CODE OF PRACTICE 32

THE SAFE FILLING OF FOOD GAS CYLINDERS FOR BEVERAGE DISPENSE

REVISION 3: 2019

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 promote safe practice and to prioritise environmental protection in the supply, use, storage, transportation and handling of industrial, food and medical 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 2. This document replaces BCGA Code of Practice 32, Revision 2: 2014. It was approved for publication at BCGA Technical Committee 160. This document was first published on 29/08/2019. For comments on this document contact the Association via the website www.bcga.co.uk.

CONTENTS

* Throughout this publication the numbers in [ ] brackets refer to references in Section 10. Documents referenced are the edition current at the time of publication, unless otherwise stated.

TERMINOLOGY AND DEFINITIONS

Beverage	Any potable liquid drink other than water. In the context of this document it includes lager, ales and soft drinks.
Corrosion	The deterioration of materials (for example, cylinders, valves, pipework, etc.) by an electro-chemical reaction, when in contact with water or other liquids (such as carbon dioxide and water).
Cylinder	A transportable pressure receptacle of a water capacity not exceeding 150 litres.
Food	Any substance or product, whether processed, partially processed or unprocessed, intended to be or reasonably expected to be, ingested by humans.
May	Indicates an option available to the user of this Code of Practice.
Mixed gas	In the context of this document, carbon dioxide and nitrogen mixed in different ratios to provide particular taste and visual characteristics.
Risk assessment	A formal assessment of a workplace or operation, performed in order to identify hazards and evaluate the extent of risk presented by the hazard, for the purpose of either eliminating the risk or establishing suitable controls to reduce the risk to an acceptable level.
Shall	Indicates a mandatory requirement for compliance with this Code of Practice and may also indicate a mandatory requirement within UK law.
Should	Indicates a preferred requirement but is not mandatory for compliance with this Code of Practice.

CODE OF PRACTICE 32

THE SAFE FILLING OF FOOD GAS CYLINDERS FOR BEVERAGE DISPENSE

1. INTRODUCTION

Gases are used in beverage dispense to operate cellar equipment, to carbonate a drink by adding the fizz, or they are used to push beer out of a pressurized keg. The gases used are air, nitrogen (N_2), carbon dioxide (CO_2) and various mixtures of N_2 and CO_2. When used in this context these gases are classified as food.

Companies that supply gases for food use, such as for beverage dispense, are defined as food businesses and therefore require to be fully compliant with *The Food Safety Act* [2] and all applicable food legislation.

Dispense gas, at the correct specification, is essential for serving the product in the way the drinks supplier intended. Good quality dispense gas will be supplied in a gas cylinder that is in a good condition, in-date for its periodic inspection and test, is filled with in-date food grade gas, is correctly labelled and is safe for use and transport.

To assure the safe filling of food gas cylinders it is very important to check that the integrity of the overall package is retained and it is suitable for filling to proceed. This has to be carried out at specially equipped centres, with qualified staff using appropriate procedures.

This Code of Practice has been prepared by the *British Compressed Gases Association* (BCGA) in consultation with the *British Beer & Pub Association* (BBPA) and the *Brewing, Food & Beverage Industry Suppliers Association* (BFBi) in order to provide guidance to users of gases in the beverage dispense industry.

BFBi operate a '*Gas Suppliers Accreditation Scheme'*, and manage a '*Register of Gas Fillers, Suppliers & Installers'*. This scheme is designed to provide assurance to retailers that the beverage gas they buy is from an accredited supplier and that it is fit for purpose.

Further guidance on beverage dispense gas cylinders can be found in BCGA Leaflet 10 [59], *Profit through quality. Good gas, good business*, and the BBPA guidance providing *Instructions for the safe operation of gas pressure systems used in the dispensing of beers and lagers* [60].

Premise owners and users of gaseous equipment should ensure they have adequate risk assessments and insurance in place to cover their activities and that they use their gases and look after their gas cylinders in a safe and responsible way. They should ensure their Insurer is aware that there are gases on-site.

2. SCOPE

This Code of Practice addresses the safety, quality and operational issues necessary for the preparation and safe filling of food gas cylinders used for beverage dispense.

The safety standards laid down are the minimum for safe working practice and the importance of the skill and competence of operators, supervisors and managerial staff is stressed.

For the safe filling of other gases and additional guidance, refer to BCGA Code of Practice 43 [46], *The safe filling of gas cylinders*.

3. RELEVANT LEGISLATION AND INDUSTRY DOCUMENTS

Companies that supply gases for food use, such as for beverage dispense, are defined as food businesses and therefore require to be fully compliant with *The Food Safety Act* [2] and all applicable food legislation.

Where products are filled or sold by weight compliance is required with the *Weights and Measures Ac*t [1].

BCGA Guidance Note 14 [51], *Production, storage, transport and supply of gases for use in food*, provides full details on the legislation relating to the use of gases for use in food.

BCGA Guidance Note 30 [53], *The safe use of gases in the beverage dispense industry*, provides guidance to those who are required to handle, use and store beverage gases. It addresses safety and operational issues associated with beverage gases, their use in cellars and beverage dispense pressure systems.

The *Food Premises (Registration) Regulations* [3] require the registration of all food premises with local authorities. These Regulations set out the criteria for registration, the principal criterion being that the premises are used for the purposes of a food business on five or more days in any period of five weeks. Any premises which produces and / or fills gas cylinders for use with food, including beverages, will require registration.

Several Regulations make specific demands, either explicitly or indirectly, regarding the process of filling gas cylinders. In particular the *Management of Health and Safety at Work Regulations* [7] require that all activities are subject to a formal risk assessment, the *Provision and Use of Work Equipment Regulations* (PUWER) [6], the *Pressure Equipment (Safety) Regulations* [14] and the *Pressure Systems Safety Regulations* (PSSR) [8] require that the equipment used for the filling process is properly designed, installed, commissioned, maintained, documented and operated.

For the in-service use of pressure equipment refer to BCGA CP 39 [45], *In-service requirements of pressure equipment (gas storage and gas distribution systems*.

The movement of equipment and gas cylinders may require compliance with the *Manual Handling Operations Regulations* [4], refer to Section 8.

The *Carriage of Dangerous Goods and Use of Transportable Pressure Equipment Regulations* [13] implements the *European Agreement on the Transport of Dangerous Goods by Road* (ADR) [17], which provides a framework for dangerous goods to be carried both nationally and internationally in road vehicles and requires compliance with standards for the packaging and labelling of the dangerous goods. Gases are classified as Class 2 Dangerous Goods. ADR [17] requires that gas cylinders are checked prior to filling to ensure they comply with specific standards and that they are safe for filling, for example, it details the requirements for testing (including periodic inspection and testing), refer to Section 5.5. The filling of gas cylinders shall only then be carried out by specially equipped centres, with qualified staff using appropriate procedures.

Cylinders not within the scope of ADR [17] may still be filled if they are within the scope of BCGA GN 36 [54], *Guidance for the use, inspection and transport of cylinders with various design codes*.

A specially equipped centre will have the following features:

- a safe working environment;
- operation to a recognised quality management system;
- a formalised management of change approval process;
- manual, and other handling facilities;
- access to expert technical support;
- standard and emergency operating procedures;
- loading and unloading facilities, with safe access and egress for vehicles;
- a cylinder marshalling area, with storage for empty and full cylinders;
- process for the pre-fill inspection of cylinders;
- process and facilities for the rejection and quarantine of unserviceable cylinders;
- appropriately designed filling line(s);
- a bulk supply of the products being filled;
- process for post fill inspection, including marking and labelling;
- adequate site security.

The operating procedures shall ensure that each gas cylinder being filled is compliant with all relevant Regulations and standards and, once filled, is safe for future storage, transportation and use.

The safe filling of gas cylinders is a complex activity. The BCGA has developed an audit checklist for use in assessing the important processes that shall be applied by any organisation that intends to carry out filling activities, refer to BCGA Technical Information Sheet (TIS) 43 [58] *Gas cylinder filling. Audit.*

3.1 Environmental impact

Any foreseeable change to the environment, whether adverse or beneficial, wholly or partially resulting from an organisation's activities, shall be appropriately managed. For example, producing or reducing of air emissions.

Each filling site should have a formal environmental management system in place that can be certified by an accredited 3rd party verifier, capable of identifying and reducing the environmental impact from these activities.

The European Industrial Gases Association (EIGA) 110 [38], *Environmental impacts cylinder filling plants*, details the environmental impacts of the management of cylinder filling operations and gives guidelines on how to reduce those impacts.

4. AWARENESS OF THE PROPERTIES OF GASES USED

Each gas (whether pure or a mixture) has its own distinctive properties.

On a gas cylinder, the label identifies the contents and provides basic information on safe use and the hazard(s) associated with the product. Refer to Section 5.

Safety Data Sheets provide detailed information on the properties of each gas as well as advice on handling and storage. Refer to Section 5.

All gases have their hazards, they are stored under pressure inside a gas cylinder and specifically N_2 is an asphyxiant, whilst CO_2 is both an asphyxiant and an intoxicant. Appropriate control measures, identified by risk assessment, shall be provided to protect all persons who may be affected by an escape, leak or accumulation of gases into the workplace.

Detailed information on the hazards from a release of a gas is available within BCGA Guidance Note (GN) 11 [50], *The management of risk when using gases in enclosed workplaces.*

If additional information is required contact your gas supplier for advice.

5. GAS CYLINDER 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 5.1.

To assist in cylinder identification a system of colour coding may be applied to each cylinder, refer to Section 5.2.

Additional identification marking to align with the customer's beverage gas system may be applied, refer to Section 5.3.

The gas supplier will provide a Safety Data Sheet for each product and can provide additional advice, refer to Section 5.4.

To ensure gas cylinders remain safe they are required to undergo periodic inspection and test, there is a marking scheme to help identify the next due date, refer to Section 5.5.

BCGA TIS 6 [55], *Gas cylinder identification. Label and colour code requirements*, provides comprehensive information on UK practice for cylinder colour coding and labelling.

5.1 Gas cylinder - labels

A cylinder label is mandatory and shall be used as the primary means of identifying the contents of a gas cylinder. The label shall meet the requirements of ADR [17] and / or the *Classification, Labelling and Packaging of substances and mixtures* Regulation (CLP) [16]. The information on the label is to align with the product Safety Data Sheet, refer to Section 5.3.

The filler of the gas cylinder is responsible for attaching a label correctly identifying the content of the gas cylinder. The label should be positioned on the shoulder area of the cylinder.

The label information shall include:

- product identity;
- supplier's name, address and telephone number;
- hazard and precautionary statements;
- signal words;
- diamond hazard label(s).

As the cylinder contains a food gas then the following addition information shall be displayed:

- the name of the food;
- the name and/or E-number in respect of each food additive or a sales description which includes the name and/or E-number of each food additive;
- the statement '*For food*' or the statement '*Restricted use in food*' or a more specific reference to its intended food use;
- a product traceability label in compliance with the *Food (Lot Marking) Regulations* [5] to identify the lot (or batch) number. A new product traceability label is attached to the cylinder, valve or valve guard, every time a cylinder is

filled, to reflect the actual gas production batch used. Usually this is a small label with a series of numbers and letters, and / or a barcode. Refer to Section 6.

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 (for example, a barcode).

Cylinders containing a mixture of CO_2 and N_2 should be labelled and / or stencilled with the CO_2 component first, for example, 30 % CO_2 / 70 % N_2.

5.2 Gas cylinder - colour coding

Colour coding is a secondary method used to identify the gas inside the cylinder with particular reference to the properties of the gas or gas mixture. Colour coding is not mandatory and, as a consequence, there may be a variety of colours in use.

Colour codes are applied to the shoulder, or curved part, at the top of the cylinder in accordance with BS EN 1089-3 [20], *Transportable gas cylinders. Gas cylinder identification (excluding LPG). Colour coding*.

Within BS EN 1089-3 [20] there is no recommendation for a body colour. For a body colour BCGA recommends the use of Dusty Grey (RAL 7037).

Cylinders containing gases for beverage dispense, should be colour coded in accordance with Table 1.

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

TABLE 1: Gas cylinders. Colour codes.

5.3 Customer beverage gas systems - identification

At customer premises individual beverage gas systems, including their pipework, may be identified by the colour identification codes shown in Table 2.

To assist the end user in connecting the correct gas cylinder to the beverage gas system, the colour code may be duplicated on beverage gas cylinders. This colour code should be displayed close to the valve outlet, for example, on the valve outlet cap, valve hand-wheel, collar or by using a special label.

There are different connections for CO_2 and for mixed gases. However the connections for all types of mixed gases are the same and care is to be taken to ensure that the identification marks for a particular mixed gas are used appropriately.

Gas	Colour
Air (for equipment use)	Blue
CO_2 100 %	Grey
30 % CO_2 / 70 % N_2	Green
50 % CO_2 / 50 % N_2	Purple
60 % CO_2 / 40 % N_2	White

TABLE 2: Beverage gas system colour identification codes.

These colours are in addition to colour coding of cylinders, described in Section 5.2, or valve guard colours identifying cylinder ownership. The location of the colour shall be agreed between supplier and customer.

5.4 Safety Data Sheets

Safety Data Sheets provide information on the product and give information on handling, storage and emergency measures in case of an incident.

Safety Data Sheets are mandated in compliance with the European Regulations on the *Classification, Labelling and Packaging of substances and mixtures* (CLP) [16] and REACH, *Registration, Evaluation, Authorisation and restriction of Chemicals* [15].

The gas supplier shall provide a Safety Data Sheet to the customer whenever a product is supplied to that customer for the first time. In many cases, a gas supplier will provide the cylinder filler with the Safety Data Sheet for the product(s) supplied, however the cylinder filler will then have an obligation to provide one or more Safety Data Sheets to their customers, including for gas mixtures produced by the cylinder filler.

Premises Operators have a responsibility to ensure that all relevant persons (for example, those filling cylinders) have the appropriate current Safety Data Sheet(s) and other relevant health and safety information available to them.

5.5 Gas cylinder - inspection and test

ADR [17] requires that gas cylinders are regularly inspected and tested to ensure they continue to be safe for filling and for the products they contain at the pressures in which

they are stored. It is mandatory for every cylinder to have been initially inspected and tested by the cylinder's manufacturer to ensure its serviceability before use, this is followed by regular periodic inspection and tests to ensure its continued serviceability whilst in service. These tests have to be carried out by a Competent Authority approved and appointed Inspection Body. The date that these inspection and tests are carried out is stamp-marked on the cylinder together with the stamp of the tester.

NOTE: Gas cylinders are subject to varying inspection and test intervals. These are defined within ADR [17]. For food gases this is typically a ten year interval.

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) inspection and 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.

Table 3 provides a guide to the colour and shape of cylinder test rings in the UK. 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.

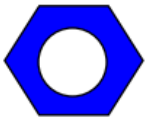
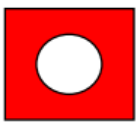
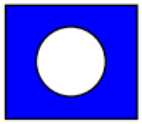
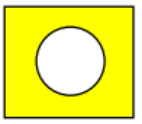
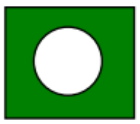
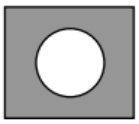
					
2013	**2014**	**2015**	**2016**	**2017**	**2018**
					
2019	**2020**	**2021**	**2022**	**2023**	**2024**
					
2025	**2026**	**2027**	**2028**	**2029**	**2030**
					
2031	**2032**	**2033**	**2034**	**2035**	**2036**

TABLE 3: Cylinder test rings

The cylinder test rings shall be replaced / updated at each periodic inspection and test.

Only complete cylinder rings are allowed to be used. If there is evidence of deliberate damage to a ring, for example, a split ring, the cylinder shall be quarantined, its test status verified, and if necessary it shall undergo inspection and test before filling is allowed.

NOTE: Cylinder test rings are based on a system described in BS EN ISO 18119 [29], *Gas cylinders. Seamless steel and seamless aluminium-alloy gas cylinders and tubes. Periodic inspection and testing*.

6. PRODUCT QUALITY

Food businesses shall have in place a recognised quality management system (QMS) at each site where the filling of food gas cylinders takes place. The quality management system shall ensure that the product in the filled cylinders conforms to specification. This will include source verification, hazard analysis and critical control point (HACCP) / control point measures, sample post fill checks as well as calibration regimes for pressure gauges and / or weigh scales, refer to Section 7.

All food gases shall be traceable. All gas cylinders used to supply food gases for beverage dispense applications as part of a lot shall be marked using a product traceability label so as to enable the lot to be identified in accordance with the *Food (Lot Marking) Regulations* [5], refer to Section 5. The quality management system shall enable suppliers of food gases to identify each lot (batch) produced and, in case of customer complaint or quality failure, to enable the recall of affected products.

Food gases supplied in cylinders for beverage dispense applications shall conform to an appropriate specification for use in foods. These include:

- Carbon dioxide. EIGA 70 [34], *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, as well as the quality assurance and quality control procedures necessary to ensure compliance. This document also provides recommendations for the qualification of plants used to produce CO_2 for use in foods and beverages. These recommendations are intended to assist CO_2 suppliers to achieve compliance with applicable regulatory standards such as the European Directives.

- Nitrogen. The International Society of Beverage Technologists (ISBT) document on *Beverage Grade Nitrogen (Cryogenic Source) Quality Guidelines and Analytical Methods Reference* [61], focuses on defining the purity grade of N_2 appropriate for use in associated, non-carbonated beverages along with providing recommended practices for its commercial processing, safe handing, transport, storage, sampling, sample shipping and analytical testing.

Where the final product is in the form of a gas mixture, each gas component shall be quality assured against the individual gas specification.

Each gas cylinder shall have a product identification label attached, refer to Section 5.1.

7. FILLING REQUIREMENTS

Prior to starting any filling operations the filling site shall be set up specifically for that purpose and have in place:

- a quality management system, refer to Section 7.1;

- competent personnel to manage, operate and maintain the plant, refer to Section 7.2;

- adequate safety equipment available, including appropriate personal protective equipment, refer to Section 7.3;

- appropriate infrastructure, correctly located, refer to Section 7.4;

- appropriate plant and equipment for conducting filling operations, refer to Section 7.5.

The process of filling a gas into a cylinder follows a series of sequential steps:

- acceptance checks, for example, on cylinders arriving at the filling centre, refer to Section 7.6, the filling product stock, etc.;

- storage prior to fill, refer to BCGA CP 44 [47], *The storage of gas cylinders*;

- pre-fill inspection, refer to Section 7.7;

- filling of the cylinder, refer to Section 7.8;

- post fill inspection, refer to Section 7.9;

- storage post fill and prior to onward distribution, refer to BCGA CP 44 [47].

7.1 Quality management system

A recognised quality management system (QMS) shall be in place for each site where a filling plant is in operation.

The quality management system shall ensure:

- that any gas cylinder being filled in the UK complies with the appropriate legislation approved by the UK Competent Authority and / or meets the requirements of ADR [17];

  NOTE: ADR [17] requires that an inspection is carried out on the gas cylinder to ensure it is authorised for the particular product, it defines the requirements for valves, for the periodic inspection and testing of the gas cylinder, for the filling conditions of each product and for many other aspects of the supply of gases.

- compliance with relevant standards and other industry documentation;

- the competence of the personnel involved;

- that every cylinder, presented for filling, is in a safe condition for being filled;

- that the quality of the source gas meets the appropriate food grade specification, and the quality is maintained throughout the filling process, refer to Section 6.

- that there is appropriate plant and equipment in place for filling a cylinder. For equipment requiring calibration, that it is calibrated at regular intervals and appropriate certification obtained;

- that there are appropriate operating procedures in place to fill a cylinder;

- that there are appropriate operating procedures in place to manage cylinders which are assessed as unsuitable for filling;

- that there are emergency operating procedures in place, including the actions to take in an emergency;

- that once filled, the cylinder is safe and compliant with relevant legislation for future transportation and use;

- that records are maintained.

The company should have a formal system of reviewing quality control to identify any system failures and to put in place appropriate rectification.

7.2 Competence

All personnel directly involved in cylinder filling shall receive suitable information, instruction, training and supervision for the work to which they have been set. This should include:

- all relevant hazards including those associated with pressure and the properties of the various gases used on site;

- the safe operation and maintenance of equipment;

- standard operating procedures;

- emergency operating procedures and actions to take in an emergency.

All staff should have the necessary skills and knowledge to carry out their job safely and shall receive appropriate information, instruction and training, including induction and continuation / refresher training. Such training shall be both theoretical and practical. It is the duty of the employer to ensure their persons are adequately trained and to establish competency. It is recommended that a training programme is carried out under a formalised system where an acceptable level of competency has to be achieved and is supervised on an ongoing basis by the employer. Records shall be kept of the information, instruction and training provided and of the competence level achieved. The programme shall make provision for periodic competence re-assessment.

General recommendations for the training of personnel are described in EIGA 23 [31], *Safety training of employees*. BCGA GN 23 [52], *Gas safety. Information, instruction and training*, provides information on the topics that should be covered when considering gases safety training.

7.3 Personal protective equipment

The work activity risk assessment will determine the requirement for the use of hazard controls, including personal protective equipment (PPE). PPE may only be considered as a control to achieve an acceptable level of residual risk after other levels of control have been addressed. Where PPE is required a PPE Assessment is to be carried out. PPE shall be provided as required by the *Personal Protective Equipment Regulations* [9]. The PPE shall be selected for a particular task, location and person and shall be appropriate and chosen to effectively reduce the overall risk to a level that is as low as is reasonably practicable (as demonstrated by risk assessment). Thus there are different PPE requirements for differing products, different tasks and possibly different personnel. Due regard is to be given to the requirements of the *Control of Substances Hazardous to Health Regulations* [10], any relevant equipment publications, manufacturers information and the product Safety Data Sheet.

HSE L25 [18], *Personal Protective Equipment at Work*, provides guidance on the *Personal Protective Equipment Regulations* [9]. EIGA 136 [40], *Selection of personal protective equipment*, provides guidance for selecting and using PPE at work.

The requirement for PPE will be determined by:

- existing control measures and the outcome from the PPE assessment;
- the properties of each individual gas;
- the pressure of the gas;
- the size, weight, type and characteristics of the cylinder(s) and / or other equipment;
- the activity being carried out;
- other activities near-by;
- incidents and emergency procedures;
- alignment with other existing site PPE requirements.

A typical requirement within the cylinder filling area will be for safety eye protection, hand protection, anti-static footwear with metatarsal protection, and clean protective clothing.

7.4 Location and infrastructure requirements for the filling plant

The area where the filling operation is to take place shall:

- be an external area or inside a structure which has been assessed to assure there is an adequate (for example, a high) ventilation rate. Filling shall not take place in an enclosed, poorly ventilated area, or in an area defined as a confined space. BCGA GN 11 [50] provides advice on safe workplace atmospheres;

- be constructed primarily of non-flammable materials;

- be constructed using compatible materials;

- have fire-risk management equipment / facilities as identified in the current Fire Risk Assessment. A Site Fire Safety Management Plan shall be developed and provided. Refer to *The Regulatory Reform (Fire Safety) Order* [12];

- have a current *Dangerous Substances and Explosive Atmospheres Regulations* (DSEAR) [11] risk assessment in place;

- have an electrical installation adequately rated for the area in which it is installed. All electrical installations shall, as a minimum, conform to BS 7671 [25], *Requirements for electrical installations. IET wiring regulations*;

- have adequate lighting;

- be exclusively for the filling operation;

- have no other hazardous products stored within the filling area;

- take into account human factors in the design of the filling equipment and the operations around it;

- be ergonomically designed and laid out, for example, to ensure visibility of pressure gauges and access to valves;

- be subject to regular housekeeping, including the collection and removal of all combustible products, such as packaging, which are no longer required;

- have multiple independent escape routes available. Emergency exits shall not require a key, card, or code to operate.

All pedestrian exits shall be able to be opened from the inside, for example, by the use of a push bar.

The hazard from oxygen depletion and from carbon dioxide enrichment shall be included in the assessment, as well as the hazard due to any other properties of the gases on-site. Refer to BCGA GN 11 [50]. This may require an assessment for the use of atmospheric monitoring equipment.

The use of video monitoring and recording equipment, such as close-circuit television (CCTV), is recommended during filling plant operation.

7.5 Filling equipment

The filling plant shall have suitable equipment available to allow the safe filling of gas cylinders.

The filling equipment shall be selected / designed for the range of cylinders being filled on-site. Only cylinders which are compatible with the available equipment shall be allowed to be filled.

The filling equipment shall be designed, operated and maintained in accordance with relevant legislation, standards, good practice and the manufacturers' instructions. The maintenance regime should include consideration of the effects of ageing on the integrity of the equipment. For the in-service use of pressure equipment refer to BCGA CP 39 [45].

It is recommended that an automatic cut-off should be fitted in the fill line to stop the fill operation once the pre-determined fill pressure or weight is achieved.

Pressure gauges and weigh scales used for the filling of gas cylinders shall be maintained and regularly calibrated in-line with the quality management system and the *Provision and Use of Work Equipment Regulations* (PUWER) [6]. Formal calibration every 12 months for pressure gauges and 6 months for weigh scales is recommended with a Certificate of Calibration obtained.

To reduce the scope for operator error it is recommended that pressure gauges and weigh scales display the same units as those stamped on the cylinders being filled i.e. bar and kg. To allow easy differentiation of the required fill pressure it is recommended that the gauge face is at least 100 mm in diameter for analogue / dial type gauges, with the fill pressure at between ½ to ⅔ of full-scale deflection.

One successful calibration methodology is to have a calibrated master pressure gauge, which is not used for routine cylinder filling. This master gauge is used on a regular basis, for example, weekly, to check all the other pressure gauges in use. This master gauge should be kept in a clean and secure location. Similarly weigh scales can be checked using a known control weight. Daily checks are recommended. Records of all checks should be kept.

Where pressure gauges or weigh scales are found to be out of calibration a procedure is required to ensure any cylinders that may have been filled whilst the gauges or weigh scales are out of calibration, are assessed for their fitness for use.

Where there are changes to the filling parameters, the gaseous products or the cylinders, then the process and the filling equipment should be reviewed, in-line with management of change procedures.

Controls shall be included in the filling system to maintain the filling process under carefully defined conditions and to ensure the mixing of gases can only happen when intended.

The mixing of gases is a complex subject and shall only be carried out using specially designed equipment following the approval of a technically competent person(s).

The use of gas specific connectors, to prevent filling incompatible gases, is strongly recommended. The use of filling adaptors (which can defeat such controls) is not recommended, however where they are used, then they shall be subject to strict managerial control.

Cylinder temperature should be kept within the design limits of the cylinder material at all times. External heating or cooling equipment for the purposes of filling a cylinder shall not be used at any stage during the filling process. For further information refer to BCGA TIS 13 [56], *Gas cylinders. Decanting gases.*

A vent system may be required to vent gases, this can be beneficial when dealing with overfilled cylinders. Exhaust gases shall only be vented in a safe area. A vent system shall be specifically designed and approved for that purpose, taking into account the properties of the gases being vented. For information on vent systems refer to BCGA CP 4 [43], *Industrial gas cylinder manifolds and gas distribution pipework (excluding acetylene).*

7.6 Cylinder selection

The owner of the cylinder shall be identified. The owner's permission shall be obtained before a cylinder can be filled.

A suitable cylinder shall be selected for the intended product. Such selection shall be made on criteria including size, material of construction, test period, valve type, and previous service history.

The cylinder and its accessories shall be manufactured to a design approved for use by the Competent Authority in the UK or conform with the requirements of ADR [17] and / or BCGA GN 36 [54].

The pressure rating of the cylinder shall be matched to the filling parameters. For liquefied gases, establish the tare weight.

The material and type of cylinder and its valve shall be compatible and appropriate for the gas(es) being filled.

All materials in contact with a food gas shall be selected for compatibility with food. They shall not introduce contaminants that would present a risk to food safety.

Food gases utilise valve outlets in accordance with BS 341, Part 3 [19], *Transportable gas container valves. Valve outlet connections*. The valve outlet used for CO_2 cylinders is BS 341-3 [19] No. 8. The valve outlet for mixed gas cylinders is BS 341-3 [19] No. 3. Adaptors shall never be used to convert from one outlet thread to another.

It is strongly recommended that these valves incorporate a residual pressure device, which includes a non-return function, to help prevent contamination, refer to Section 7.10. For additional guidance refer to EIGA 64 [33], *Use of residual pressure valves*.

CO_2 cylinder valves are fitted with bursting discs that are designed to rupture and safely relieve the excess pressure that can be produced in CO_2 cylinders as a result of overfilling or excessive ambient temperature conditions.

Mixed, or permanent, gas cylinder valves do not normally have bursting discs fitted. There is no legal requirement to fit bursting discs and therefore gas suppliers may make their own decisions about their use.

NOTE: If mixed, or permanent, gas cylinder valves are filled in error with CO_2, then without a bursting disc fitted, protection against excess pressure is absent, and safety could be compromised. Company procedures for filling shall ensure that this cannot happen.

Gas chilling equipment may use CO_2 liquid off-take cylinders. When supplied to the same location as normal gaseous off-take CO_2 cylinders, the liquid off-take cylinders should be fitted with special valves with an outlet connection in accordance with ISO 5145 [24] No. 16, *Cylinder valve outlets for gases and gas mixtures. Selection and dimensioning.*

NOTE: Some CO_2 cylinders are fitted with dip tubes, designed to allow liquid off-take. These cylinders may be identified by a white line (stripe) painted on the side of the cylinder, and / or an 'indicator' ring under the valve. Refer to Figure 1. These cylinders are not generally used in conventional beverage dispense systems, as liquid CO_2 would be delivered into the dispense system possibly resulting in the failure of downstream equipment.

FIGURE 1:
CO_2 cylinder fitted with a dip tube. Indicated by a white line and the use of a white indicator ring. The white ring may have additional identification such as the words "DIP TUBE" embossed on to it.

If painting of the cylinder is required then this should be carried out prior to the filling process. Adequate controls shall be in place to prevent contamination of the inside of the cylinder and valve, as well as to ensure temperature / time limits are not exceeded. For colour schemes refer to Section 5.

The cylinder shall be in-date for its periodic inspection and test. Refer to Section 5.

NOTE: It is recommended that the selection process for filling cylinders allows a reasonable time prior to the periodic inspection and test date. This will provide an opportunity to transport the cylinder to the end user whilst the cylinder remains in-date.

Gas cylinders can suffer from internal corrosion if used incorrectly and this is particularly relevant to food gases used for beverage dispense. For the potential causes and procedures to minimise internal corrosion refer to Section 7.10. Where the cylinder has been subject to internal contamination or corrosion, it shall be cleaned and

inspected to ensure that, when filled with a beverage gas, contamination of the gas does not take place, there is no risk to food safety and that the cylinder body is serviceable and safe for continued use.

Filling sites may be presented with cylinders for filling that are owned by customers or other third party organisations. Where this is acceptable practice, the filling site shall follow a sequence of checks before filling the cylinder(s), including obtaining permission from the owner of the cylinder, to ensure the safety of the personnel who will fill them and to confirm that the filled cylinder is legal and safe for eventual use. The customers or other third party organisations have a duty of care to inform the fillers of the nature and the mechanical integrity of the cylinders presented for filling. Further advice is available in EIGA 182 [41], *Pre-fill inspection of customer owned cylinders*.

There are certain cylinders which will not be filled. The UK follows European guidance which identifies specific cylinder types which are not considered safe for their original design conditions and need either to be withdrawn from further service or have limitations placed on their continued use. For further information refer to EIGA 86 [37], *Gas cylinders and valves with restricted use in the EU*.

Where a cylinder does not meet the acceptance criteria then it shall not be filled. These cylinders shall either be disposed, or, if appropriate, sent for further inspection and test.

7.7 Pre-fill inspection

Each filling site shall prepare standard operating procedures for carrying out a pre-fill inspection. The pre-fill inspection shall ensure the absence of any damage that might affect safety and that the gas cylinder is in a safe condition to fill. As appropriate, reference should be made to the following documents:

- BS EN ISO 24431 [30], *Gas cylinders. Seamless, welded and composite cylinders for compressed and liquefied gases (excluding acetylene). Inspection at time of filling*.

  NOTE: BS EN ISO 24431 [30], is referenced within ADR [17] and will, in due course, supersede standards BS EN 1919 [21] and BS EN 1920 [22].

- BS EN 1919 [21], *Transportable gas cylinders. Cylinders for liquefied gases (excluding acetylene and LPG). Inspection at time of filling*.

- BS EN 1920 [22], *Transportable gas cylinders. Cylinders for compressed gases (excluding acetylene). Inspection at time of filling*.

- EIGA Training Package 51 [42], *Prefill inspection of gas cylinders*.

If any problems are identified with blocked or inoperable valves then refer to EIGA 129 [39], *Pressure receptacles with blocked or inoperable valves*.

Cylinders shall not be filled with a substance different from that which they have previously contained unless the specific operations necessary for a change of gas service have been carried out. A change of gas service shall be carried out under the control of the quality management system, refer to Section 7.1, and may require

approval by a Notified Body. Refer to BS EN ISO 11621 [26], *Gas cylinders. Procedures for change of gas service*.

The conversion of a cylinder from one gas service to a different gas service requires that a detailed review is undertaken by a competent person. The conversion is to ensure that the new gas, or a different composition mixture of the original gases, may be safely filled into the cylinder. This is particularly critical with CO_2 and mixed gas cylinders where the permissible filling pressure is not the same for the different products. Other concerns in the conversion process include the type of valve and factors that may adversely affect product quality. Cylinders specifically designed for CO_2 service with test pressures of 250 bar or under shall not be considered for mixed gas service as the pressure rating is unsuitable for the potential developed pressure of mixed gas. It is recommended that new cylinders are put into service, rather than attempting to change gas service.

Information permanently stamped onto the shoulder of each gas cylinder, for example, the date of periodic test, the fill pressure or the serial number, should be clearly visible to the filler. If this information cannot be determined, or there is evidence that this information has been tampered with, then the cylinder shall not be filled. The quality management system should have a clear procedure that details what marks should be visible on a cylinder before filling and what action to take when such markings cannot be seen.

Grinding operations are not approved on cylinders. Remove from service any cylinders where there is evidence of grinding.

NOTE: Standards such as BS EN ISO 18119 [29], allow defects to be removed by grinding, however this practice is discouraged by the UK Competent Authority.

All cylinders shall be checked for residual pressure. If fitted, the functionality of the residual pressure valve shall be checked. Each cylinder should have retained a residual pressure of nominally 2 to 5 bar(g). Where the residual pressure is less than this, procedures shall be established to ensure that the cylinder is internally dry and completely free of contaminants, particularly liquids such as beer, soft drink concentrate and cleaning fluid. Appropriate control measures should be employed, such as purging or internal inspection before filling.

NOTE: The use of automated residual pressure checking is recommended, if not available then manual prod testing shall be carried out.

All cylinders shall be completely vented prior to filling. Under no circumstances shall any cylinder within the scope of this Code of Practice be top filled (i.e. filled on top of pre-existing, un-vented contents). The cylinder shall be internally free of any residual or contaminant gas that would affect the filling operation or the product quality. Any gas removed from the cylinder shall be disposed of safely.

A cylinder valve guard shall be fitted. Check it is secure and is serviceable.

The valve shall be inspected. It shall be suitable for the gas service and have the correct valve outlet. It shall be free from unacceptable damage and external contamination.

Where necessary, valves shall be cleaned; use approved cleaning methods and materials that will not present a risk to food safety or the integrity of the valve.

7.8 Filling process

Each filling site shall prepare standard operating procedures for filling a cylinder, taking into account the filling parameters detailed in ADR [17], each piece of equipment and the filling methods being used. This shall be based on the manufacturers' instructions and on a risk assessment. The standard operating procedure shall be approved by appropriate competent persons and be periodically reviewed.

As appropriate, reference should be made to the following documents:

- BS EN 13096 [27], *Transportable gas cylinders. Conditions for filling gases into receptacles. Single component gases.*

- BS EN 13099 [28], *Transportable gas cylinders. Conditions for filling gas mixtures into receptacles.*

When filling a cylinder the filler shall be aware of, and take into account, the developed pressure. Refer to Section 7.11.

Temperature compensation is required when filling any cylinder by pressurisation. In the UK gas cylinders are rated at a fill temperature of 15 ºC. The filling temperature shall be monitored and a method of calibrating the fill pressure shall be established to ensure that the gas cylinder rated pressure at 15 ºC is not exceeded.

Filling is normally carried out either by pressure or by weight. Pressure filling involves high pressure process equipment, and has the advantage that different sizes of cylinder can be filled at the same time. Liquefied gases are usually filled individually by weight, the filler shall always establish the tare weight before commencing filling.

Where products are filled or sold by weight compliance is required with the *Weights and Measures Ac*t [1].

At any time, at any filling manifold, only one product should be in the process of being filled.

Some gas cylinders are filled by decanting a product from one container to another. The safe decanting of gases is a complex and lengthy procedure, requiring expertise, specialist equipment and a high level of technical understanding. This process may be suitable for some circumstances, but involves many safety and quality issues. A detailed description of the relevant concerns is given in BCGA TIS 13 [56].

Many gases and gas mixtures require very detailed procedures that shall be tailor-made for the product being filled. Such procedures may need to address issues such as material compatibility, cylinder preparation, corrosion, interaction between substances, safe concentration limits, product disposal, product handling and personnel exposure.

The filling of gas mixtures requires particular care. Additional guidance is available from EIGA 39 [32], *The safe preparation of gas mixtures,* which sets out the basic requirements to ensure that gas mixtures are manufactured safely.

During the filling of carbon dioxide cylinders particular care is required to check and prevent internal corrosion and overfilling. Further guidance is available in EIGA 83 [36], *Recommendations for safe filling of CO_2 cylinders and bundles*.

Carbon dioxide cylinder valves are fitted with bursting discs. Industry has experienced the rupture of bursting discs during the filling process. Often the cause of the problem is identified as inaccurate weigh scales. It is recommended that company quality assurance procedures include a calibration check of the weigh scales at frequent intervals, for example, every shift, and sample post fill checks.

Emergency procedures shall be prepared and put in place for dealing with any incidents that may occur. These shall be supported by the provision of emergency use equipment and appropriate training for all personnel who access that location.

During the filling process the filler is to ensure that:

- cylinder valves are always opened and closed slowly;

- cylinders are filled at a rate which prevents excessive temperature rises. Temperature compensation may be required when filling any cylinder by pressurisation. For compressed gases the internal pressure at 65 ºC shall not exceed the test pressure. For high pressure liquefied gases the filling ratio shall ensure that the settled pressure at 65 ºC does not exceed the test pressure;

- the valve is not blocked;

- that the operation is progressing satisfactorily, for example, temperature rise checks of cylinder;

- that the valve does not leak in the open position, for example, by the use of a leak detection fluid compatible with the gas, cylinder and valve.

In the event of any leakage, then filling shall be stopped and the cylinder / connections vented. The leak shall be rectified before proceeding. Leaks shall not be rectified whilst the system is pressurised. Residual or excess gases shall only be vented to a safe location.

NOTE: Advice on leak detection fluids is available in EIGA 78 [35], *Leak detection fluids. Cylinder packages.*

The filling centre shall remain under the control of a competent person(s) at all times whilst filling is being carried out.

7.9 Post-fill inspection and settling

A check shall be carried out to ensure that the filling was completed as intended. This shall involve:

- a check in accordance with your quality management system of the finished product to ensure compliance with the desired specification;

- ensure that sufficient settling time is allowed in accordance with your quality management system. This will vary between different products and / or containers;

- a check that the contents are correctly identified, refer to Section 5;

- a check of the pressure / weight. The cylinder shall be within its safe operating limits. It shall not be overfilled or over pressurised. Any excess gas shall be removed in a safe manner and the cylinder checked for continued fitness for service. For liquefied gases the weight of the cylinder shall not exceed the total weight allowed for the cylinder and contents combination;

- a check that the outlet valve is closed;

- a leak check;

NOTE: Advice on leak detection fluids is available in EIGA 78 [35].

- a visual inspection of the gas cylinder for any obvious problems, including security of attachments.

Procedures should exist for dealing with cylinders that have been filled incorrectly or are not fit for continued use (or are so suspected). If the over-filling is marginal the excess contents can be vented. If gross over-filling occurs, the cylinder should be completely vented and then returned for inspection by a competent person to assess if it is fit for further service. The cylinders should not be moved whilst overfilled. Where it is safe to do so, venting should be carried out at the filling position so that it is not necessary to disconnect the cylinder from the filling line or move it in any way.

Once a filled cylinder has been assessed as serviceable then appropriate protective covers and / or valve caps should be fitted around the valve. These can help to prevent damage to the valve and to minimise contamination of the valve outlet. They also assist in giving the customer confidence that the cylinder being delivered is in a condition where it is ready for use and can provide evidence that the contents have not been tampered with.

Filling records shall be maintained in accordance with the quality management system. These are to identify:

- when a cylinder was filled and by whom;

- the product with which it was filled;

- batch / lot identification;

- the test status of each cylinder;

- quality control checks and results.

7.10 Gas cylinder corrosion preventive measures

The ingress of moisture / water and other contaminants into food gas cylinders will cause internal corrosion and can lead to catastrophic failure if undetected.

Water / liquid contaminants may be found in food gas cylinders used for beverage dispense, due to:

- back-feed from the customer's product or cleaning fluids;
- the ingress of rainwater, due to the cylinder valves being left open after use;
- submersion of a cylinder in water with the valve left open;
- condensation of humid air sucked into a cylinder due to temperature changes if the valve is left open;
- being filled with a poor quality gas (wet gas).

Contaminants can cause internal corrosion of the cylinder. For example, water, which combines with CO_2 to form a dilute carbonic acid electrolyte, will cause general and pitting corrosion in a steel cylinder. There is also some evidence that stress corrosion cracking can be experienced in steel cylinders where water has been present; this can lead to sudden failure of the cylinder or valve. Some soft drinks syrups and cleaning fluids containing phosphates, sulphates, chlorides and quinine compounds can also be particularly corrosive to cylinders.

The risk of moisture / water and other contaminants entering a cylinder should be minimised by one of the following:

- using a cylinder fitted with a residual pressure valve, which incorporates a non-return device (strongly recommended for all cylinders containing CO_2, particularly for cylinders in mixed gas service);
- ensuring that the filling procedures prevent the filling of contaminated cylinders;
- instructing users to ensure that cylinder valves are always closed when not in use or disconnected;
- following a hydraulic test, ensuring that water is not left inside a cylinder and the cylinder is thoroughly dried;
- before valves are fitted, ensuring that cylinders are not left open to the elements between testing and filling.

All filling sites shall have suitable procedures for the fitting of cylinder valves and shall use only calibrated torque wrenches. Valves that are over-tightened can lead to

overstressing of the cylinder neck threads; for example, this can cause problems such as sustained load cracking in some aluminium alloy cylinders.

A residual pressure valve incorporates a residual pressure device. A residual pressure device prevents ingress of contaminants by maintaining a positive differential pressure between the pressure within the cylinder and the valve outlet. A serviceable residual pressure valve prevents the ingress of external air into the cylinder should the valve be left open. A non-return feature prevents back flow from the customer's process whenever the cylinder is at a lower pressure than the application (involving a fluid) to which it is connected. For additional guidance refer to EIGA 64 [33].

Where a residual pressure valve is fitted the filler shall not interfere with or remove the device. The use of a residual pressure valve will have been assessed by the cylinder owner (gas supplier) and will form part of the construction requirements of the cylinder and valve assembly and the overall quality control plan under their duties within the *Provision and Use of Work Equipment Regulations* (PUWER) [6].

Further information on this important topic is available in BCGA Guidance Note 6 [49], *Avoidance and detection of internal corrosion of gas cylinders*.

7.11 Developed pressures

Cylinders containing N_2 and CO_2 mixtures will develop higher pressures than a cylinder containing N_2 alone. Refer to Figure 2.

BCGA has agreed values for the maximum developed pressure for the most commonly used mixtures and settled pressures. Refer to Table 4.

These developed pressures should be used as maxima when selecting cylinder specifications or converting cylinders for service with CO_2 / N_2 mixtures. Additional information is available in BCGA CP 35 [44], *Filling ratios and developed pressures for liquefied and compressed gases*.

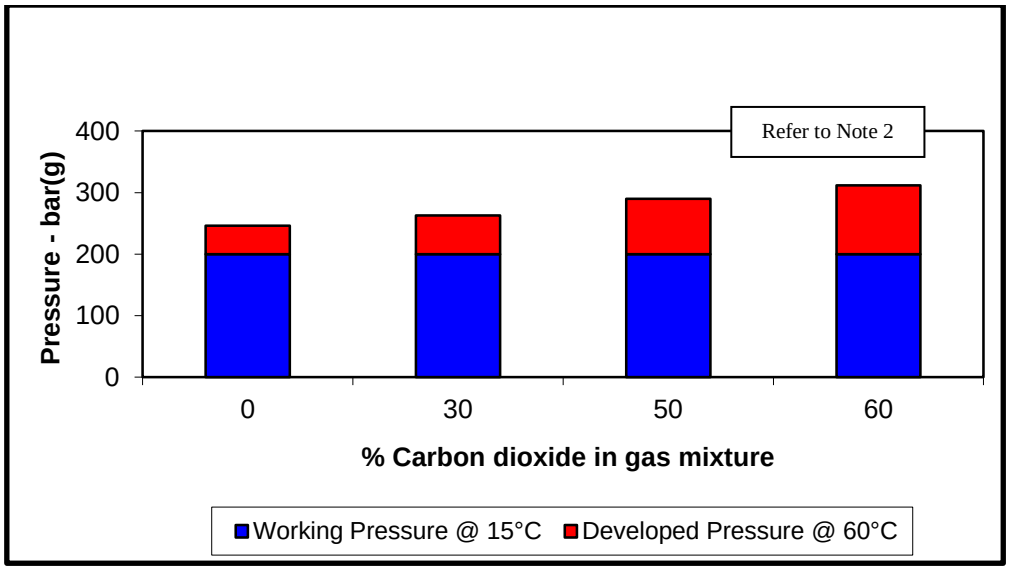


FIGURE 2: Pressure differences

CO_2 % V/V	N_2 % V/V	Working Pressure at 15 °C - bar(g)	Developed Pressure at 60 °C - bar(g)	Minimum Cylinder Test Pressure [1] - bar(g)
30	70	137	174	206
30	70	150	193	228
30	70	200	263	310
50	50	137	188	222
50	50	150	209	246
50	50	200	290	342
60	40	137	202	238
60	40	150	226	266
60	40	180 [2]	279	329

TABLE 4: Maximum developed pressures

NOTES:

1. The minimum cylinder test pressures are based on typical cylinders manufactured to BS 5045 [23] only. Cylinders manufactured to other codes should be selected with due regard to the developed pressure data given, though the relationship with test pressure may vary from that given above. Great care shall be exercised in ensuring that cylinders are suitable for the mixed gas application intended.

2. The 60 / 40 mixture is unstable at settled pressures above 180 bar and is not normally supplied. This is to avoid any possibility of the two gases separating into layers.

3. ADR [17] allows the developed pressure at 65 °C to equal the test pressure of the cylinder.

8. SAFETY WHEN MOVING AND HANDLING GAS CYLINDERS

Food gases supplied in gas cylinders can be in compressed or liquefied form. The cylinders vary in weight, size and shape. These physical characteristics present potential manual handling hazards. Appropriate risk assessment, competence and handling aids are required.

BCGA GN 3 [48] *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 cylinders.

The minimum requirements for the movement and handling of gas cylinders are:

- a current manual handling risk assessment shall be in place;
- all personnel shall wear appropriate personal protective equipment as assessed in accordance with Section 7.3;
- mechanical handling equipment, such as serviceable purpose-designed trolleys, should be used for moving cylinders, wherever practicable;

- subject to risk assessment, for moving over even, level floors and only for short distances, by competent operators, the 'churning' method may be considered;

- cylinders shall not be rolled horizontally along the ground; this may damage or even open the valve and will also damage identifying labels, marks and symbols;

- a cylinder shall not be moved with the valve open. A valve should be opened only at the location and time that the cylinder is being emptied or filled;

- where provided, valve protection caps should be fitted before moving a cylinder;

- do not lift cylinders by using the valve protection device (for example, the valve guard) unless it has been designed for that purpose. Do not use ropes, chains or slings to suspend cylinders unless the supplier has installed appropriate lifting attachments such as lugs. Suitable cradles, platforms or pallets to hold the cylinders may be used for lifting. Refer to BCGA TIS 38 [57], *Moving gas cylinders and bundles within the workplace*;

- on fork lift trucks, gas cylinders should be either secured vertically within specially designed gas cylinder pallets using restraining straps or horizontally within specially designed gas cylinder pallets. Gas cylinders shall not be lifted and moved directly on the forks of fork lift trucks;

  Exceptionally gas cylinders may be palletised horizontally on wooden pallets. Only wooden pallets which are in a good condition, for example, no protruding nails, and which are free of contamination, for example, no oil, grease or tar contamination, shall be used. Gas cylinders that are laid flat on pallets shall not overhang the pallet and shall be adequately secured to the pallet;

Throughout the filling process follow these basic principles for cylinder safety:

- maintain good ventilation in all areas where cylinders are located;

- keep cylinders away from sources of ignition or combustible material;

- do not expose cylinders to excessive heat;

- secure cylinders to prevent them falling over, for example, by palletising (contained within a rigid or transportable frame), nesting (three or more cylinders grouped together so that there is three or more points of contact on each cylinder), etc.

9. SECURITY

Gas cylinders and the gases they contain are hazardous. Whilst in storage (before and after the filling process) they should be located in a secure area. For further information refer to BCGA CP 44 [47], *The storage of gas cylinders*.

At all times gas cylinders should be traceable and be subject to routine management checks.

Additional advice is available from the BCGA.

10. REFERENCES

	Document Number	Title
1.		Weights and Measures Act 1985
2.		Food Safety Act 1990
3.	SI 1991: No.2825	The Food Premises (Registration) Regulations 1991.
4.	SI 1992: No. 2793	Manual Handling Operations Regulations 1992.
5.	SI 1996: No. 1502	Food (Lot Marking) Regulations 1996
6.	SI 1998: No. 2306	The Provision and Use of Work Equipment Regulations 1998 (PUWER).
7.	SI 1999: No. 3242	The Management of Health and Safety at Work Regulations 1999.
8.	SI 2000: No. 128	Pressure Systems Safety Regulations 2000 (PSSR).
9.	SI 2002: No. 1144	Personal Protective Equipment Regulations 2002.
10.	SI 2002: No. 2677	Control of Substances Hazardous to Health Regulations 2002 (COSHH).
11.	SI 2002 No. 2776	The Dangerous Substances and Explosive Atmospheres Regulations 2002 (DSEAR).
12.	SI 2005: No. 1541	The Regulatory Reform (Fire Safety) Order 2005
13.	SI 2009: No. 1348	The Carriage of Dangerous Goods and Use of Transportable Pressure Equipment Regulations 2009 (as amended).
14.	SI 2016. No. 1105	Pressure Equipment (Safety) Regulations 2016
15.	European Regulation EC No 1907/2006	Registration, Evaluation, Authorisation and restriction of CHemicals (REACH).
16.	European Regulation EC No 1272/2008	The Classification, Labelling and Packaging of Substances and Mixtures (CLP).
17.	ECE/TRANS/275	European Agreement concerning the International Carriage of Dangerous Goods by Road (ADR) (as amended).
18.	HSE L25	Personal Protective Equipment at Work.

19.	BS 341 Part 3	Transportable gas container valves. 3. Valve outlet connections.
20.	BS EN 1089 Part 3	Transportable gas cylinders. Gas cylinder identification (excluding LPG). 3. Colour coding.
21.	BS EN 1919	Transportable gas cylinders. Cylinders for liquefied gases (excluding acetylene and LPG). Inspection at time of filling.
22.	BS EN 1920	Transportable gas cylinders. Cylinders for compressed gases (excluding acetylene). Inspection at time of filling.
23.	BS 5045 Part 1: 1982 Part 3: 1984	Transportable gas containers: 1. Specification for seamless steel gas containers above 0.5 litre water capacity. 3. Seamless aluminium alloy. NOTE: Part 1 and 3 of this standard have been superseded but the original reference material remains valid.
24.	BS ISO 5145	Cylinder valve outlets for gases and gas mixtures. Selection and dimensioning.
25.	BS 7671	Requirements for electrical installations. IET wiring regulations
26.	BS EN ISO 11621	Gas cylinders. Procedures for change of gas service.
27.	BS EN 13096	Transportable gas cylinders. Conditions for filling gases into receptacles. Single component gases.
28.	BS EN 13099	Transportable gas cylinders. Conditions for filling gas mixtures into receptacles.
29.	BS EN ISO 18119	Gas cylinders. Seamless steel and seamless aluminium-alloy gas cylinders and tubes. Periodic inspection and testing.
30.	BS ISO 24431	Gas cylinders. Cylinders for compressed and liquefied gases (excluding acetylene). Inspection at time of filling.
31.	EIGA 23	Safety training of employees.
32.	EIGA 39	The safe preparation of gas mixtures.
33.	EIGA 64	Use of residual pressure valves.
34.	EIGA 70	Carbon dioxide source qualification quality standards and verification.
35.	EIGA 78	Leak detection fluids. Cylinder packages.

36.	EIGA 83	Recommendations for safe filling of CO_2 cylinders and bundles.
37.	EIGA 86	Gas cylinders and valves with restricted use in the EU.
38.	EIGA 110	Environmental impacts cylinder filling plants.
39.	EIGA 129	Pressure receptacles with blocked or inoperable valves.
40.	EIGA 136	Selection of personal protective equipment.
41.	EIGA 182	Pre-fill inspection of customer owned cylinders.
42.	EIGA Training Package 51	Prefill inspection of gas cylinders.
43.	BCGA Code of Practice 4	Industrial gas cylinder manifolds and gas distribution pipework (excluding acetylene).
44.	BCGA Code of Practice 35	Filling ratios and developed pressures for liquefied and compressed gases.
45.	BCGA Code of Practice 39	In-service requirements of pressure equipment (gas storage and gas distribution systems).
46.	BCGA Code of Practice 43	The safe filling of gas cylinders.
47	BCGA Code of Practice 44	The storage of gas cylinders.
48.	BCGA Guidance Note 3	Safe cylinder handling and the application of the manual handling operations regulations to gas cylinders.
49.	BCGA Guidance Note 6	Avoidance and detection of internal corrosion of gas cylinders.
50.	BCGA Guidance Note 11	The management of risk when using gases in enclosed workplaces.
51.	BCGA Guidance Note 14	Production, storage, transport and supply of gases for use in food.
52.	BCGA Guidance Note 23	Gas safety. Information, instruction and training.
53.	BCGA Guidance Note 30	The safe use of gases in the beverage dispense industry.

54.	BCGA Guidance Note 36	Guidance for the use, inspection and transport of cylinders with various design codes.
55.	BCGA Technical Information Sheet 6	Gas cylinder identification. Label and colour code requirements.
56.	BCGA Technical Information Sheet 13	Gas cylinders. Decanting gases.
57.	BCGA Technical Information Sheet 38	Moving gas cylinders and bundles within the workplace.
58.	BCGA Technical Information Sheet 43	Gas cylinder filling. Audit.
59.	BCGA Leaflet 10	Profit through quality. Good gas, good business.
60.	BBPA Booklet	Instructions for the safe operation of gas pressure systems used in the dispensing of beers and lagers.
61.	ISBT N_2 Quality Guideline	Beverage Grade Nitrogen (Cryogenic Source) Quality Guidelines And Analytical Methods Reference.

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.berandpub.com
Brewing Food and Beverage Industry Suppliers Association (BFBi)	www.bfbi.org.uk
The British Soft Drinks Association (BSDA)	www.britishsoft drinks.com
The International Society of Beverage Technologists (ISBT)	www.bevtech.org

British Compressed Gases Association

www.bcga.co.uk