



**CODE OF PRACTICE 43**

**THE SAFE FILLING OF  
GAS CYLINDERS**

**REVISION 1: 2018**

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**British Compressed Gases Association**

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## PREFACE

The British Compressed Gases Association (BCGA) was established in 1971, formed out of the British Acetylene Association, which existed since 1901. 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.

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## CONTENTS

<b>Section</b>		<b>Page</b>
	TERMINOLOGY AND DEFINITIONS	1
1.	INTRODUCTIONS	2
2.	SCOPE	2
3.	RELEVANT LEGISLATION AND INDUSTRY DOCUMENTS	3
4.	FILLING REQUIREMENTS	4
4.1	Quality management system	5
4.2	Competence	6
4.3	Personal protective equipment	6
4.4	Location and infrastructure requirements of the filling plant	7
4.5	Filling equipment	8
4.6	Cylinder selection	9
4.7	Pre-fill inspection of cylinders	10
4.8	Filling process	11
4.9	Post-fill inspection and settling	13
5.	SAFETY WHEN MOVING AND HANDLING GAS CYLINDERS	14
6.	ENVIRONMENTAL IMPACT	16
7.	SECURITY	16
8.	REFERENCES *	16

\* Throughout this publication the numbers in brackets refer to references in Section 8. Documents referenced are the edition current at the time of publication, unless otherwise stated.

## TERMINOLOGY AND DEFINITIONS

The following terminology and definitions are used throughout this Code of Practice:

Bundle	An assembly of cylinders that are fastened together and which are interconnected by a manifold and carried as a unit. The total water capacity shall not exceed 3000 litres except that bundles intended for the carriage of toxic gases of Class 2 (groups starting with letter T according to ADR (11) 2.2.2.1.3) shall be limited to 1000 litres water capacity.
Corrosion	Deterioration of the cylinder material by an electro-chemical reaction, when in contact with water or other liquids (e.g. carbon dioxide and water).
Cylinder	A transportable pressure receptacle of a water capacity not exceeding 150 litres.
May	Indicates an option available to the user of this Code of Practice.
Pressure receptacle	A collective term that includes cylinders, tubes, pressure drums, closed cryogenic receptacles, metal hydride storage systems, bundles of cylinders and salvage pressure receptacles.
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 43

## THE SAFE FILLING OF GAS CYLINDERS

### 1. INTRODUCTION

Cylinder gases are used in most industries and in a wide variety of environments. The majority of gas cylinders are reusable and each year millions of gas cylinders are (re)filled within the UK, almost entirely free of any incident.

However, the activity has many potential hazards, including the properties of the substance being used; the compatibility with the container it will be filled into; and the pressures involved. Filling is also subject to a wide range of statutory controls.

To assure the safe filling of 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.

**NOTE:** Transportable pressure receptacles, or transportable pressure vessels, are legal terms which collectively includes individual cylinders, tubes, pressure drums and bundles of cylinders. To aid clarity this document will refer to all these as gas cylinders.

Premise owners and users of gaseous equipment should ensure they have adequate insurance 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.

This code of practice is intended for use in conjunction with current guidance and information produced by the Health and Safety Executive (HSE) and other related bodies and trade associations.

### 2. SCOPE

This Code of Practice considers the filling of gas into gas cylinders. With the variety of gases covered, compressed or liquefied, receptacle size, and the number of gas cylinders filled together, it is inevitably generic in much of its content.

For additional information on filling gas cylinders containing food gases refer to the British Compressed Gases Association (BCGA) Code of Practice (CP) 32 (25), *The safe filling of beverage gas cylinders*.

This Code of Practice excludes the filling of acetylene cylinders, refer to:

- European Industrial Gases Association (EIGA) 123 (47), *Code of Practice. Acetylene*.
- BS EN ISO 11372 (17), *Gas cylinders. Acetylene cylinders. Filling conditions and filling inspection*.

- BS EN ISO 13088 (19), *Gas cylinders. Acetylene cylinder bundles. Filling conditions and filling inspection.*

### 3. RELEVANT LEGISLATION AND INDUSTRY DOCUMENTS

Many of the documents referenced 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* (4) require that all activities are subject to a formal risk assessment, the *Provision and Use of Work Equipment Regulations* (PUWER) (3), the *Pressure Equipment (Safety) Regulations* (10) and the *Pressure Systems Safety Regulations* (PSSR) (5) 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 (27), *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* (2), refer to Section 5.

The supply of medical gases and the filling of medical gas cylinders requires that the organisation be in possession of a Manufacturer's Authorisation granted by the Medicines and Healthcare products Regulatory Agency (MHRA) for the manufacture of medical gases. The organisation shall comply with the principles and practices of Good Manufacturing Practice (GMP) and Good Distribution Practice (GDP) as laid down in the relevant European Guidelines.

The *Carriage of Dangerous Goods and Use of Transportable Pressure Equipment Regulations* (CDG Regulations) (9) implements the *European Agreement on the Transport of Dangerous Goods by Road* (ADR) (11). ADR (11) requires that gas cylinders are checked prior to filling to ensure they comply with specific standards, 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 (11) may still be filled if they are within the scope of BCGA GN 36 (32), *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 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 TIS 43 (36) *Gas cylinder filling. Audit.*

#### **4. 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 4.1;
- competent personnel to manage, operate and maintain the plant, refer to Section 4.2;
- adequate safety equipment available, including appropriate personal protective equipment, refer to Section 4.3;
- appropriate infrastructure, correctly located, refer to Section 4.4;
- appropriate plant and equipment for conducting filling operations, refer to Section 4.4.

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

- acceptance check on cylinders arriving at the filling centre, refer to Section 4.6;

- storage prior to fill, refer to BCGA CP 44 (28), *The storage of gas cylinders*;
- pre-fill inspection, refer to Section 4.7;
- filling of the cylinder, refer to Section 4.8;
- post fill inspection, refer to Section 4.9;
- storage post fill and prior to onward distribution, refer to BCGA CP 44 (28).

#### **4.1 Quality management system**

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

The QMS shall ensure:

- that any gas cylinder being filled in the UK complies with the appropriate legislation approved by the UK Competent Authority, the Department for Transport, and / or meets the requirements of ADR (11);

NOTE: ADR (11) 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 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.

## **4.2 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. 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 where appropriate.

General recommendations for the training of personnel are described in EIGA Document 23 (38), *Safety training of employees*. BCGA GN 23 (31), *Gas safety. Information, instruction and training*, provides information on the topics that should be covered when considering gases safety training.

## **4.3 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 is to be provided as required by the *Personal Protective Equipment Regulations* (6). The PPE shall be selected for a particular task and location and shall be appropriate and chosen to effectively reduce the overall risk. 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* (7), any relevant equipment publications, manufacturers information and the product Safety Data Sheet.

HSE L25 (13), *Personal Protective Equipment at Work*, provides guidance on the *Personal Protective Equipment Regulations* (6). EIGA Document 136 (49), *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 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.

#### **4.4 Location and infrastructure requirements of 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 a high ventilation rate. Filling shall not take place in an enclosed area.

BCGA GN 11 (30), *The management of risk when using gases in enclosed workplaces*, provides advice on safe workplace atmospheres;

- be constructed primarily of non-flammable materials;
- be constructed using compatible materials, for example, when filling with oxygen avoid the use of oil, greases and bitumen products;
- have fire-fighting equipment / facilities as identified in the Site Fire Safety Management Plan provided. A responsible person shall carry out a Fire Safety Risk Assessment on the filling site, the findings from which are to be incorporated into the Site Fire Safety Management Plan. Refer to *The Regulatory Reform (Fire Safety) Order* (8);
- 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 (16), *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 exits shall be able to be opened from the inside, for example, by the use of a push bar.

During the site risk assessment the hazard from oxygen depletion and enrichment shall be assessed, as well as the hazard due to any other properties of the gases on-site. Refer to BCGA GN 11 (30). This may require an assessment for the use of gas detection equipment.

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

#### **4.5 Filling equipment**

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

The filling equipment shall be designed, operated and maintained in accordance with relevant legislation, standards and the manufacturers' instructions. The maintenance regime should include consideration of the effects of ageing on the integrity of the equipment, refer to BCGA CP 39 (27).

The filling equipment shall be designed to fill specific sizes of cylinder. The filling equipment shall be selected and be compatible with the cylinders being filled.

Pressure gauges and weigh scales used for the filling of gas cylinders shall be properly maintained and regularly calibrated in-line with the quality management system. To reduce 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.

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 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 (34), *Gas cylinders. Decanting gases*.

A vent system may be required to safely relieve gases. They 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 (24), *Industrial gas cylinder manifolds and gas distribution pipework (excluding acetylene)*.

For the design of liquefied petroleum gas (LPG) cylinder filling plants refer to UKLPG CP 12 (52), *Recommendations for safe practice in the design and operation of LPG cylinder filling plants*.

#### **4.6 Cylinder selection**

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

The cylinder and its accessories shall conform with the requirements of ADR (11) and / or BCGA GN 36 (32).

BCGA recommend the use of residual pressure valves to maintain the integrity of the cylinder by preventing the ingress of contaminants into the cylinder.

The pressure rating of the cylinder shall be matched to the filling parameters.

The material and type of cylinder shall be compatible with the gas(es) being filled.

The material and type of valve, including the valve outlet connection, shall be compatible and appropriate for the gas(es) being filled.

The cylinder shall be in-date for its periodic inspection and test. BCGA TIS 6 (33), *Gas cylinder identification. Label and colour code requirements*, provides a guide to the use of cylinder test rings.

**NOTE:** It is recommended that the selection process for filling cylinders allows a reasonable time prior to the periodic inspection and test date so as to allow transportation of the cylinder to the end user.

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 with gas. The QMS (refer to Section 4.1) 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.

Filling sites are often presented with cylinders for filling that are owned by customers or other third party organisations. In such cases the filling site shall follow a sequence of checks before filling the cylinder(s) 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 by the end user. 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 Document 182 (51), *Pre-fill inspection of customer owned cylinders*.

There are certain cylinders which will not be filled. The UK follow the 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 Document 86 (43), *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 sent for further inspection and test.

#### **4.7 Pre-fill inspection of cylinders**

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 (23), *Gas cylinders. Seamless, welded and composite cylinders for compressed and liquefied gases (excluding acetylene). Inspection at time of filling.*
- BS EN 1919 (14), *Transportable gas cylinders. Cylinders for liquefied gases (excluding acetylene and LPG). Inspection at time of filling.*
- BS EN 1920 (15), *Transportable gas cylinders. Cylinders for compressed gases (excluding acetylene). Inspection at time of filling.*
- BS EN 13365 (22), *Transportable gas cylinders. Cylinder bundles for permanent and liquefied gases (excluding acetylene). Inspection at time of filling.*
- EIGA Training Package 51 (37), *Prefill inspection of gas cylinders.*

Cylinders provided for service in the marine environment should be subject to additional pre-fill checks as detailed in EIGA Document 61 (40), *Safe use of gas cylinders in marine service*.

If any problems are identified with blocked or inoperable valves then refer to EIGA 129 (48), *Pressure receptacles with blocked or inoperable valves*.

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.

#### **4.8 Filling process**

Each filling site shall prepare standard operating procedures for filling a cylinder taking into account the filling parameters detailed in ADR (11), 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 (20), *Transportable gas cylinders. Conditions for filling gases into receptacles. Single component gases*.
- BS EN 13099 (21), *Transportable gas cylinders. Conditions for filling gas mixtures into receptacles*.
- BCGA CP 35 (26), *Filling ratios and developed pressures for liquefied and compressed gases*.

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, always establish the tare weight before commencing filling.

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 (34).

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 Document 39 (39), *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 and bundles, particular care is required to check and prevent internal corrosion and overfilling. Further guidance is available in

EIGA Document 83 (42), *Recommendations for safe filling of CO<sub>2</sub> cylinders and bundles*.

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

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

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.

Cylinders containing carbon monoxide or carbon monoxide / carbon dioxide mixtures can be sensitive to cracking. Before filling such cylinders refer to EIGA Document 95 (44), *Avoidance of failure of CO and of CO / CO<sub>2</sub> mixtures cylinders*.

Controls shall be included in the filling system to prevent the mixing of chemically incompatible gases. For example, it should be physically impossible to inadvertently add flammable gases to oxidant gases without disconnecting the cylinder from the filling equipment. Control of the cylinder by analysis or some other appropriate measure defined by the risk assessment should be used to assure safety before taking the next step in the process.

NOTE: Historically, during the manufacture and use of these gas mixtures, industry has experienced accidents and losses resulting in explosions that have caused injuries and death. These incidents have been caused by mixtures being manufactured that have been within the explosive range. Compressed oxidant-fuel gas mixtures can be manufactured safely provided the correct principles are followed. Refer to EIGA Document 139 (50), *Safe preparation of compressed oxidant-fuel gas mixtures in cylinders*.

For medical gases, EIGA Document 99 (45), *Good manufacturing practice guide for medicinal gases*, is provided for use by manufacturers of medicinal gases and fillers of medicinal gas cylinders. It covers the manufacture and distribution of all medicinal gases on gas company premises and the filling of medicinal gas cylinders to meet the specifications set in the relevant Pharmacopoeia standards and, where required by the national authorities, in the relevant Marketing Authorisations.

For the operation of LPG cylinder filling plants refer to UKLPG CP 12 (52).

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 QMS, refer to Section 4.1. For a change of gas service refer to BS EN ISO 11621 (18). *Gas cylinders. Procedures for change of gas service*.

Where products are filled or sold by weight compliance is required with the *Weights and Measures Act (1)*.

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 °C shall not exceed the test pressure. For high pressure liquefied gases the filling ratio shall ensure that the settled pressure at 65 °C does not exceed the test pressure;
- the valve is not blocked;
- that the operation is progressing satisfactorily e.g. temperature rise checks of cylinder;
- that the valve does not leak in the open position, for example, by the use of a gas compatible leak test fluid.

In the event of any leakage, then filling is to 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 are to be vented to a safe location.

NOTE: Advice on leak detection fluids is available in EIGA 78 (41), *Leak detection fluids. Cylinder packages*.

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

#### **4.9 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 QMS of the finished product to ensure compliance with the desired specification;
- ensure that sufficient settling time is allowed in accordance with your QMS. This will vary between different products and / or containers;
- providing the correct identification of the product, e.g. marking and labelling;

Marking and labelling shall meet the requirements of ADR (11) and/or the *Classification, Labelling and Packaging of substances and mixtures* Regulation

(CLP) (12). For information on labels and colour codes refer to BCGA TIS 6 (33);

- 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 (41).

- 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.

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.

Filling records shall be maintained in accordance with your QMS. These are to identify:

- when a cylinder was filled;
- the product with which it was filled;
- batch / lot identification;
- quality control checks and results.

## **5. SAFETY WHEN MOVING AND HANDLING GAS CYLINDERS**

Gases supplied in cylinders can be in compressed, liquefied or dissolved 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 (29) *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:

- all personnel shall wear appropriate PPE as assessed in accordance with Section 4.3;
- 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 unless they have 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 (35), *Moving gas cylinders and bundles within the workplace*;
- some cylinder bundles are designed to be lifted via their permanently attached pad-eyes or lifting eyes lugs. Some bundles can only be lifted using fork lift trucks. If you are not sure check with your gas supplier. Refer to BCGA TIS 38 (35);
- 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;

- bundles may be moved by fork lift truck where the bundles are so designed.

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;

- where practical, 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.

## 6. ENVIRONMENTAL IMPACT

Any 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 3<sup>rd</sup> Party verifier, capable of identifying and reducing the environmental impact from these activities.

EIGA Document 110 (46), *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.

## 7. 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 (28).

During the filling process gas cylinders should be traceable and be subject to routine management checks.

Additional advice is available from the BCGA.

## 8. REFERENCES

1. Weights and Measures Act 1985.
2. SI 1992. No. 2793 The Manual Handling Operations Regulations 1992.
3. SI 1998. No. 2306 The Provision and Use of Work Equipment Regulations 1998 (PUWER).
4. SI 1999: No. 3242 The Management of Health and Safety at Work Regulations 1999.
5. SI 2000. No. 128 Pressure Systems Safety Regulations 2000 (PSSR).
6. SI 2002. No. 128 The Personal Protective Equipment Regulations 2002.

7. SI 2002. No. 2677 The Control of Substances Hazardous to Health Regulations 2002 (COSHH).
8. SI 2005. No. 1541 The Regulatory Reform (Fire Safety) Order 2005.
9. SI 2009. No. 1348 Carriage of Dangerous Goods and Use of Transportable Pressure Equipment Regulations 2009 (as amended).
10. SI 2016. No. 1105 The Pressure Equipment (Safety) Regulations 2016.
11. ECE/TRANS/257 European Agreement Concerning the International Carriage of Dangerous Goods by Road (ADR) (as amended).
12. EC No. 1272/2008 European Regulation (EC) No 1272/2008 on classification, labelling and packaging of substances and mixtures (CLP).
13. HSE L25 Personal protective equipment at work.
14. BS EN 1919 Transportable gas cylinders. Cylinders for liquefied gases (excluding acetylene and LPG). Inspection at time of filling.
15. BS EN 1920 Transportable gas cylinders. Cylinders for compressed gases (excluding acetylene). Inspection at time of filling.
16. BS 7671 Requirements for electrical installations. IET wiring regulations.
17. BS EN ISO 11372 Gas cylinders. Acetylene cylinders. Filling conditions and filling inspection.
18. BS EN ISO 11621 Gas cylinders. Procedures for change of gas service.
19. BS EN ISO 13088 Gas cylinders. Acetylene cylinder bundles. Filling conditions and filling inspection.
20. BS EN 13096 Transportable gas cylinders. Conditions for filling gases into receptacles. Single component gases.
21. BS EN 13099 Transportable gas cylinders. Conditions for filling gas mixtures into receptacles.
22. BS EN 13365 Transportable gas cylinders. Cylinder bundles for permanent and liquefied gases (excluding acetylene). Inspection at time of filling.
23. BS EN ISO 24431 Gas cylinders. Seamless, welded and composite cylinders for compressed and liquefied gases (excluding acetylene). Inspection at time of filling.

24.	BCGA Code of Practice 4	Industrial gas cylinder manifolds and gas distribution pipework (excluding acetylene).
25.	BCGA Code of Practice 32	The safe filling of beverage gas cylinders.
26.	BCGA Code of Practice 35	Filling ratios and developed pressures for liquefied and compressed gases.
27.	BCGA Code of Practice 39	In-service requirements of pressure equipment (gas storage and gas distribution systems).
28.	BCGA Code of Practice 44	The storage of gas cylinders.
29.	BCGA Guidance Note 3	Safe cylinder handling and the application of the manual handling operations regulations to gas cylinders.
30.	BCGA Guidance Note 11	The management of risk when using gases in enclosed workplaces.
31.	BCGA Guidance Note 23	Gas safety. Information, instruction and training.
32.	BCGA Guidance Note 36	Guidance for the use, inspection and transport of cylinders with various design codes.
33.	BCGA Technical Information Sheet 6	Gas cylinder identification. Label and colour code requirements.
34.	BCGA Technical Information Sheet 13	Gas cylinders. Decanting gases.
35.	BCGA Technical Information Sheet 38	Moving gas cylinders and bundles within the workplace.
36.	BCGA Technical Information Sheet 43	Gas cylinder filling. Audit.
37.	EIGA Training Package 51	Prefill inspection of gas cylinders
38.	EIGA Document 23	Safety training of employees.

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| 39. | EIGA Document<br>39          | The safe preparation of gas mixtures.   |
| 40. | EIGA Document<br>61          | Safe use of gas cylinders in marine service.  |
| 41. | EIGA Document<br>78          | Leak detection fluids. Cylinder packages.   |
| 42. | EIGA Document<br>83          | Recommendations for safe filling of CO <sub>2</sub> cylinders and bundles.                    |
| 43. | EIGA Document<br>86          | Gas cylinders and valves with restricted use in the EU.                                       |
| 44. | EIGA Document<br>95          | Avoidance of failure of CO and of CO / CO <sub>2</sub> mixtures cylinders.                    |
| 45. | EIGA Document<br>99          | Good manufacturing practice guide for medicinal gases.  |
| 46. | EIGA Document<br>110         | Environmental impacts cylinder filling plants.  |
| 47. | EIGA Document<br>123         | Code of practice. Acetylene.  |
| 48. | EIGA Document<br>129         | Pressure receptacles with blocked or inoperable valves.                                       |
| 49. | EIGA Document<br>136         | Selection of personal protective equipment  |
| 50. | EIGA Document<br>139         | Safe preparation of compressed oxidant-fuel gas mixtures in cylinders.                        |
| 51. | EIGA Document<br>182         | Pre-fill inspection of customer owned cylinders   |
| 52. | UKLPG Code of<br>Practise 12 | Recommendations for safe practice in the design and operation of LPG cylinder filling plants. |

Further information can be obtained from:

UK Legislation	<a href="http://www.legislation.gov.uk">www.legislation.gov.uk</a>
Health and Safety Executive (HSE)	<a href="http://www.hse.gov.uk">www.hse.gov.uk</a>
British Standards Institute (BSI)	<a href="http://www.bsigroup.co.uk">www.bsigroup.co.uk</a>
European Industrial Gases Association (EIGA)	<a href="http://www.eiga.eu">www.eiga.eu</a>
International Organization for Standardization (ISO)	<a href="http://www.iso.org">www.iso.org</a>
British Compressed Gases Association (BCGA)	<a href="http://www.bcgaco.uk">www.bcgaco.uk</a>
The UK LPG trade association (UKLPG)	<a href="http://www.uklpg.org">www.uklpg.org</a>



**British Compressed Gases Association**

[www.bcgga.co.uk](http://www.bcgga.co.uk)