whip-wire is in place. Tighten the nut initially using finger-torque only, then firmly using the correctly sized spanner.

(ix) Carefully turn on the valve, open the valve slowly and gradually and remain alert for indications of leaks, relief valves operating, system malfunctions, gas monitoring alarms, etc.

(x) If a leak is suspected and if it may be done safely, turn the valve 'off'. Follow your local procedures for notifying leaks and (where applicable) evacuation. Local procedures may require that a competent person carries out a leak inspection and / or test of the system using appropriate techniques such as using an approved leak detection fluid. For information on leak detection fluids refer to EIGA Document 78 (27), *Leak detection fluids cylinder packages*.

NOTE: The cylinder valve should be turned off between periods of service.

13.2 Changing a mixed gas cylinder

(i) Close the valve on top of the empty dispense gas cylinder.

(ii) Close the isolating valve.

(iii) Taking account of any asphyxiation / confined space considerations, if safe, open the bleed valve to relieve this part of the system of any gas pressure.

NOTE: Not all pressure systems will have a bleed valve, other methods of de-pressurising may be considered.

(iv) Unfasten the nut on the gas cylinder outlet to disconnect the main pressure regulator or high pressure hose from the cylinder. Use a correctly sized spanner.

NOTE: If the main pressure regulator was coupled directly to the cylinder, it should be restrained, supported and placed in a safe place. It shall not be dropped or left hanging unsupported on the gas hose.

(v) Release the gas cylinder securing device and remove the empty cylinder to the storage area. Store the empty cylinder securely. Refer to Section 14.

(vi) Collect the replacement cylinder. Carry out the pre-connection checks detailed at the start of Section 13.

(vii) Place the cylinder in an upright position into its location and make it secure.

(viii) Remove the gas supplier's protective seal from the cylinder outlet.

(ix) Carry out a visual inspection of the gas outlet. Ensure it is clear of any contaminants. Any visible material or moisture should be removed by cleaning with a clean, dry, lint-free cotton cloth. Do not apply any oils, abrasives or greases.

NOTE: When cylinders are obtained from reputable gas suppliers and are subsequently stored and handled in line with the supplier's advice with valve outlet protection fitted, there should be no need for any valve clearing to be carried out.

(x) Refit the high pressure hose or primary reducing valve, making sure the 'O' ring seal is undamaged and is correctly fitted. Tighten the nut initially by hand only, noting that over-tightening can damage the 'O' ring seal and that cross-threading (for example, by the premature use of a spanner) can damage the screw threads. Final tightening should be with a correctly-sized spanner.

(xi) Close the bleed valve.

(xii) Carefully turn on the valve, open the valve slowly and gradually and remain alert for indications of leaks, relief valves operating, system malfunctions, gas monitoring alarms, etc.

(xiii) Open the isolating valve. Open the valve slowly and gradually and remain alert for indications of leaks, relief valves operating, system malfunctions, gas monitoring alarms, etc.

(xiv) If a leak is suspected, turn the valve(s) 'off'. Report the suspected leak. A competent person should carry out a leak test of the system using appropriate techniques such as using an approved leak detection fluid. For information on leak detection fluids refer to EIGA Document 78 (27).

13.3 Protecting gas cylinders during beverage system cleaning

Beverage pipelines require cleaning on a regular basis. A number of options are available that include pressurised and non-pressurised systems.

NOTE: Direct connection of a beverage system to a water main is not recommended, as there is the potential for water to be forced into the gas system under pressure. Gas pressure systems and their supports are not mechanically rated for water (hydraulic) weight loads.

Where ring main cleaning systems are provided these will typically incorporate a 'dummy' connector (cleaning socket). As pressurised systems can produce back flow from the cleaning process the gas pressure system shall be protected by a suitable non-return valve. This will help prevent contamination from water, cleaning fluids or residues of products.

NOTES:

1. This non return valve is in addition to any non-return feature included in individual cylinder valves and which are (it should be noted) designed to operate only on gas flows.

2. Non-return valves do not provide absolute protection against reverse flow, especially if not regularly maintained and integrity checked.

Systems where cryogenic products are used shall be specifically protected from water ingress – any moisture which finds its way into the system will freeze on contact with the cryogen, causing serious operational (and possibly safety) problems. Even small amounts of water vapour and moisture can create significant problems. Non return valves do not provide adequate protection from moisture ingress in these cases – instead Premises Operators shall use full physical disconnection or double-block-and-bleed type methods.

Breweries sometimes provide two-way valves on the cleaning main to allow manual selection of cleaning fluid or mains water. The water supply shall be restricted by the use of a pressure reducing valve set at a suitable maximum pressure. Where pressurised line cleaning bottles are still in use they shall be rated to a test pressure of 1.5 times the system design pressure. They shall have a suitably sized pressure relief device fitted.

14. STORAGE

Gas cylinders shall be stored in accordance with BCGA CP 44 (35), *The storage of gas cylinders*. Bulk storage tanks and vessels shall be located in accordance with the appropriate BCGA documents, for example:

- BCGA CP 26 (31), *Bulk liquid carbon dioxide storage at users' premises*.
- BCGA CP 36 (33), *Cryogenic liquid storage at users' premises.*

The following general principles shall be followed:

- Where practical, store gas containers in an external location;
- Store all gas containers in a secure location;
- Ensure the location has adequate ventilation;
- Store gases away from sources of ignition, heat and combustible material. Particular consideration should be given to cylinders and vessels fitted with bursting discs; heating could potentially lead to a rupture of the bursting disc. Avoid storing gases in any area with potential to be affected by heat from radiators, boilers chimneys stoves and flues, heat-emitting machinery, exhaust vents or un-shaded windows.

  NOTE: Gas cylinder temperatures should not exceed 65 °C, noting that this high temperature should not be encountered in normal storage. Cylinders are designed to be used and stored within the range of typical international ambient temperatures.

- Ensure each cylinder is appropriately restrained to prevent falling or toppling, for example by using cylinder chains or straps (for vertical cylinders) or chocks (for horizontal cylinders).

- Safety signs and warning notices shall be displayed in and around each gas storage area, in accordance with the risk assessment(s), relevant legislation and BCGA CP 44 (35). All signage shall be clearly visible, legible and maintained.

Rather than utilising an external location, it is common practice in the beverage industry to store some or all of the gas inventory indoors. However, indoor gas storage areas are likely to be classified as confined spaces due to their design, size, ventilation etc. Premises Operators shall identify if confined spaces exist within their premises, or might exist, within the meaning of the *Confined Spaces Regulations* (4). These regulations require that employers (Premises Operators) should carry out an adequate risk assessment and put in place appropriate control measures to protect those accessing or working in the area. Refer to Section 14.2.

Where the gas storage area is enclosed, for example a cellar, atmospheric monitoring with an alarm system shall be provided. The atmospheric monitoring shall detect the presence of compromised atmospheres in line with the confined space risk assessment, for example due to gas leakage. Refer to Section 14.1.

Premises Operators shall ensure that the cellar and gas storage area(s) are adequately ventilated. Forced (mechanical) ventilation is very likely to be required where gas storage is below ground level, or where above ground installations have limited natural ventilation.

Where forced (mechanical) ventilation systems are fitted they shall be designed and constructed with ducts of suitable cross-sectional area and be positioned to provide a suitable rate of ventilation in line with the confined spaces risk assessment. They shall be automatically linked into other control systems and features, for example, the gas detection system, to ensure the ventilation is triggered automatically by a gas detection alarm, refer to Section 14.1. Where forced ventilation systems are in use they shall be assessed for secondary health and safety effects such as noise - and mitigation measures shall be provided as appropriate.

Access to the gas storage area shall be controlled. Anyone who may be required to access the gas storage area shall be competent to undertake the range of tasks required, for example shall be informed of the hazards and risks and instructed as to how these shall be managed, refer to Section 12. Personnel shall not be allowed to access or work in the cellar unsupervised until and unless they are competent to do so.

The BSDA provide advice for managing cylinders and for CO_2 in the cellar in their leaflet *The safe use of dispense equipment in retail and other non-licensed premises* (52).

When cylinders contents are expired or no longer required, they shall be returned to the owner (usually the gas supplier). Refer to Section 15. Some Premises Operators may choose to store cylinders that are ready for collection in a convenient place for the delivery / collection vehicle, away from the cellar. Any such storage areas shall meet the requirements detailed in this document, noting that cylinders will still have at least minimum contents, and that the storage area may require a separate confined space risk assessment.

14.1 Gas detection – Atmospheric monitoring

The requirement for gas detection equipment shall be determined by the Premises Operator’s risk assessment.

NOTE: In addition to the beverage gases being stored and in-use, there may be a variety of other gases, fumes and vapours, and the potential to produce these, present. These will all need to be considered as part of the risk assessment, refer to Section 14.2.

Where required, appropriate gas detectors shall be fitted to detect any potentially hazardous and non-respirable atmospheres and to provide an alarm. The risk assessment should indicate the appropriate location(s) for the detector / monitor measurement head(s).

Separate gas sensors (and where necessary, systems) shall be provided for the different foreseeable gas detection duties. For example, separate sensors are necessary for CO_2 enrichment and for O_2 deficiency.

Fixed gas detection equipment is preferable to personal mobile equipment. Fixed equipment has an improved ability to detect hazards before a person is exposed, whereas personal equipment generally confirms that the person is about to be or may already be exposed to the hazard (which may be too late). Fixed equipment also covers an area, rather than the spot location where an individual happens to be.

Gas detection equipment shall be to a recognised national or international quality and performance standard.

Gas detectors shall be installed and maintained in line with the manufacturer's recommendations.

The gas detection system status shall be checked for serviceability before entry to the protected area and during occupancy. Alarm warnings, for example, flashing lights, audible alarms, etc, shall be clearly visible and shall be duplicated / repeated both outside (i.e. at all access points) and inside the cellar. Appropriate, clear and legible warning signs shall be provided (for example, '*Do not enter unless monitoring system shows no fault/safe to enter condition*', '*Evacuate the area in the event of gas alarm*', etc), located appropriately and, where of potential benefit, repeated in several locations.

Personnel competence development programmes shall include clear details of the gas monitoring system(s), and the actions to take to ensure safe entry to confined spaces, maintenance / checking of the system, verifying status, how to respond to alarms, etc. Refer to Section 12.

Where mechanical ventilation systems are used, they should interconnect with the gas detection system to allow automatic operation. What 'automatic operation' precisely means will depend upon the details of the overall control system(s). An integrated control system should be provided, in line with the Confined Space Risk Assessment. Whilst it is not possible to provide definitive advice that will apply to all installations and circumstances, Premises Owners should consider the following points in relation to system control integration:

- Will the ventilation automatically trigger in the event of a gas detection alarm?

- Is there value in installing multi-stage alarms (different percentage concentration detection) to trigger corresponding multi-speed ventilation fans?

- What fan overrun time should be applied, before an alarm resets?

- What self-diagnostics should the system(s) include?

- Is auto detection of ventilation failure (flow switches, differential pressure switches, etc) desirable for the system?

- Should the ventilation system operate even when personnel entry is not required, or for a specific period in advance of entry?

- Will the alarm activate in the event of gas detection or ventilation fault/failure?

- Can or should inter-locking of access doors be included in the system functionality, to prevent entry during an alarm?

- Can remote automatic shut-down of the dispense system be included, in the event of alarm?

- Is an uninterruptable power supply (UPS) desirable for whole or part of the system, for example, critical control functionality or lock-outs?

- Auto detection of ventilation failure (flow switches, differential pressure switches, motor overload or underload, etc.)?

- How / should the system(s) be linked to the premises fire alarms, taking account of the desirability of disabling the ventilation fans in the event of fire.

- How will system outages be managed (for example, for planned maintenance)?

- Should ancillary systems (for example, refrigeration fans) be incorporated into the ventilation system (for example, where they might enhance the ventilation, rather than just recirculate the confined space atmosphere)?

With each level of increased control system complexity, costs will increase in terms of both initial installation and in maintenance. The Confined Spaces Risk Assessment shall be employed by the Premises Operator to ascertain the appropriate balance between safety and cost.

The gas detection / ventilation system(s) shall be subject to a formally planned and recorded maintenance programme that includes calibration, periodic functional and end-to-end testing, alarm and interlock checks, lamp (bulb) checks for visual alarms or annunciators and the periodic replacement of critical or wearing components, etc.

Attention is drawn to Section 14.3, in relation to mechanical ventilation and cellar doors.

NOTE BFBi publish a poster highlighting the actions to be taken in the event of a CO_2 alarm activation in a cellar. It is available on the BFBi website.

14.2 Work in confined spaces

Beverage gases, if released to an inadequately ventilated space, will produce local oxygen-deficient atmospheres, which will produce asphyxia if breathed. CO_2 is also an intoxicant. Refer to Section 4.

Premises Operators shall identify if confined spaces exist within their premises, or might exist, within the meaning of the *Confined Spaces Regulations* (4). These regulations require that employers (Premises Operators) should carry out an adequate risk assessment and put in place appropriate control measures to protect those accessing or working in the area.

For further information refer to:

- HSE L101 (18), *Safe work in confined spaces. Approved code of practice*.
- BCGA GN 9 (37), *The application of the confined spaces regulations to the drinks dispense industry*.
- BBPA technical guidance leaflet, *Carbon dioxide in cellars* (47).

As part of the confined space risk assessment, the assessor (Premises Operator, or the specialist conducting the confined space risk assessment on the Premises Operator's behalf) shall determine:

- which gases, fumes and / or vapours may be present;
- from where the gases, fumes and / or vapours might originate;
- the volume or quantity of gas, fumes and / or vapours that may be present;
- where the gases, fumes and / or vapours might pass through and / or accumulate;
- the ventilation available and the dimensions of the confined space;
- any other relevant factors, refer to Section 14.2.1

14.2.1 Factors to consider in conducting confined space risk assessment

In addition to traditional 'beverage gases' (CO_2 and N_2), cellars can be affected by other gases and vapours that will have their own hazards. These should be considered as part of the risk assessment. For example, gases may evolve from natural sources that may be present or may appear periodically such as radon (Rn), methane (CH_4), sewer gases etc. Vapours arising from cleaning activities or stored solvents will need to be considered where applicable. Gases stored for ancillary purposes (heating gases, novel dispense gases, cream whipping agents, party balloon gases, calibration gases, aerosols, etc.) and gases produced as by-products (for example, oxygen from a gas generator) shall be included in the risk assessment process.

Review the Safety Data Sheet for each gas, refer to Section 7.3. Take account of the properties of each gas, vapour, fume or mixture. For example, CO_2 is a relatively dense gas that will tend to accumulate at low levels if released into ambient air, potentially creating a greater concentration of CO_2 close to the floor.

Consider the efficiency of the ventilation system, for example, mechanical ventilation systems can be more effective than natural ventilation. Old systems may be less effective than newer systems.

Consider displacement of air and other features caused by thermal (convection) effects for example:

- during or as a result of pipe / hose freezing (for example, when using cryogenics);
- during pipe cleaning/flushing where a temperature differential may exist;
- where liquefied gases are stored or used, including where liquid-oxygen run-off may occur;
- where space heating or solar effects may have an effect on the local air currents and flows.

A gradual depletion of oxygen may occur due to occupant's breathing. Furthermore oxygen may be consumed by work processes (for example, combustion during soldering/welding or other hot work, use of adhesives or solvents, etc.);

Gases, vapours, fumes and liquids may leak or may have leaked into the cellar from adjacent plant, premises, installations, processes or landfill sites, boiler/fire flues, traffic, etc especially where the cellar is below ground level.

Air quality can vary within a confined space, for example where the confined space contains remote or low-lying compartments or pits. The risk assessment shall take into consideration the possible effects of the dimensions, natural ventilation routes and layout of the cellar or other confined space.

Equipment, such as gas driven (pneumatically powered) pumps, may vent asphyxiant gases into the cellar.

14.3 Special considerations in relation to cellar doors

Consideration may be given to having cellar doors open, where there is no forced (mechanical) ventilation in place. There may be a benefit (in the absence of mechanical ventilation only) in improving ventilation in some cases.

Where a mechanical ventilation system is installed, keeping the cellar door open will change the efficiency and will challenge the design intention of such a system. Expert advice should be obtained before individual installations adopt a policy of routinely leaving doors in the open position where mechanical ventilation is in use.

If a cellar door is left open, consider the implications of allowing open access to the cellar (product security – beverage and gas, unauthorised cellar access, confined space entry implications, etc.).

If the cellar door is designated as a Fire Door, this will determine its status in relation to being left open or closed (i.e. it shall remain closed when not in use to access the space).

Cellar doors shall open in the outwards direction (from the cellar) to facilitate evacuation.

14.4 Lone working

Where there is a requirement for lone working then this activity shall be subject to a specific risk assessment. Appropriate control measures shall be put in place to establish a healthy and safe working environment for lone workers. This may include additional competence development (instruction, training, supervision, PPE - including consideration of 'person down' movement detectors with remote dial-out, etc.) HSE INDG 73 (20), *Working alone. Health and safety guidance on the risks of lone working*, provides additional guidance.

14.5 Gas storage cellar management

Gases and their storage areas shall be managed to ensure the gas containers remain safe for use and to prevent harm to people. A routine inspection is to be carried out in the cellar and storage area by a competent person, on a regular basis. BCGA CP 44 (35) provides advice on the checks to be carried out. Action shall be taken to deal with all non-conformities. Where required seek advice from your gas supplier or other specialist. The inspection should be recorded and records kept.

The inspection shall include:

a) Receipt of cylinders. Carry out a check on delivery of your cylinders:

- Are the cylinder contents clearly identified on the cylinder? Is it the product you ordered?

- Does the cylinder have a product safety label complete with the gas suppliers contact information?

- Is the product traceability label visible?

- Does the cylinder have a valve guard fitted?

- Is there a coloured plastic test date ring between the valve and the cylinder? Is the cylinder in-date for its periodic inspection and test?

- Is the cylinder valve outlet protected by an anti-tamper device?

- Are the cylinder and valve in good condition?

- You have the appropriate product safety data sheets? Are they up-to-date?

BCGA TIS 9 (42), *Gas safety in the hospitality industry*, provides a useful check list to help identify gas cylinders that are safe to use.

b) Daily checks. The following daily checks should be completed:

- Ensure any atmosphere monitoring is operational;

- Check for obvious signs of leakage;

- Gas containers and equipment are undamaged and in generally good condition;

- All gas containers are clearly labelled with their contents;

- The correct cylinders are installed and connected to the corresponding system;

- Off-line cylinders and vessels are appropriately and securely stored or located. All valves turned to the 'off' position;

- Full cylinders, yet to be connected, are securely stored, in good condition and with anti-tamper valve devices in place. All valves turned to the 'off' position;

- All cylinders are correctly restrained and secured, segregated and grouped as appropriate, refer to BCGA CP 44 (35);

- Stores are being kept clean and are subjected to regular housekeeping measures.

c) Other checks. The following checks should be completed at a regular frequency, based on risk. The interval between checks should in most cases be in multiples of days:

- Cylinders are 'in-date' for their periodic inspection and testing, the contents remain 'in date' for use;

- Inventory is appropriate, with sufficient but not excessive stocks;

- Empty, unserviceable, surplus or otherwise unwanted cylinders are identified for return to the owner and are appropriately stored. Refer to Section 15;

- The pressure system(s) is in good repair, is operating safely and is appropriately maintained, refer to Section 6.

- Ancillary systems (for example, ventilation systems, monitors, etc) are in good condition, maintained and operating correctly;

- Safety Data Sheets and other documentation is available as required, for all substances held;

- Carry out a housekeeping review, including cleanliness;

- Gas store integrity is intact, there is no standing water near cylinders or vessels;

- Hazard notices and signs are legible, in the right places, etc in accordance with industry guidance and the risk assessment(s);

- Access and egress routes are unobstructed, appropriately marked and available in case of emergency;

- Identification, management and removal of 'foreign' items, not part of the legitimate purpose of the gas store and/or cellar;

- That gas store and/or cellar security is adequate;

- Relevant risk assessments are reviewed from time to time.

BBPA provide additional guidance for licensees in their Technical Guidance Leaflet, *Carbon Dioxide in cellars* (47).

15. CYLINDER RETURN AND DISPOSAL

The vast majority of gas cylinders in circulation in the UK are the property of the gas suppliers. They are supplied to gas users under a rental agreement, which requires the Premises Operator to pay rental on the cylinder until it is notified for return. The simplest and best way to deal with cylinders that are empty, or no longer required, is to identify this to the owner and request that they are collected. Even if the cylinders were not originally supplied to the premises where they are discovered, the owner will make arrangements to collect them.

There is usually an economic advantage to the Premises Owner user in returning used cylinders promptly, as this can minimize rental charges. The details of the cylinder owner will be printed on the cylinder contents label. Refer to Section 7.1.

Detailed advice on the recovery and disposal of cylinders is available on the BCGA website under '[Cylinder Recovery and Disposal]'.

16. EMERGENCY PROCEDURES

WARNING: Attempts to rescue persons from confined spaces or where high concentration of an asphyxiant gas may be present should be made only by persons trained in the use of air-supplied breathing apparatus and confined space entry procedures, refer to Section 12. Many fatalities that occur in confined spaces due to asphyxiating atmospheres are the result of good intentioned but ill-advised rescue attempts.

WARNING: Filter respirators and surgical-style face masks give **NO PROTECTION** in atmospheres containing dangerous concentrations of CO_2, or any other asphyxiant gas.

The significant hazards within a cellar environment are likely to be either from a gas leak, refer to Section 16.1, or a fire, refer to Section 16.2.

16.1 Gas leak

The Premises Operator shall develop suitable procedures for dealing with leaks (or suspected leaks). It is not possible to give definitive advice in this document on what these procedures should be, as all cellars, gas stores, operational circumstances, layouts, personnel shift resources, ventilation systems, local risk assessments etc. will have considerable mutual variability. However, it may be useful for Premises Operator to consider the following points when developing suitable procedures:

- Who will take control in the event of an emergency?

- What gases are present (or likely to be present) and what are their characteristics and physical properties?

- Which areas, rooms, zones, etc. might a leak affect?

- Are ducts, pipes, corridors, drains, etc. present which might affect or convey an escaped gas elsewhere and expose others to danger?

- Depending on the scale of the leak, will you evacuate the vicinity, or have a system in place to approach the leaking equipment/container?

NOTE: Only approach leaking equipment by following a pre-prepared procedure and wearing appropriate PPE.

- How will the ventilation arrangements impact on the procedures?

- Are temporary ventilation arrangements possible at various stages of the emergency, and if so how will these be managed and applied?

- If special equipment is to be used, who is competent to use it (for example, breathing apparatus, personal gas monitors, etc.)?

- How will personnel be prevented from entering the affected area, for example, if casualties are present and others are considering an ill-advised rescue attempt?

- How will you know when the 'emergency' is over, and when it will be safe to give an 'all clear'?

- What other evacuation procedures do you have or will you adopt (for example, in case of Fire, refer to Section 16.2) and how will these procedure(s) be coordinated with this?

- Will all emergencies be treated the same, or can different, minor and major events be identified and treated differently?

- Who will you (or others) communicate with during an emergency – is it clear who needs to be told, and are their contact details readily available? This includes seeking assistance and dealing with customers / the public.

- How will the procedures be communicated to those who need to know them, and how will this be included in the Premises Operator and his staff's competence development programme?

NOTES:

1. It may be possible, without entering the area affected by the leak, to turn off the gas supply at source (especially when liquid storage vessels or cylinders are located outdoors and the leak is inside). Use this opportunity when it could be of benefit.

2. Ensure no-one touches frozen or frosted gas cylinders, pipes, vessels, receivers or other equipment. Do not approach frosted cylinders or receivers.

3. Be aware that some acts conducted in response to an emergency may be counter-productive and / or may generate fresh hazards. Examples include ill-advised rescue attempts of casualties from confined spaces, or opening of cellar trap-doors without managing the slip / trip / fall hazard thereby created, etc.

16.2 Fire

In the event of a fire, Premises Operators will have a great deal to worry about. The guidance provided in this section is directed specifically at the effects of fire upon gas systems, vessels and cylinders. Other potential impacts of fire shall be considered in line with statutory duties.

A responsible person shall carry out a Fire Safety Risk Assessment for the premises which is to include the cellar and take account of any additional gas storage areas and any beverage gas pressure systems. The findings from which are to be recorded, implemented, maintained and reviewed periodically. As necessary, advice should be sought from the local fire authority. The Premises Operator should keep a record of the location of all hazardous areas and their contents, this is to be made available to the emergency services in the event of an incident. Refer to *The Regulatory Reform (Fire Safety) Order* (11).

In common with all enclosed containers, vessels, liquid cylinders and gas cylinders present an explosion risk if exposed to fire. Flammable gas cylinders (if ill-advisedly stored in or near a cellar) are a particular risk. Fire and Rescue Services are aware of this and have safe methods for dealing with cylinders involved in fires. BCGA Leaflet 6 (44), *Cylinders in fire*, provides detailed guidance on the action to take in the event of fire. In brief summary, the immediate actions in the event of a fire shall be to:

(i) If the fire is at or near the gas storage location, KEEP AWAY and do NOT approach. Do not attempt to move cylinders or vessels or operate valves.

(ii) Sound the alarm.

(iii) Evacuate the area.

(iv) Contact the Fire and Rescue Services.

It is good practice to locate fire alarm initiation points (for example, '*break glass in the event of fire'* points, etc.) on all egress routes, to enable both the evacuation and the sounding of the alarm actions (ii and iii) to take place simultaneously.

Do not attempt to use any heat-, smoke- or fire-damaged cylinders, vessels or gas equipment. Premises Operators shall inform the gas supplier and/or equipment owner whenever a gas system component may have been affected by a fire or excessive heat. Once the incident is over, and the area has been returned to the control of the Premises Operator by the Fire and Rescue Services, the gas supplier will arrange to inspect or collect damaged equipment at a convenient date.

17. REFERENCES

Document Number		Title
1		The Health and Safety at Work etc. 1974
2		Food Safety Act 1990.
3	SI 1992: No 2793	Manual Handling Operations Regulations 1992.
4	SI 1997: No 1713	The Confined Spaces Regulations 1997.
5	SI 1998: No 2306	The Provision and Use of Work Equipment Regulations 1998.
6	SI 1999: No 2001	The Pressure Equipment Regulations 1999 (as amended).
7	SI 2000: No 128	The Pressure Systems Safety Regulations 2000 (PSSR).
8	SI 2002: No 1144	Personal Protective Equipment Regulations 2002.
9	SI 2002: No 2677	Control of Substances Hazardous to Health Regulations 2002 (COSHH).
10	SI 2002: No 2776	The Dangerous Substances and Explosive Atmospheres Regulations 2002 (as amended).
11	SI 2005: No 1541	The Regulatory Reform (Fire Safety) Order 2005.
12	SI 2009: No. 1348	The Carriage of Dangerous Goods and Use of Transportable Pressure Equipment Regulations 2009 (as amended).
13	European Regulation EC No 1907/2006	Registration, Evaluation, Authorisation and restriction of Chemicals (REACH).
14	European Regulation EC No 1272/2008	The Classification, Labelling and Packaging of Substances and Mixtures (CLP).
15	HSE Guidance Note EH 40	Workplace Exposure Limits
16	HSE L22	Safe use of work equipment. Provision and Use of Work Equipment Regulations 1998. Approved Code of Practice and guidance.
17	HSE L25	Personal Protective Equipment at Work.
18	HSE L101	Safe work in confined spaces. Approved code of practice.
19	HSE L122	Safety of pressure systems. Pressure Systems Safety Regulations 2000. Approved Code of Practice and guidance.

	Document Number	**Title**
20	HSE INDG 73	Working alone. Health and safety guidance on the risks of lone working.
21	BS 341 Part 3	Transportable gas container valves. 3. Valve outlet connections.
22	BS EN 1968	Transportable gas cylinders. Periodic inspection and testing of seamless steel gas cylinders.
23	BS 7121 Part 1	Code of practice for the safe use of cranes. 1. General
24	BS 7671	Requirements for electrical installations. IET wiring regulations.
25	EIGA IGC Document 23	Safety training of employees.
26	EIGA IGC Document 70	Carbon dioxide source qualification quality standards and verification.
27	EIGA IGC Document 78	Leak detection fluids cylinder packages.
28	EIGA IGC Document 136	Selection of personal protective equipment.
29	EIGA Safety Information Sheet 24	Carbon dioxide physiological hazards. "Not just an asphyxiant!"
30	EIGA Safety Information Sheet 25	Crane transport of cylinder packages.
31	BCGA Code of Practice 26	Bulk liquid carbon dioxide storage at users' premises.
32	BCGA Code of Practice 32	The safe filling of beverage gas cylinders.
33	BCGA Code of Practice 36	Cryogenic liquid storage at users' premises.
34	BCGA Code of Practice 39	In-service requirements of pressure equipment (gas storage and gas distribution systems).
35	BCGA Code of Practice 44	The storage of gas cylinders.

Document Number		Title
36	BCGA Guidance Note 3	Safe cylinder handling and the application of the manual handling operations regulations to gas cylinders.
37	BCGA Guidance Note 9	The application of the confined spaces regulations to the drinks dispense industry.
38	BCGA Guidance Note 11	The management of risk when using gases in enclosed workplaces.
39	BCGA Guidance Note 14	Production, storage, transport and supply of gases for use in food.
40	BCGA Guidance Note 23	Identifying gas safety training requirements in the workplace.
41	BCGA Technical Information Sheet 6	Cylinder identification. Colour coding and labelling requirements.
42	BCGA Technical Information Sheet 9	Gas safety in the hospitality industry.
43	BCGA Technical Information Sheet 17	Model risk assessment for manual handling activities in the industrial gas industry.
44	BCGA Leaflet 6	Cylinders in fire.
45	BCGA Leaflet 10	Profit through quality. Good gas, good business.
46	BBPA Booklet	Instructions for the safe operation of gas pressure systems used in the dispensing of beers and lagers.
47	BBPA Technial Guidance Leaflet	Carbon dioxide in cellars.
48	BBPA Code of Practice	Code of practice for the dispense of beer by pressure systems in licensed premises.
49	BFBi Code of Practice	BFBi Gas suppliers equipment code of practice
50	ISBT N_2 Quality Guideline	Beverage Grade Nitrogen (Cryogenic Source) Quality Guidelines And Analytical Methods Reference.
51	BSDA Code of Practice	Code of Practice for the dispense of soft drinks by pressure systems.
52	BSDA Leaflet	The safe use of dispense equipment in retail and other non-licensed premises.

Further information can be obtained from:

UK Legislation	www.legislation.gov.uk
Health and Safety Executive (HSE)	www.hse.gov.uk
British Standards Institute (BSI)	www.bsigroup.co.uk
European Industrial Gases Association (EIGA)	www.eiga.eu
British Compressed Gases Association (BCGA)	www.bcga.co.uk
The British Beer & Pub Association (BBPA)	www.beerandpub.com
Brewing Food and Beverage Industry Suppliers Association (BFBi)	www.bfbi.org.uk
The British Soft Drinks Association (BSDA)	www.britishsoftdrinks.com
The International Society of Beverage Technologists (ISBT)	www.bevtech.org

KEG AND GAS DISPENSE SYSTEM ARRANGEMENTS

Keg arrangements. Kegs will be connected into the dispense system via the keg coupler. The keg coupler and its attached hoses will be colour coded to identify the correct product, refer to Section 8. Similar colours will be displayed on the gas cylinders, refer to Section 7. One of several keg arrangements can be used.

Single keg arrangement. A single keg may be connected to the pressure system. The pressure relief devices may be bursting discs or pressure relief valves. Connection to the container is normally with plastic tubing. Some breweries specify stop valves firmly attached to the cellar wall. Self-sealing couplings are also sometimes specified.

Multiple keg arrangement with the same pressure. The same arrangement is used as with the single keg, except that stop valves in the individual branches to the kegs can be specified as standard.

Multiple keg arrangement with different pressures. Where the CO_2 content of the products are not the same, different top pressures are applied. This is achieved from a single CO_2 source. The output from the main pressure regulator feeds a ring main, normally with a higher pressure than that required by any of the beers. The ring main is protected by at least two pressure relief devices. Each individual branch from the ring main may be provided with a secondary pressure regulator. This will reduce the pressure to that required by the keg connected to that particular branch. Many breweries use self-relieving types of secondary pressure regulators.

As a variant of this arrangement, the ring main may be split into regions of reduced pressure. When a sufficient number of branches have been taken off the ring main for the product requiring the highest pressure, the main pressure is reduced by means of a reducing valve and its associated pressure relief devices. Further reductions of pressure can occur in the ring main. Each time the ring main is split it must be protected by an adequate number of pressure relief devices.

Figures A1:1 to A1:6 are generic and are displayed for general information. For more detailed information it is recommended that reference is made to the current edition of the BBPA, C*ode of practice for the dispense of beer by pressure systems in licensed premises* (48).

NOTE: The main pressure regulator is often wall mounted – however in some cases it may be attached directly to the cylinder valve.

The layout shown in Figure A1:1 is most commonly used in single keg applications, for example, small outlets, temporary bars, etc.

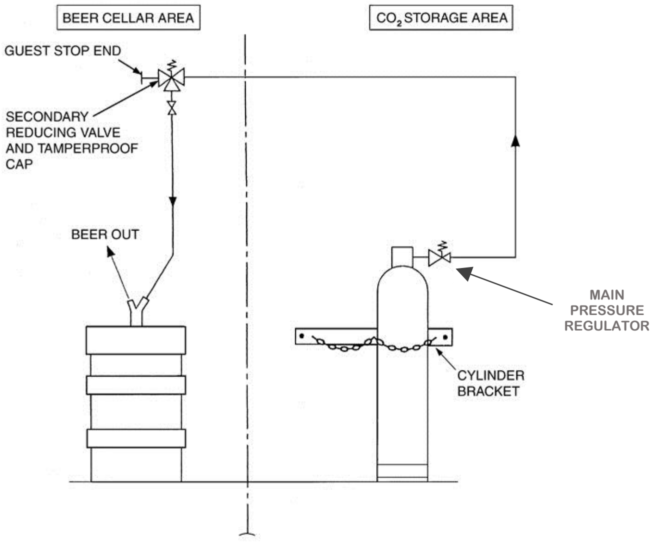


Figure A1:1: CO_2 supply, single keg

Figure A1:2 shows a single line common main with the main pressure regulator providing pressure to a single gas feed to the secondary pressure regulators. These are then set to the desired pressure depending on the product to be dispensed.

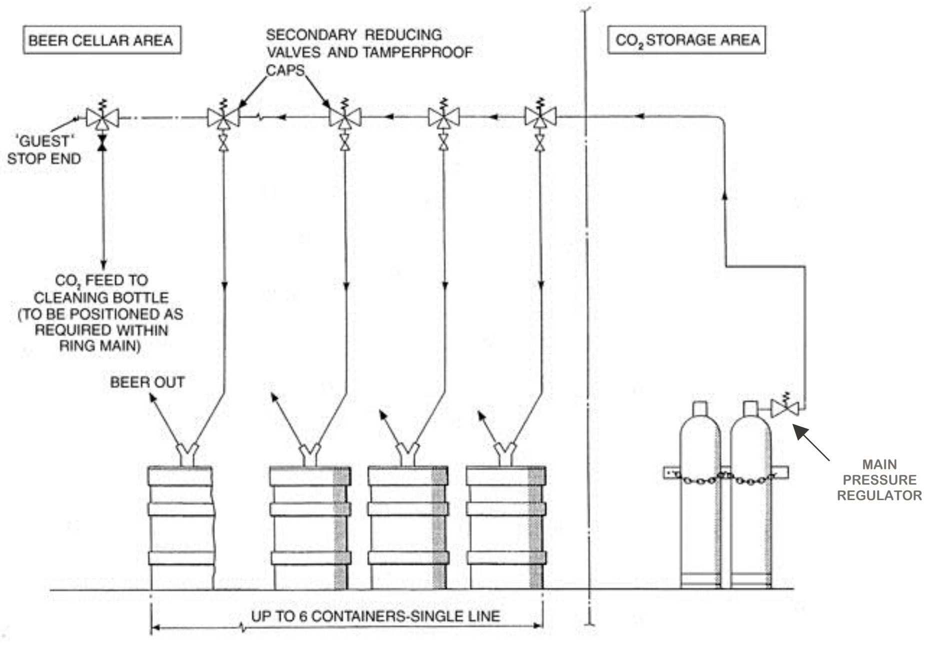


Figure A1:2: Single line common main (CO_2)

Figure A1:3 shows a complete looped 'ring' main with the main pressure regulator providing pressure to a gas pipe that loops back on itself. This helps ensure that the secondary pressure regulators are fed at a common pressure and are much less susceptible to flow / pressure starvation, such that there is a reduced chance of pressure loss at busy periods.

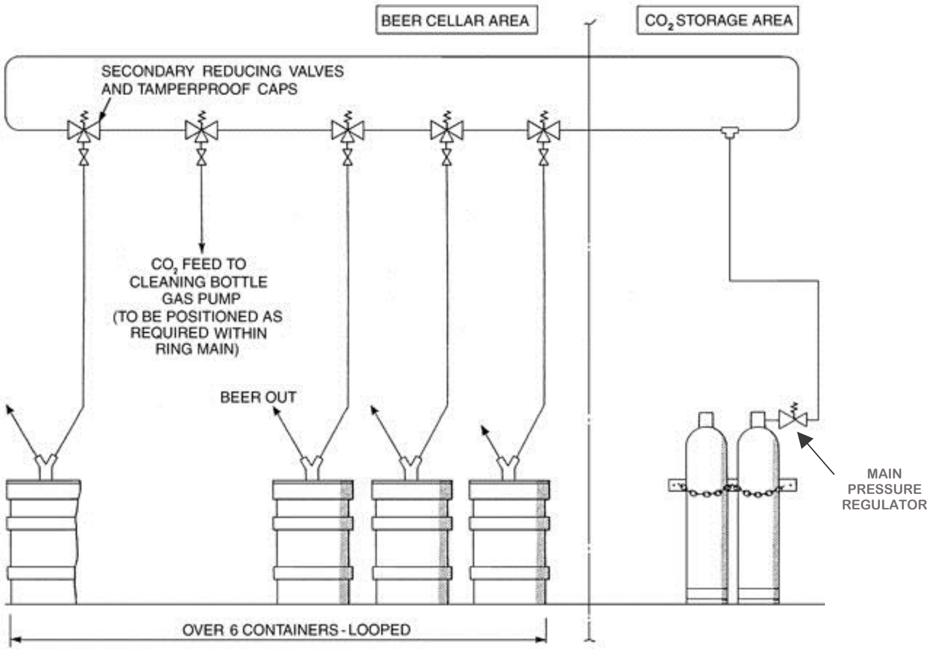


Figure A1:3: CO_2 ring main

Figure A1:4 shows a liquid CO_2 vessel that supplies CO_2 to the beer and soft drinks equipment. The vessel usually remains on site and is directly filled by a tanker either from an external fill point or, preferably, directly into the vessel. This system has a backup CO_2 facility connected via a three way manifold. This allows the customer to change to the emergency CO_2 cylinder supply if necessary. Each CO_2 supply has its own regulator on the manifold. These are set to the desired pressure to provide the soft drinks equipment with enough pressure, whilst a secondary pressure regulator is installed to reduce the pressure further for beer dispense.

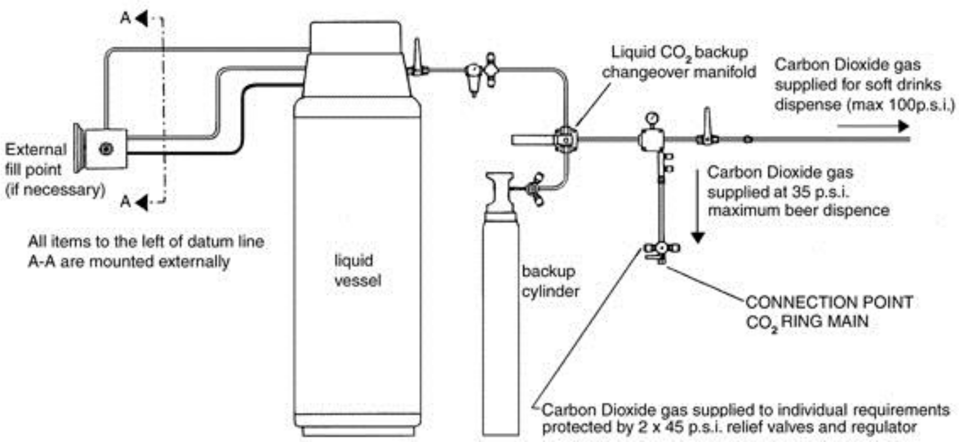


Figure A1:4: Cryogenic bulk CO_2 system with cylinder back-up

Figure A1:5 shows a mixed gas single line keg system. These systems are most commonly used in small single product outlets or for temporary bars, for example, for outdoor events.

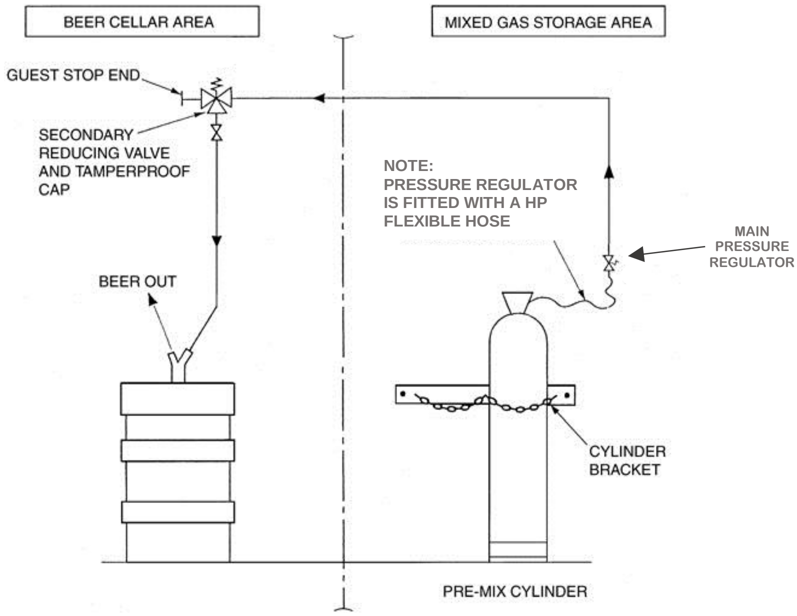


Figure A1:5: Mixed gas supply to single keg

Figure A1:6 shows a common line main for two mixed gas types. This is a typical mixed gas system layout for most beer dispense outlets. The main pressure regulator for each mix will supply a line pressure of < 3.1 bar (45 psi), and each secondary pressure regulator will reduce this further to the desired dispense pressure for each product. As with pure CO_2, this type of system can also be installed as a ring main, to assist the maintenance of constant pressure at each secondary regulator during high demand periods. The looped ring main is mainly used in larger outlets with a greater demand.

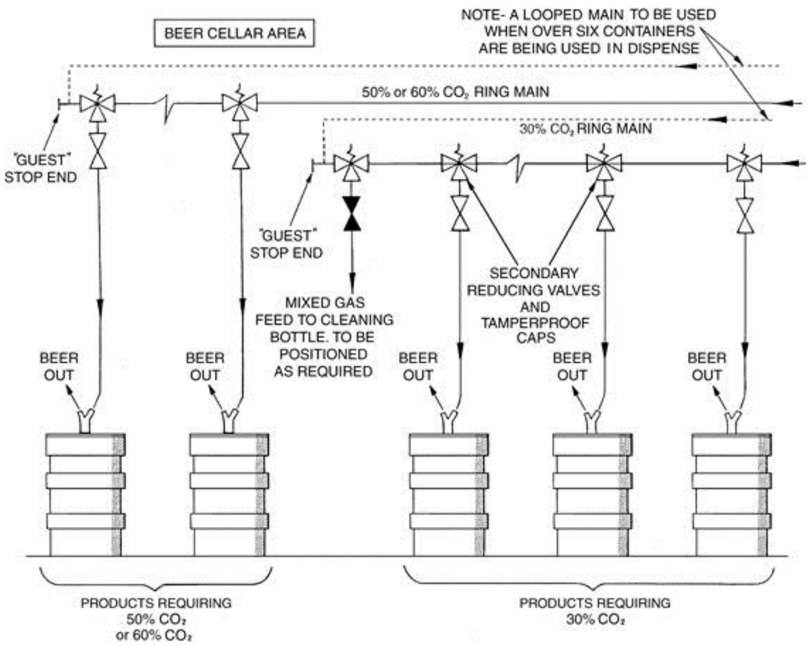


Figure A1:6: Mixed gas common and ring mains

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