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CODE OF PRACTICE 47

The safe use of individual portable or mobile cylinder gas supply equipment

Revision 2: 2024

CODE OF PRACTICE 47

THE SAFE USE OF INDIVIDUAL PORTABLE OR MOBILE CYLINDER GAS SUPPLY EQUIPMENT

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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 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, 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 3. This document replaces BCGA Code of Practice 47, Revision 1: 2018. It was approved for publication at BCGA Technical Committee 171. This document was first published on 04/12/2024. For comments on this document contact the Association via the website www.bcga.co.uk.

JOIN US: BECOME A BCGA MEMBER

The *British Compressed Gases Association* (**BCGA**) is the leading UK Trade Association representing the interests of the industrial, food and medical gases industries, whose members include manufacturers and suppliers of liquefied, dissolved and compressed gases in a wide variety of containers, including cylinders, tubes, tanks, etc., as well as the associated gaseous pressure systems, pipework, components and related equipment. Members also provide specialist safety, health, environment, quality, inspection and training services.

There are currently three categories of BCGA Membership designed to reflect the needs of the gases industry. These are:

Full Membership

For companies or individuals who have any practical involvement in the manufacture, mixing, handling, sales, distribution, storage or transportation of industrial, food and medical related gases or equipment.

Associate Membership

For companies or individuals who have no practical involvement (as noted in Full Membership), and is therefore for designers, consultants, training providers, academics, interested individuals involved with the industry, other associations or simply those that regularly use gases in their work environment.

Start-up Scheme

The start-up scheme is designed to support young companies, who are in the early years of their business, working in the gases industry.

As a member you'll have access to a wide variety of benefits and services to help you develop your company including:

- Certificate of Membership;
- Information about all the latest news and updates in our industry;
- The opportunity to influence oncoming regulation and guidance produced by Government;
- The opportunity to be involved in developing standards (BS EN ISO) for our industry;
- The opportunity to shape the future direction of our industry;
- Technical advice;
- Interaction with other members;
- The right to attend any of our Technical Sub-Committees;
- Access to all BCGA publications;
- The opportunity to be involved in writing BCGA publications;
- Being able to attend the BCGA Conference at Member rates;
- Appropriate listings on the BCGA website;
- Use of BCGA logo.

Becoming a BCGA member couldn't be easier. Simply download and fill in the membership application and turnover declaration forms on our website, under '**Membership**'.

If you have any questions email: admin@bcga.co.uk

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Where websites and webpages have been cited, they are provided for ease of reference and are correct at the time of publication. The location of a website and webpage, and their contents, cannot be guaranteed. BCGA is not responsible for the content of referenced websites.

TERMINOLOGY AND DEFINITIONS

Composite safety device (Flashback arrestor)	A unit which embodies a flame arrestor, a non-return valve and either one or more of these devices: • Temperature sensitive cut-off valve • Pressure sensitive cut-off valve
Bundle (of cylinders)	A pressure receptacle comprising an assembly of cylinders or cylinder shells 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 shall be limited to 1000 litres water capacity.
Confined space	Any place, including room, chamber, tank, vat, silo, pit, trench, pipe, sewer, flue, well, or other similar space in which, by virtue of its enclosed nature, there arises a reasonably foreseeable specified risk. It has two defining features: 1. It is a place which is substantially, (though not always entirely) enclosed. 2. There will be a reasonably foreseeable risk of serious injury from; flammable or toxic atmosphere, oxygen deficient or enriched oxygen atmosphere. (as defined in the *Confined Spaces Regulations* [3])
Cylinder	A pressure receptacle of a water capacity not exceeding 150 litres. NOTE: This includes the gas cylinder, the valve and all accessories permanently fitted to the gas cylinder.
Flame arrestor	A device which arrests a flame front (caused by flashback or decomposition) and which is suitable for the most severe type of flame which may occur, i.e. detonation. NOTE: This is also known as a decomposition blocker.
Flow meter	A device for measuring gas flow by volume or mass per unit time.
Hose assemblies	The means by which the gases are conveyed from the regulator to the blowpipe.
May	Indicates an option available to the user of this Code of Practice.
Non-return valve	A self-actuating valve which prevents the passage of gas in the opposite direction to the normal gas flow. Specifically, a non-return valve shall be effective against the return of gas towards the cylinder.

Pressure	Within this Code of Practice the ‘bar’ is used as the unit of pressure. 1 bar = 100 kPa = 10^5 N/m^2 = 14.5 lbf/in^2 Pressures used are gauge pressures except where otherwise stated.
Pressure receptacle	A transportable receptacle intended for holding substances under pressure including its closure(s) and other service equipment and is a collective term that includes cylinders, tubes, pressure drums, closed cryogenic receptacles, metal hydride storage system, bundles of cylinders and salvage pressure receptacles.
Pressure regulator	Fitted to the outlet of the gas cylinder valve, the pressure regulator reduces the pressure of the gas from the cylinder pressure to the lower pressure required for the operation of the process equipment.
Pressure relief valve	A valve, which automatically vents gas to the atmosphere in order to prevent a build-up of pressure in a system when the pressure exceeds a predetermined value. The pressure relief valve automatically reseats when the conditions causing the over-pressure are corrected.
Pressure sensitive cut-off device	A valve which automatically stops the gas flow in the event of a slow or sudden back-pressure from the downstream side of the cut-off valve. The valve remains closed until manually reset.
Safety device	A device which, when correctly used and placed, prevents any damage or injury from misuse or malfunction of the blowpipe or associated equipment.
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.
Specialty gas	A gas with a defined purity level (typically N5.0 and above), or whose properties include being pyrophoric, toxic or corrosive.
Temperature sensitive cut-off device	A device which stops the gas flow when a predetermined temperature is reached.
Valve with integrated pressure regulator (VIPR)	A device intended to be permanently fitted to a gas cylinder connection and comprising a shut-off valve system and a pressure reduction system.
Working pressure (for a gas cylinder)	The settled pressure of a compressed gas at a reference temperature of 15 °C in a full pressure receptacle. NOTE: This is the ADR [15] definition which refers to the fill pressure inside the cylinder.

CODE OF PRACTICE 47

THE SAFE USE OF INDIVIDUAL PORTABLE OR MOBILE CYLINDER GAS SUPPLY EQUIPMENT

1. INTRODUCTION

This Code of Practice has been prepared by the *British Compressed Gases Association* (BCGA) to provide best practice for the safe use of individual portable or mobile gas supplies, each gas being supplied from a cylinder or bundle and individually controlled by a pressure regulator.

Gas cylinders are designed and constructed to safely contain a gas under pressure. Used with the correct downstream pressure equipment they provide an efficient and effective means of delivering a gas to the end process.

Due to the properties of gases, compliance will be required with the *Health and Safety at Work etc. Act* [1], and its associated legislation. Refer to Section 4.

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

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 industry associations.

2. SCOPE

This Code of Practice gives a guide to minimum safety standards required for the assembly, storage, handling, preparation for use, examination, inspection and maintenance of individual portable or mobile cylinder gas supply pressure equipment, the gas being controlled by a single cylinder mounted pressure regulator, which is used to deliver the gas(es) to downstream equipment.

This guide covers any industry or process where single gas cylinders or bundles are in use, such as industrial, scientific and academic establishments, etc.

As examples, the gases covered can include argon, nitrogen, helium, oxygen, hydrogen, nitrous oxide, acetylene, liquefied petroleum gas (LPG), methane, carbon dioxide and mixtures of these gases.

This Code of Practice only covers the gas delivery equipment. For downstream process equipment the user should refer to the manufacturer's / supplier's instructions for the use of that equipment. The user shall ensure compatibility between the downstream process equipment and the gas delivery equipment.

For further information on:

- food grade gases, refer to BCGA Guidance Note (GN) 30 [52], *The safe use of gases in the beverage dispense industry*, and appropriate industry documents;

- specialty gases, refer to BCGA Code of Practice (CP) 18 [42], *Gas supply and distribution systems. Specialty gases*.

This Code of Practice excludes:

- medicinal gases, where compliance is required with the appropriate medical legislation;

- oxy-fuel equipment, where best practice is available in BCGA CP 7 [41], *The safe use of oxy-fuel gas equipment (individual portable or mobile cylinder supply)*.

It does not apply to installed gas supply and distribution systems which are covered in:

- BCGA CP 4 [39], *Gas supply and distribution systems (excluding acetylene)*;

- BCGA CP 5 [40], *Gas supply and distribution systems. Acetylene;*

- BCGA CP 18 [42], *Gas supply and distribution systems. Specialty gases*.

- BCGA CP 39 [44], *In-service requirements of pressure equipment (gas storage and gas distribution systems)*.

3. LEGISLATION

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

There are several Regulations that are relevant to the use of pressure equipment.

The Management of Health and Safety at Work Regulations [5], require employers to carry out risk assessments for their workplace activities and to put in place appropriate controls.

The Provision and Use of Work Equipment Regulations (PUWER) [4], which requires that work equipment should not result in health and safety risks, regardless of its age, condition or origin. The PUWER [4] requires that the employer selects suitable equipment and carries out appropriate maintenance, inspection, identifies any specific risks and provides suitable information, instructions and training.

The HSE provide further guidance on the PUWER [4] within HSE L22 [18], *Safe use of work equipment. Provision and Use of Work Equipment Regulations 1998. Approved Code of Practice and guidance*.

The *Pressure Equipment (Safety) Regulations* [14], which apply to the design, manufacture and conformity assessment of pressure equipment and assemblies of pressure equipment, with a maximum allowable pressure above 0.5 bar.

The *Pressure Systems Safety Regulations* (PSSR) [6], cover the safe design and use of pressure systems. The aim of PSSR [6] is to prevent serious injury from the hazard of stored energy (pressure) as a result of the failure of a pressure system or one of its component parts. It covers all pressure equipment operating above 0.5 bar. The PSSR [6] requires such equipment to be examined and maintained. The primary responsibility for compliance with these regulations lies with the user of the pressure equipment and it is the users' responsibility to enlist any assistance required to comply with the Regulations.

The HSE provide guidance in HSE L122 [21], *Safety of pressure systems. Pressure Systems Safety Regulations 2000. Approved Code of Practice and guidance*. This guidance specifies that owners and users, in consultation with a competent person, have to decide if a Written Scheme of Examination is required (HSE L122 [21], Clause 113). However, if a Written Scheme of Examination is not required, it is emphasised that such equipment will still require inspection and maintenance to comply with PUWER [4].

The Construction (Design and Management) Regulations (CDM) [13] govern the way construction projects of all types and sizes are planned and may apply in some circumstances. For further information refer to HSE L153 [23], *Managing health and safety in construction. Construction (Design and Management) Regulations 2015. Guidance on Regulations.*

The *Dangerous Substances and Explosive Atmospheres Regulations* (DSEAR) [9] require employers to control the risks to safety from fire, explosions and substances corrosive to metals. DSEAR [9] places a formal requirement on employers to assess the risks for substances if classified for these properties and put in place suitable controls. Guidance is available in:

- BCGA GN 13 [50], *DSEAR risk assessment guidance for compressed gases*.

- HSE L138 [22], *Dangerous substances and explosive atmospheres. Dangerous Substances and Explosive Atmospheres Regulations 2002. Approved Code of Practice and guidance*.

- HSE INDG 370 [24], *Controlling Fire & Explosion risks in the workplace. A brief guide to DSEAR*.

The Control of Substances Hazardous to Health (COSHH) *Regulations* [8], requires employers to adequately control exposure to materials in the workplace that cause ill health. For further information refer to HSE L5 [17], *Control of substances hazardous to health. The Control of Substances Hazardous to Health Regulations 2002 (as amended). Approved Code of Practice and guidance*.

The *Confined Spaces Regulations* [3], require employers to conduct risk assessments for any activity which may take place in a confined space where there is the potential for serious injury. For further information, refer to HSE L101 [20], *Safe work in confined spaces. Confined Spaces Regulations 1997. Approved Code of Practice and guidance*

The *Regulatory Reform (Fire Safety) Order* [10]. This requires that a responsible person shall carry out a Fire Safety Risk Assessment for the workplace. This shall include an assessment of the impact from the use of a pressure system and its associated gas source. The findings from the risk assessment shall be incorporated into the Site Fire Safety Management Plan. Appropriate fire-control and other risk management measures, as determined by the Fire Safety Risk Assessment, shall be provided;

The *Carriage of Dangerous Goods and Use of Transportable Pressure Equipment Regulations* [11], which implements the *Agreement Concerning the International Carriage of Dangerous Goods by Road* (ADR) [15], is applicable for individual gas cylinders and bundles, including their valves and permanently fitted accessories. This legislation governs safe filling, transport, inspection and maintenance requirements. The owner of the gas cylinder or bundle, who is normally the gas supplier, is responsible for compliance.

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. If the label is not present, the gas cylinder shall not be used; it shall be returned back to the gas supplier.

Safety Data Sheets provide detailed information on the properties of a gas as well as advice on handling and storage. They can be obtained from the Gas Supplier for all gases. They shall be available for the user of the gas.

All gases have their hazards. The *Control of Substances Hazardous to Health* (COSHH) Regulations [8] requires that a risk assessment is conducted where exposure to any hazardous substance may occur.

The use of gases, gas cylinders and associated equipment requires a suitable and sufficient risk assessment for the workplace activity being carried out, with appropriate control measures being implemented. Advice on carrying out risk assessment involving gas cylinders is available in BCGA TIS 49 [59], *Risk assessment considerations for activities involving compressed gas cylinders within the workplace*.

BCGA CP 52 [48], *The management of risks from gases in the workplace*, provides advice on the hazards of gases.

If additional information is required, contact the gas supplier for advice.

5. COMPETENCE

All persons shall have the necessary competence (including knowledge, skills and experience) to carry out their job safely. They shall receive appropriate information, instruction, training and supervision. This should include induction and refresher sessions, as required. It is the duty of the Employer to ensure their persons are competent. It is recommended that a training programme with a competency assessment is carried out under a formalised system. Records shall be kept of the information, instruction, training and supervision provided and of the competence level achieved.

General recommendations for the training of personnel are described in *European Industrial Gases Association* (EIGA) 23 [62], *Safety training of employees*. BCGA GN 23 [51], *Gas safety. Information, instruction and training*, provides guidance on the minimum knowledge required for the safe interaction of personnel with industrial, food and medical gases.

6. EXAMINATION, INSPECTION AND MAINTENANCE

For individual gas cylinders, the owner, who is normally the gas supplier, has responsibility for inspection and maintenance. In the case of gas cylinders fitted with a valve with an integral pressure regulator (VIPR), the responsibility for the serviceability of the VIPR is also with the owner of the cylinder. If there are any queries over the inspection, maintenance or serviceability of a gas cylinder or its permanently fitted valve and accessories, then contact the owner of the cylinder for advice.

To ensure all other pressure equipment remains safe and serviceable throughout its operational life it shall be subject to regular examination, inspection and maintenance. All examination, inspection and maintenance shall take into account the manufacturer's / supplier's recommendations. Such a regime shall ensure pressure equipment complies with PUWER [4] and PSSR [6]. For further information, refer to Section 3 and BCGA CP 39 [44].

PUWER [4] requires that work equipment, that is in-service, is inspected and maintained at regular intervals to ensure that it is safe for continued use and remains in good repair regardless of its age, condition or origin.

PSSR [6] requires that the owner of a mobile system (which does not include the gas cylinders, as these are managed under the *Carriage of Dangerous Goods and Use of Transportable Pressure Equipment Regulations* [11]), shall ensure that the system is properly maintained in good repair, so as to prevent danger. PSSR [6] requires that pressure systems undergo a thorough examination in accordance with a Written Scheme of Examination, unless a specific exclusion applies.

The need for a Written Scheme of Examination shall be formally assessed in accordance with the PSSR [6], Regulation 8. HSE guidance is that owners and users, in consultation with a competent person, have to decide if a Written Scheme of Examination is required. HSE provide an example of a portable oxy-fuel gas welding set being unlikely to require a written scheme of examination (HSE L122 [21], Clause 113). However, it is emphasised that equipment used in pressure systems will still require inspection and maintenance to comply with PUWER [4].

Where assessment of the potential risk of using pressure equipment results in recognition that injury could result from a failure of the system, then a Written Scheme of Examination shall be drawn up by a Competent Person, as defined in the PSSR [6]. Such a Scheme may use the information in Appendix 1, provided it includes information about the nature and frequency of the required examination of all protective devices and parts of the system where a defect would give rise to danger. Where a Written Scheme of Examination is implemented for the equipment, written records shall be maintained by the User covering the Scheme itself and the records of examinations carried out by the Competent Person under the Scheme.

It is the duty of the employer to ensure persons undertaking examination, inspection or maintenance activities are competent to do so. Refer to Section 5.

Appendix 1 provides guidance on recommended examination, inspection and maintenance requirements for typical pressure equipment used in the gas delivery pressure system.

The following checks shall be carried out:

- An '*assembly*' check. To be carried out when assembling the equipment.

  The equipment shall be assembled in accordance with the manufacturer's instructions. Check during and after assembly. Check that all the required components are fitted,

they are suitable for the service, they are installed in the correct order and any required maintenance activities have been completed. A visual inspection shall be carried out, for example, for correct assembly, compatibility with the gas, suitable pressure rating, direction of flow, damage, oil, grease or other contamination.

- A '*before use'* inspection check. To be carried out by the user prior to the use of the equipment. The purpose being to check the equipment is serviceable and ready to use.

Typically, a visual examination to determine that all required components are present and their suitability for service, for example, gas, pressure rating, damage, oil, grease or other contamination, and, where appropriate, that the relevant equipment is in-date to the manufacturer's specification.

Any damaged, contaminated or out-of-date equipment shall not be used. This equipment shall be replaced.

- An '*after use'* inspection check. To be carried out by the user on completion of use of the equipment. The purpose being to check that any faults that occur in-service are rectified or reported / recorded.

Any damaged or contaminated equipment should be replaced where the system will be required for a period of further use.

- A '*thorough'* inspection. A competent Independent Safety Inspector shall carry out a thorough inspection at suitable intervals, typically annually. Aside from the time interval, other factors may prompt a thorough examination, such as time-in-use, incidents or near misses, observed defects, external events, supplier's safety alerts, issues with similar equipment, etc.

The Independent Safety Inspector should not be involved in the day-to-day management of the equipment to be inspected. Guidance on carrying out a thorough inspection and the competence of an Independent Safety Inspector is available in BCGA GN 44 [54], *Portable or mobile cylinder gas equipment. Thorough inspection*.

- An *'examination'* where required by, and in accordance with, a Written Scheme of Examination. To be carried out by a Competent Person in accordance with PSSR [6].

BCGA do not support refurbishment of components, such as regulators, by the user. The user should obtain replacement components. If refurbishment is necessary, then the component should be returned to the manufacturer for refurbishment to take place.

7. CYLINDER STORAGE AND HANDLING

All persons involved in the storage and handling of gas cylinders shall be competent to do so. Refer to Section 5.

For the storage of gas cylinders, refer to Section 7.1.

For manual handling activities involving gas cylinders, refer to Section 7.2.

There are specific regulations for transporting gas cylinders, refer to Section 7.3.

7.1 Cylinder storage

Gas cylinders and cylinder bundles shall be stored in accordance with BCGA CP 44 [46], *The storage of gas cylinders*, which defines the principles of safe practice for storage.

All gas cylinder stores should follow these basic principles:

- be well-ventilated;
- be outdoors (if a store is in any location other than outdoors, then additional controls are required);
- have adequate security (to manage access to the store);
- meet the required separation distances. Refer to BCGA GN 41 [53], *Separation distances in the gases industry*.

In storage, the valves on all individual cylinders shall be closed and any additional equipment removed.

BCGA CP 44 [46] allows the storage of an assembled mobile gas supply system. At the end of the working day, or when not required for use, each mobile gas supply system shall be stored in a dedicated space, ensuring the gas cylinder valve is closed. In this circumstance, additional equipment may remain connected, for example, hoses, safety devices, etc. These may be kept stowed around the handles of the trolley but shall not be coiled around the gas cylinder.

7.2 Cylinder handling

Gases supplied in cylinders can be in compressed, liquefied or dissolved form. Cylinders vary in weight, size and shape. These physical characteristics present potential manual handling hazards. Appropriate risk assessment, training and handling aids are required.

The *Manual Handling Operations Regulations* [2] require that before any manual handling takes place a risk assessment of manual handling operations is conducted and suitable and appropriate controls implemented. Manual handling operations shall only be carried out by competent persons, refer to Section 5. Wherever practicable the operation should be mechanised, or suitable handling aids provided.

BCGA GN 3 [49], *Gas cylinder. Manual handling operations*, defines the principles of safe practice for handling and moving cylinders and provides a basic understanding of the *Manual Handling Operations Regulations* [2] relating to gas cylinders.

7.3 Cylinder transportation

The transportation of any gas cylinder shall comply with the *Carriage of Dangerous Goods and Use of Transportable Pressure Equipment Regulations* [11].

BCGA provide advice for transporting gas cylinders in BCGA CP 50 [47], *The carriage of gas cylinders on vehicles*, additional advice is provided in BCGA Leaflet 1 [60], *The carriage of small quantities of gas cylinders on vehicles*.

Where gas cylinders are transported in mobile workshops and other specialist vehicles refer to BCGA CP 31 [43], *The safe storage and use of cylinders in mobile workshops and service vehicles*.

8. EQUIPMENT

A simple gas delivery pressure system, connected to the gas source (a portable or mobile gas cylinder or bundle), will consist of a pressure regulator, safety devices, such as a non-return valve, and a flexible hose assembly which will supply the output from the pressure regulator to the process equipment.

Where this pressure system is installed in a static installation, long lengths of flexible hose are required on a regular basis or there is a requirement to connect into a vent system, the workplace risk assessment shall assess the alternative use of a permanent gas supply and distribution system in accordance with BCGA CP 4 [39].

Where a gas delivery pressure system is designated as a temporary solution, this should be for a reasonable defined period. If this period of time is exceeded, then the workplace risk assessment shall assess the alternative use of a permanent gas supply and distribution system in accordance with BCGA CP 4 [39].

Where the pressure system is assembled as a mobile gas supply system, for example, mounted on a trolley, refer to Section 7.1.

Always refer to the manufacturers' / suppliers' instructions for the correct and safe use of all equipment and materials used.

All equipment should conform to appropriate standards.

Any modifications, changes or repairs to gas equipment should only be carried out by the manufacturer and shall be done by a competent person. On completion of any modifications, changes or repairs, the gas equipment shall be retested to ensure integrity and functionality are within manufacturer's original specification.

All components should be selected so they connect directly to each other without the need for interim components such as adaptors.

All equipment which is in contact with a gas shall be compatible with that gas. For example, information on compatibility is available in:

- BS EN ISO 11114 [36]. *Transportable gas cylinders. Compatibility of cylinder & valve materials with gas contents. Part 1, Metallic materials. Part 2, Non-metallic materials.*

Only equipment designed and cleaned for oxygen service shall be used with oxygen to ensure that safe operating conditions are met. Equipment not marked for oxygen service shall not be used with oxygen. Oxygen equipment shall only be used in oxygen service.

High purity gases require components which are manufactured and cleaned to meet the requirements of the purity levels. Equipment and component choice should reflect the integrity requirements of the User process. The use of lower specification components will compromise the quality of the final process!

The *Acetylene Safety (England and Wales and Scotland) Regulations* [12] require that any equipment used for acetylene shall be designed and marked for that purpose.

Under no circumstances shall oil and grease be used on components in gas service. When installing or connecting equipment ensure hands are free from oil and grease. If hands have

been cleaned using an alcohol gel, make sure that it has fully evaporated before handling components. Where barrier creams are applied, use only those that are water based.

Specialist jointing tape may be used by some manufacturers of gas equipment. However, jointing tape should not be used by end-users. If equipment is worn or leaking, replace it. The equipment provider or gas supplier can provide further advice.

Equipment is generally marked and identified to show the gas service it has been designed for and the service for which it is intended. However, some gas equipment is manufactured to a specification which is suitable for multiple gas use and is labelled as such. Once equipment is placed in-service with one gas, it is best practice that it stays in that gas service for the remainder of its life.

Most gas components are given a service life. Refer to the manufacturer / supplier to determine the life of equipment. BCGA TIS 18 [56], *Date marking of gas accessories*, provides information on some of the equipment marking schemes used by manufacturers. Where no date is able to be determined, then typically the life of the component should be limited to 5 years from the date of purchase from the supplier. This service life will be dependent on the conditions of service in which the component is used, as this may reduce the service life. Components used in specialty gas systems may be subject to reactions with the gases that they are controlling, which may require more frequent replacement. For example, service lives for components in corrosive service are significantly reduced, compared to non-corrosive gases.

Gas equipment shall not be marked with a conformity assessment mark (i.e. a UKCA or CE mark), where it is manufactured in compliance with sound engineering practice.

Guidance on examination, inspection and maintenance is available in Appendix 1.

When selecting a pressure regulator, refer to Section 8.1. For assembling a pressure regulator into a pressure system, refer to Section 9.6.

When selecting safety devices, refer to Section 8.2. For assembling safety devices into a pressure system, refer to Section 9.7.

When selecting hose assemblies, refer to Section 8.3. For assembling a hose assembly into a pressure system, refer to Section 9.8.

8.1 Pressure regulator

Fitted to the gas cylinder valve outlet, or bundle valve outlet, the pressure regulator reduces the pressure of the gas from the cylinder pressure to the lower pressure required for the operation of the process equipment.

Pressure reduction within the regulator may be in one or two stages (single or two stage regulators).

A pressure regulator shall:

- be constructed using materials which are compatible with the gas service;
- be compatible and suitable for the quality and purity requirements of the gas service;

- be designed for the supply and system pressure; Do not select a regulator, where the cylinder pressure will be higher than that for which the regulator is designed and labelled.

- be designed to provide the delivery pressure or required pressure range;

- be designed to meet the accuracy requirements of the delivery pressure;

- provide the required flow range.

Regulators for gas welding equipment, up to a maximum of 20 bar outlet pressure, shall conform to:

- BS EN ISO 2503 [29], *Gas welding equipment. Pressure regulators and pressure regulators with flow-metering devices for gas cylinders used in welding, cutting and allied processes up to 300 bar (30 MPa);* or

- BS EN ISO 7291 [33], *Gas welding equipment. Pressure regulators for manifold systems used in welding, cutting and allied processes up to 30 MPa (300 bar)*.

Regulators to BS EN ISO 7291 [33], shall be used in Class 4 mobile installations for bundles, as defined in BCGA CP 5 [40].

Valves with an integrated pressure regulator (VIPR) shall conform to:

- BS EN ISO 22435 [38], *Gas cylinders. Cylinder valves with integrated pressure regulators. Specification and type testing*.

Where a regulator is required for alternative gas types, different pressure and quality requirements, not covered by the standards listed above, then consult with the gas supplier, gas equipment supplier or manufacturer of regulators for a suitable design for each individual system.

The regulator outlet pressure shall be suitable for the process equipment.

Regulators may be supplied with a pressure gauge or indicator to show the internal gas pressure and a pressure gauge or flow meter to indicate the outlet pressure or flow.

All regulators shall be selected so they connect directly to the valve outlet without the need for interim components or adaptors.

Cylinder valve outlets have either a top outlet or a side outlet. Select an appropriate regulator for the cylinder to which it will be connected, i.e. one designed for either a top outlet or a side outlet connection. BCGA TIS 29 [58], *Oxy-fuel gas equipment. Selection and assembly*, provides guidance on fitting a regulator to a cylinder.

The following information should be clearly and permanently marked on the regulator body or cover:

- gas service. The gas service is usually identified by the manufacturer. Where there is an option to install a regulator which is able to be used on a variety of gases, the user should mark the gas service on the regulator at first use;

- maximum inlet pressure;
- maximum outlet pressure;
- the name or trademark of the manufacturer and / or distributor;
- a date mark showing either the date of manufacture or a date when the regulator is to be replaced or refurbished. Refer to BCGA TIS 18 [56].

When the regulator is not in use, the pressure-adjusting screw shall be set to the zero-pressure position by turning the pressure adjustment control knob fully anti-clockwise.

Pressure regulators should be treated as precision instruments and should not be jarred or knocked.

Whether they are in store or in use, pressure regulators shall be kept free of dust, debris, oil, grease, solvents or any other contaminants. When not in use, protective covers should be used to protect the gas ports. Regulators which are contaminated, damaged or life-expired shall not be used.

When preparing a pressure regulator for use, refer to Section 9.6.

8.2 Safety devices

The incorporation of safety devices shall in no way be considered to be a substitute for safe operating procedures.

Each pressure system may require the fitment of appropriate safety relief devices, such that the pressure system shall not give rise to danger, for example, through over pressurisation. Compliance may be required with PSSR [6], refer to Section 3.

Safety devices shall conform to an appropriate standard, for example, BS EN ISO 5175 [31], *Gas welding equipment. Safety devices*, and shall be suitable for the required conditions of service (type of gas used, maximum operating pressure and minimum operating flow, etc.).

For use with acetylene, the *Acetylene Safety (England and Wales and Scotland) Regulations* [12] require that a flame arrestor, a non-return valve and a quick-acting shut-off device shall be fitted, which shall be fitted within one metre of the pressure regulator.

NOTE: A pressure sensitive shut-off device is likely to act faster than a temperature sensitive shut-off device.

The risk assessment should take into account the use of a composite safety device to protect the gas cylinder from an ignition.

When preparing a safety device for use, refer to Section 9.7.

8.3 Hose assemblies

The hose assembly provides a flexible connection between the pressure regulator, safety devices and the process equipment. A hose assembly consists of a flexible hose with a hose connection inserted into each end, suitably secured.

The hose assembly shall:

- be suitable for the application, and in compliance with PUWER [4];
- be compatible with the gas with which they are to be used;
- not be used at pressures other than those for which they have been designed;
- as a minimum, be rated for the maximum pressure produced at the outlet of the pressure regulator;
- be as short a length as is reasonably practical for the application.

Where extended hose lengths are intended to be used, the alternative use of a permanent gas supply and distribution system, in accordance with BCGA CP 4 [39], should be considered.

As an alternative to a flexible hose, where short hose lengths are required, flexible small bore metallic tubing may be used. Metallic tubing should be kept to the minimum length necessary.

Hose assemblies shall conform to an appropriate standard, such as:

- BS EN 1256 [27], *Gas welding equipment. Specification for hose assemblies for equipment for welding, cutting and allied processes*.
- ISO 8207 [34], *Gas welding equipment. Specification for hose assemblies for equipment for welding, cutting and allied processes.*

Individual hoses shall conform to an appropriate standard, such as:

- BS EN 1327 [28], *Gas welding equipment. Thermoplastic hoses for welding and allied processes*.
- BS EN ISO 3821 [30], *Gas welding equipment. Rubber hoses for welding, cutting and allied processes*.
- BS EN ISO 14113 [37], *Gas welding equipment. Rubber and plastics hose and hose assemblies for use with industrial gases up to 450 bar (45 MPa)*.

Hose connections are usually fitted with left-hand threads for flammable gases and right-hand threads for oxygen and inert gases. Hose connections shall conform to an appropriate standard, such as:

- BS EN 560 [25], *Gas welding equipment. Hose connections for equipment for welding, cutting and allied processes.*

Hose connections with non-standard threads shall be tested in accordance with BS 1256 [27] or BS EN ISO 14113 [37].

Non return valves shall conform to appropriate standards, such as:

- BS EN ISO 5175-2 [31]. Refer to Section 7.2.

NOTE: Non return valves are often referred to as ‘Hose check valves’.

Quick action couplings shall conform to an appropriate standard, such as:

- BS EN 561 [26], *Gas welding equipment. Quick-action coupling with shut-off valves for welding, cutting and allied processes*.

- BS ISO 7289 [32], *Gas welding equipment. Quick-action coupling with shut-off valves for welding, cutting and allied processes*.

Hose connections shall be secured using suitable clamps, for example, clips or ferrules. Re-usable worm-drive clamps shall not be used to secure hose connections.

Suitable proprietary fittings may used, provided that:

- only the proprietary fittings and associated pipe is used;

- the manufacturer’s instructions for use are followed;

- the manufacturer’s recommended tools are used;

- persons are appropriately trained and are competent to use the tools and fittings.

Where a hose assembly comes pre-installed on process equipment, for example, a *metal inert gas* (MIG) welding machine, the manufacturer’s instructions are to be followed. The choice of hose or equipment is the responsibility of the manufacturer. If the hose assembly requires replacement:

- replace with hose or equipment that meets the specification required by the manufacturer and the requirements of this document or BCGA CP 7 [41], as applicable, or

- if the hose assembly is provided separately, then it should meet the requirements of this document or BCGA CP 7 [41], as applicable.

Hoses may have identification marks and may be colour coded. Refer to Table 1 and BS EN ISO 3821 [30].

Hose lengths shall be kept to the minimum necessary. Where greater lengths are needed only occasionally, extension hoses, connected by means of hose couplers conforming to BS EN 560 [25] can be used. The extension being dismantled when the need for it has passed.

WARNING: Copper pipe or copper fittings shall not be used to couple hoses carrying acetylene. Certain metals, including copper, can form compounds (acetylides) with acetylene under certain conditions that even in small quantities may explode when subjected to friction or shock. Guidance on the compatibility of materials with acetylene is available in BCGA CP 5 [40].

The good condition of the hose is of vital importance to safety. Hoses shall be protected from heat, mechanical damage, traffic, sparks, hot splatter, slag and oil or grease. Always discard hoses when the general condition shows signs of deterioration.

Localised repairs should not be carried out. Where a repair is carried out, then the hose shall, as a minimum, meet the specification set by the Manufacturer. The correct style of hose-splicer and associated fittings shall be fitted. Any repair should ensure there is no significant difference in the length or diameter of either of the hoses. Following a modification or repair the hose assembly shall be re-tested and certified by a competent person to BS EN 1256 [27]. Following any local repairs, the Owner of the hose will assume full responsibility for its fitness for service.

Following any repair, carry out a leak detection test. Where a liquid based leak detection fluid is used, ensure that it is free of ammonia. For information on leak detection fluids refer to EIGA 78 [63], *Leak detection fluids cylinder packages*.

Gas	Hose colour	Thread
Oxygen	Blue	Right hand
Inert gases (compressed air, nitrogen, argon and carbon dioxide)	Black	Right hand
LPG, methane, natural gas and MPS[2]	Orange	Left hand
Acetylene, hydrogen[1] and other flammable gases (excludes LPG, methane, natural gas & MPS)	Red	Left hand
Universal fuel gases (included in this table)	Red / orange	Left hand
NOTE: 1. The manufacturer shall be consulted on the suitability of the hose for use with hydrogen. 2. Methylacetylene-propadiene mixtures		

Table 1: Hose assemblies – colours and threads.

When preparing a hose assembly for use refer to Section 9.8.

9. PREPARATION FOR USE

All gases have their hazards. Where gases are in use a suitable and sufficient risk assessment shall be carried out, with the appropriate controls being implemented. Advice on carrying out risk assessments involving gas cylinders is available in BCGA TIS 49 [59].

Following risk assessment, as required, the appropriate personal protective equipment shall be provided and worn, refer to Section 9.1.

Where gases are on-site and in use, a responsible person shall carry out a Fire Safety Risk Assessment, the findings from which shall be incorporated into the Site Fire Safety Management Plan. Refer to Section 9.2.

Should the work area be classified as a confined space, a specific confined space risk assessment shall be carried out in accordance with the *Confined Spaces Regulations* [3]. Any required controls shall be implemented, refer to Section 9.3.

The Control of Substances Hazardous to Health (COSHH) *Regulations* [8] requires employers to either prevent or reduce workers' exposure to substances that are hazardous to their health. For further information, refer to Section 3. For managing the workplace atmosphere, refer to Section 9.4.

All persons handling and using gaseous cylinders and pressure equipment shall be authorised and competent to do so. Refer to Section 5 and Section 7.2.

The supplier or employer of a person who puts into service a mobile system, or components of it, shall provide sufficient information to enable the user of a pressure system to determine how to operate and maintain it safely. This information may be included in the instructions for use supplied to the User or marked on the equipment.

Before a pressure system is put into service there shall be safe systems of work in place, including:

- standard operating procedures, which include instructions for use and safe operating limits, for example, for pressure, temperature, etc.;
- emergency operating procedures, refer to Section 11;
- an examination, inspection and maintenance regime, refer to Section 6.

The correct location of cylinders, correct assembly of equipment and correct operation will all contribute to minimising the risk of an incident involving gas cylinders. For information on:

- the storage, handling and transportation of gas cylinders, refer to Section 7;
- identifying and preparing a cylinder, refer to Section 9.5;
- assembling a pressure regulator, refer to Section 9.6;
- incorporating safety devices, refer to Section 9.7;
- assembling hose assemblies, refer to Section 9.8;
- connection to the process equipment, refer to Section 9.9;
- pressurising the system, refer to Section 9.10;

The person assembling the pressure system shall carry out an ‘assembly’ check in accordance with Section 6.

On completion of the activity, the gas cylinder and associated pressure equipment shall be closed down, following a safe system of work. Refer to Section 10.

9.1 Personal protective equipment

A work activity risk assessment shall determine the requirement for the use of hazard controls, including, where necessary, for personal protective equipment (PPE).

Only after all other levels of control have been determined to be ineffective in controlling risks to a reasonably practicable level, should PPE be considered as a control.

Even with PPE, if the risk is not reduced to as low a level as is reasonably practicable, then the activity shall not proceed.

HSE L25 [19], *Personal Protective Equipment at Work,* provides guidance on the *Personal Protective Equipment Regulations* [7]. EIGA 136 [64], *Selection of personal protective equipment*, provides guidance for selecting and using PPE at work.

Where PPE is required, a PPE assessment shall be carried out in accordance with the *Personal Protective Equipment Regulations* [7]. This shall be carried out by competent persons.

The selection of PPE shall be appropriate for the hazard, task, location and individuals.

PPE shall be provided by the employer, along with the necessary information, instruction, training and supervision for its use. The employer shall ensure that employees wear any PPE required.

Cleaning and maintenance (including its replacement) shall be included in the PPE management system. Suitable storage shall be provided for PPE when it is not in use.

The effectiveness of the PPE shall be reviewed periodically.

Emergency situations may require different or additional PPE.

Users shall take into account the requirements of other applicable Regulations, such as the *Control of Substances Hazardous to Health (COSHH) Regulations* [8], in relation to assessing risks, along with any relevant equipment publications, manufacturers information and the product(s) safety data sheet.

NOTE: Any equipment that has a personal protective function is classified as PPE, for example, a personal atmospheric monitor.

9.2 Fire management

Appropriate fire-control, fire- fighting equipment / facilities and other risk management measures, as identified in the Site Fire Safety Management Plan shall be provided, refer to Section 3;

Oxidant and flammable gases increase the fire risk when on-site and / or in use.

Where there is the potential for a flammable or an explosive atmosphere to occur, a specific risk assessment shall be carried out in accordance with DSEAR [9], with suitable controls put in place. Refer to Section 3.

Where oxy-fuel equipment is in use, refer to BCGA CP 7 [41].

Where hot work on containers is required, refer to BCGA CP 7 [41].

Emergency operating procedures shall be prepared for managing a fire in the workplace. Refer to Section 11.

9.3 Work in confined spaces

The *Confined Spaces Regulations* [3], require employers to conduct risk assessments for any activity which may take place in a confined space where there is the potential for serious injury. Refer to Section 3.

These regulations contain the following key duties:

- avoid entry to confined spaces, for example, by doing the work from the outside;
- if entry to a confined space is unavoidable, follow a safe system of work, for example, through the use of a permit to work system;
- before starting work, put in place adequate emergency operating procedures (including emergency rescue).

The controls required include:

- constant and thorough ventilation. Refer to BCGA CP 52 [48];
- atmospheric monitoring. Refer to BCGA CP 52 [48];
- avoiding taking gas cylinders into a confined space;
- a system of communication;
- personal protective equipment (including for emergency rescue). Refer to Section 9.1.
- emergency operating procedures (including emergency rescue).

9.4 Changes to the workplace atmosphere

The *Control of Substances Hazardous to Health* (COSHH) Regulations [8] requires that a risk assessment is conducted where exposure to any hazardous substance may occur. Each gas has its own particular properties and associated hazards. Refer to Section 4. The safety data sheet will provide specific product information.

The normal oxygen content of the air is approximately 21 %. Any change to the normal atmospheric conditions can create a hazardous situation.

Be aware of the properties of each gas. The HSE provide guidance on Workplace Exposure Limits in HSE EH 40 [16], *Workplace exposure limits*. Not all gases and mixtures of gases are listed, however the effect of asphyxiation is covered within HSE EH 40 [16] as a special case.

Where gases are mixed together, or where combustion takes place, this may generate additional hazards, for example, combustion fumes, which may escape into the local atmosphere.

BCGA CP 52 [48] provides guidance for managing the workplace atmosphere.

9.5 Gas cylinders

Prior to use, check and confirm that the cylinder contains the gas required. The primary method for identifying the gas contents of a cylinder is the label. If the label is defaced or missing the cylinder is not to be used and is to be returned to the gas supplier. Additional information is available on the Safety Data Sheet. Refer to Section 4 and, as necessary, seek further advice from the gas supplier.

As an aid to identification, cylinders may be painted in a specific colour(s). For further information refer to BCGA TIS 6 [55], *Gas cylinder identification. Label and colour code requirements*.

The number of cylinders in the work area should be kept to a minimum. If a cylinder is not required for use, it should be returned to the gas cylinder store. Refer to Section 7.

To aid safe operation it is essential to locate the cylinders in a safe place relative to the work to be carried out. The cylinders should be within view of the operator wherever possible.

The following controls shall be taken into account during the risk assessment:

- the area is well ventilated;
- they are in a secure location where there is managed access only for authorised and competent people;
- they are protected from sources of ignition and excessive heat;
- they are protected from mechanical damage, for example, damage to the cylinders from the process, sparks, slag, etc.;
- they are protected from sources of contamination, for example, from oils, greases, etc.;
- they are protected from electric current, for example, from arc welding processes. Steel floors, structural members or metal benches can carry earth return currents;
- cylinders can be and are secured to prevent toppling. Cylinders are usually designed to be in an upright position.

Before connecting a pressure regulator or any other fitting to the cylinder valve, check the valve is closed, then ensure that the cylinder valve outlet is clean, dry, and free from damage, dirt and contamination. Refer to BCGA TIS 22 [57], *Connecting gas cylinders*.

9.6 Pressure regulator

For information on selecting a pressure regulator refer to Section 8.1.

Before attaching a regulator to a cylinder, check:

(i) the regulator is in a serviceable condition, it is manufactured to the required standard(s) and it is within its service life. The pressure gauges are not damaged, do not show signs of over pressurisation and zero correctly. It has not been modified or tampered with.

(ii) that the gas inside the cylinder is correctly identified and that the regulator is suitable for that specific gas.

(iii) the regulator can be fitted in the correct orientation. This shall include that:

- it is suitable for the cylinder valve outlet, that is either top outlet or side outlet;

- the gauges and controls are positioned so that they are visible and accessible to the operator;

- where a gas cylinder spindle key is required to operate the cylinder valve, the regulator is positioned to allow the valve to be open or closed without the spindle key fouling the regulator.

(iv) Where the gas cylinder is fitted with an open access valve guard, the valve guard shall not be removed to allow a regulator to be fitted. If the regulator is not suitable an alternative regulator shall be sourced.

(v) The regulator inlet connection is free from damage. If a washer or an 'O' ring is fitted to the inlet, check it is serviceable and replace, as appropriate, with a washer or an 'O' ring recommended by the regulator manufacturer. Check the inlet is clean and free of contamination. Refer to BCGA TIS 22 [57].

(vi) that the cylinder valve outlet thread is mechanically compatible with the regulator inlet connection and is undamaged, clean and free of contamination. Adaptors shall not be used. Refer to BCGA TIS 22 [57].

(vii) that the regulator is suitable for the maximum cylinder pressure (regulator inlet pressure).

(viii) the regulator has a suitable outlet pressure for the process equipment. Outlet pressures should not be set in excess of those needed for the operation in hand.

(ix) that the regulator outlet thread is undamaged, clean and free of contamination.

(x) check the cylinder outlet valve and the regulator are closed. The regulator pressure-adjusting screw shall be carefully turned to the zero pressure position by turning the pressure adjustment control knob fully anti-clockwise. Do not use excessive force.

Fit the pressure regulator to the cylinder. Only use the correct sized spanner when attaching a regulator. Do not use any form of jointing paste or sealing tape between the regulator and cylinder valve.

9.7 Safety devices

For information on selecting safety devices, refer to Section 8.2.

When installing safety devices, ensure that all threads and seats are in good condition and are not contaminated. Fit the device in accordance with supplier's instructions.

Ensure the safety device is correctly aligned. Safety devices usually have appropriate text or an arrow indicating the direction of flow.

NOTE: The use of additional safety devices will provide increased safety. However, in such cases, the flow capacity of the system will be less than the rated flow of each individual safety device. Therefore, care should be taken to ensure flow capacity is adequate for the correct and safe use of the equipment in accordance with the supplier's operating instructions.

The *Acetylene Safety (England and Wales and Scotland) Regulations* [12] require that all acetylene mobile systems shall be fitted with a flame arrestor within one metre of the pressure regulator and incorporate a non-return valve and a quick acting shut-off device.

9.8 Hose assemblies

For information on the selection and assembly of hose assemblies, refer to Section 8.3.

Ensure that all threads and seats are in good condition in accordance with manufacturers' / suppliers' instructions. Where a non-return valve is fitted, install the device in the correct orientation such that the direction of flow is correct.

Replace any hose assemblies that are unserviceable or whose condition is in any way unsatisfactory.

When the equipment is in use, the hose assembly should not be coiled around cylinders, regulators or the handle of the trolley.

As necessary, provide protection for the hose assemblies from damage and contamination, for example, heat, mechanical damage, traffic, sparks, hot spatter, slag, oil, grease, etc.

9.9 Connection to process equipment

Process equipment shall:

- be suitable for the application, and in compliance with PUWER [4];
- be compatible with the gas with which it is to be used;
- not be used at pressures other than those for which it has been designed;
- as a minimum, be rated for the maximum pressure produced at the outlet of the pressure regulator.

Check the process equipment inlet connection is free from damage. If a washer or an 'O' ring is fitted to the inlet, check it is serviceable and replace, as appropriate, with a washer or an 'O' ring recommended by the manufacturer. Check the inlet is clean and free of contamination.

Locate and secure the cylinder and associated pressure equipment into their designated position.

Connect to the process equipment. Follow the instructions provided by the supplier of the process equipment. Only use the correct sized spanner when attaching. Do not use any form of jointing paste or sealing tape between the hose assembly and the process equipment.

9.10 Pressurising the system

Before pressurising a system and before first use, carry out a '*before use*' inspection, refer to Section 6.

The opening of a gas cylinder valve shall only be carried out in a well-ventilated space or in a managed space where appropriate controls are in place.

The following procedure should be followed:

(i) Check the pressure regulator(s) and downstream valve(s) are closed.

(ii) **Slowly** open the cylinder valve.

Where the valve is operated by a hand-wheel, open fully and then close a quarter of a turn. This will enable others to distinguish readily between an open and a closed valve.

Where the valve is operated by a gas cylinder spindle key (as approved by the gas cylinder supplier), open the valve and ensure the gas cylinder spindle key is left fitted to the valve.

(iii) Carry out a leak detection test of the high-pressure cylinder fitting.

In the event of a leak, close the cylinder valve and vent off any excess gas. Then check the reasons for leakage, for example, by disassembly, inspection, re-assembly, before re-pressuring and leak testing the system again.

NOTES:

1. Where a liquid based leak detection fluid is used, ensure that it is free of ammonia. For information on leak detection fluids refer to EIGA 78 [63].

2. Where a 'pressure drop test' is carried out to perform leak detection, a minimum of 5 minutes observation is required.

(iv) Adjust the regulator by the pressure adjusting screw, rotate the pressure adjustment control knob clockwise to give the required pressure. Carry out a leak detection test (refer to the NOTES above). Adjust the gas pressure or flow for the required application.

(v) If required, purge the system to establish that the correct gas is present in the system.

During a purge, sufficient time should be allowed to allow ambient gases to be removed from the system and a pure gas to flow. As a guideline, a purge time of three to five seconds for every five metres of hose is usually adequate. Longer times are required for longer hose lengths. Care should be taken when purging gases to prevent the possible creation of an unsafe atmosphere. For further information, refer to BCGA CP 52 [48].

10. CLOSING DOWN PROCEDURE

Close down the process equipment according to the manufacturer's instructions.

To close down the gas delivery equipment:

(i) Close the cylinder valve.

(ii) Vent any residual gas via the process equipment. Where a pressure gauge is fitted, observe the pressure and ensure it reduces to zero.

(iii) The regulator pressure-adjusting screw shall be carefully turned to the zero-pressure position by turning the pressure adjustment control knob fully anticlockwise. Do not use excessive force.

(iv) Close the flow meter valve if fitted.

(v) Ensure the controls on the process equipment are turned to the closed or off position.

On completion of use, the following additional operations should be carried out:

- disconnect and remove the pressure regulator from the cylinder;
- carry out any required examination, inspection or maintenance requirements in accordance with Section 6, including an '*after use*' check;
- return gas cylinders to their store, refer to Section 7. Check that the cylinder valve(s) is closed and that there is no leakage of gas;
- return gas delivery equipment to a safe place of storage, as appropriate fit protective covers. Report any unserviceability.

11. EMERGENCY OPERATING PROCEDURES

Before gas cylinders and their associated pressure system(s) are put into service there shall be safe systems of work in place. These shall include emergency operating procedures.

As identified in the Site Fire Safety Management Plan and in accordance with the fire risk assessment, the user shall have fire-fighting equipment / facilities and a site-specific emergency procedure in place for fire situations in compliance with The *Regulatory Reform (Fire Safety) Order* [10]. Refer to Section 3.

Each site should keep a record of the location of its hazardous store(s), this is to be made available to the emergency services in the event of an incident.

Correct location of cylinders, correct assembly of equipment and correct operation will all contribute to minimising the risk of an incident involving gas cylinders.

If a gas leak occurs and / or ignites (flammable and oxidant gases) in the presence of an operator, if safe to do so, isolate by turning off the cylinder valve.

BCGA Leaflet 6 [61], *Cylinders in fires*, provides guidance on dealing with gas cylinders involved in a fire.

BCGA CP 52 [48] provides advice for managing gases which may be released in the workplace.

Additional information for managing specialty gases is available in BCGA CP 18 [42].

12. SECURITY

Gas cylinders and the gases they contain are hazardous. When not in use they should be located in a secure store, refer to Section 7.1.

When in use at the workplace they should be subject to routine management checks.

A documented security vulnerability risk assessment (SVRA) shall be carried out at each location where gas cylinders are stored or are in use. Refer to BCGA CP 40 [45], *Security requirements for the industrial, medical and food gases industry*.
When gas cylinders are empty, or no longer required, then they should be returned to the gas supplier at the earliest opportunity.

Advice on security can be obtained from BCGA or from local crime prevention officers.

13. REFERENCES

Document Number		Title
1.		The Health and Safety at Work etc. Act 1974.
2.	SI 1992: No 2793	Manual Handling Operations Regulations 1992.
3.	SI 1997: No 1713	The Confined Spaces Regulations 1997.
4.	SI 1998: No. 2306	The Provision and Use of Work Equipment Regulations 1998. (PUWER).
5.	SI 1999: No 3242	The Management of Health and Safety at Work Regulations 1999.
6.	SI 2000: No. 128	The Pressure Systems Safety Regulations 2000 (PSSR).
7.	SI 2002: No 1144	Personal Protective Equipment Regulations 2002.
8.	SI 2002: No 2677	Control of Substances Hazardous to Health Regulations 2002 (COSHH).
9.	SI 2002: No 2776	The Dangerous Substances and Explosive Atmosphere Regulations 2002 (DSEAR).
10.	SI 2005: No. 1541	The Regulatory Reform (Fire Safety) Order 2005.
11.	SI 2009 No. 1348	The Carriage of Dangerous Goods and Use of Transportable Pressure Equipment Regulations 2009 (as amended).
12.	SI 2014: No. 1639	The Acetylene Safety (England and Wales and Scotland) Regulations 2014.
13.	SI 2015: No. 51	The Construction (Design and Management) Regulations 2015 (CDM)
14.	SI 2016 No. 1105	Pressure Equipment (Safety) Regulations 2016 (PESR) (as amended).
15.	UNECE	Agreement concerning the international carriage of dangerous goods by road (ADR) (as amended)

	Document Number	Title
16.	HSE EH 40	Workplace exposure limits.
17.	HSE L5	Control of substances hazardous to health. The Control of Substances Hazardous to Health Regulations 2002 (as amended). Approved Code of Practice and guidance.
18.	HSE L22	Safe use of work equipment. Provision and Use of Work Equipment Regulations 1998. Approved Code of Practice and guidance.
19.	HSE L25	Personal Protective Equipment at Work.
20.	HSE L101	Safe work in confined spaces. Confined Space Regulations 1997. Approved Code of Practice, regulations and guidance.
21.	HSE L122	Safety of pressure systems. Pressure Systems Safety Regulations 2000. Approved Code of Practice.
22.	HSE L138	Dangerous substances and explosive atmospheres. Dangerous Substances and Explosive Atmospheres Regulations 2002. Approved Code of Practice and guidance.
23.	HSE L153	Managing health and safety in construction. Construction (Design and Management) Regulations 2015. Guidance on Regulations.
24.	HSE INDG 370	Controlling Fire & Explosion risks in the workplace. A brief guide to DSEAR.
25.	BS EN 560	Gas welding equipment. Hose connections for equipment for welding, cutting and allied processes.
26.	BS EN 561	Gas welding equipment. Quick-action coupling with shut-off valves for welding, cutting and allied processes.
27.	BS EN 1256	Gas welding equipment. Specification for hose assemblies for equipment for welding, cutting and allied processes.
28.	BS EN 1327	Gas welding equipment. Thermoplastic hoses for welding and allied processes.
29.	BS EN ISO 2503	Gas welding equipment. Pressure regulators and pressure regulators with flow-metering devices for gas cylinders used in welding, cutting and allied processes up to 300 bar (30 MPa).
30.	BS EN ISO 3821	Gas welding equipment. Rubber hoses for welding, cutting and allied processes.
31.	BS EN ISO 5175	Gas welding equipment. Safety devices. Part 1: Devices incorporating a flame (flashback) arrestor. Part 2: Devices not incorporating a flame (flashback) arrestor.

	Document Number	Title
32.	BS ISO 7289	Gas welding equipment. Quick-action coupling with shut-off valves for welding, cutting and allied processes.
33.	BS EN ISO 7291	Gas welding equipment. Pressure regulators for manifold systems used in welding, cutting and allied processes up to 30 MPa (300 bar).
34.	ISO 8207	Gas welding equipment. Specification for hose assemblies for equipment for welding, cutting and allied processes.
35.	BS EN ISO 9090	Gas tightness of equipment for gas welding and allied processes.
36.	BS EN ISO 11114	Transportable gas cylinders. Compatibility of cylinder & valve materials with gas contents. Part 1: Metallic materials. Part 2: Non-metallic materials.
37.	BS EN ISO 14113	Gas welding equipment. Rubber and plastics hose and hose assemblies for use with industrial gases up to 450 bar (45 MPa).
38.	BS EN ISO 22435	Gas cylinders. Cylinder valves with integrated pressure regulators. Specification and type testing.
39.	BCGA Code of Practice 4	Gas supply and distribution systems (excluding acetylene).
40.	BCGA Code of Practice 5	Gas supply and distribution systems. Acetylene.
41.	BCGA Code of Practice 7	The safe use of oxy-fuel gas equipment (individual portable or mobile cylinder supply).
42.	BCGA Code of Practice 18	Gas supply and distribution systems. Specialty gases.
43.	BCGA Code of Practice 31	The safe storage and use of cylinders in mobile workshops and service vehicles.
44.	BCGA Code of Practice 39	In-service requirements of pressure equipment (gas storage and gas distribution systems).
45.	BCGA Code of Practice 40	Security requirements for the industrial, medical and food gases industry.
46.	BCGA Code of Practice 44	The storage of gas cylinders.
47.	BCGA Code of Practice 50	The carriage of gas cylinders on vehicles.
48.	BCGA Code of Practice 52	The management of risks from gases in the workplace.

	Document Number	Title
49.	BCGA Guidance Note 3	Gas cylinder. Manual handling operations.
50.	BCGA Guidance Note 13	DSEAR risk assessment guidance for compressed gases.
51.	BCGA Guidance Note 23	Gas safety. Information, instruction and training.
52.	BCGA Guidance Note 30	The safe use of gases in the beverage dispense industry.
53.	BCGA Guidance Note 41	Separation distances in the gases industry.
54.	BCGA Guidance Note 44	Portable or mobile cylinder gas equipment. Thorough inspection.
55.	BCGA Technical Information Sheet 6	Gas cylinder identification. Label and colour code requirements.
56.	BCGA Technical Information Sheet 18	Date marking of gas accessories.
57.	BCGA Technical Information Sheet 22	Connecting gas cylinders.
58.	BCGA Technical Information Sheet 29	Oxy-fuel gas equipment. Selection and assembly.
59.	BCGA Technical Information Sheet 49	Risk assessment considerations for activities involving compressed gas cylinders within the workplace.
60.	BCGA Leaflet 1	The carriage of small quantities of gas cylinders on vehicles.
61.	BCGA Leaflet 6	Cylinders in fires.
62.	EIGA 23	Safety training of employees.
63.	EIGA 78	Leak detection fluids cylinder packages.
64.	EIGA 136	Selection of personal protective equipment.

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
British Compressed Gases Association (BCGA)	www.bcga.co.uk
European Industrial Gases Association (EIGA)	www.eiga.eu

GUIDANCE ON EXAMINATION, INSPECTION AND MAINTENANCE

REGULATORS and their integral protective devices. *Sections 6, 8.1, 9.6.*

INTERVALS				
At assembly	**Before use**	**After use**	**Thorough Inspection**	**Replacement intervals**
Regulator compliant with the appropriate standard and marked accordingly. Check compatible with the gas. Ensure within life for use. Check the regulator inlet pressure is compatible with the maximum cylinder pressure. As appropriate, ensure the pressure adjustment control knob is attached to the body and operates freely. Check the inlet and outlet connections sit square to the regulator's body.	Regulator compliant with the appropriate standard and marked accordingly. Check compatible with the gas. Ensure within life for use. Check body for any signs of soot, oil, grease or other contamination. As appropriate, ensure the pressure adjustment control knob is attached to the body and operates freely. Ensure the regulator gauges start at zero prior to use. Where fitted, ensure the pressure rises on the high-pressure gauge when opening the cylinder outlet valve.	Check for any damage, contamination, defects or faults. Check that gauges return to zero during the venting process.	Regulator compliant with the appropriate standard] and marked accordingly. Full visual inspection. Check life dates. Functional tests to ensure correct operation. Typically, this will include a creep test to ensure regulator integrity. Leak test. NOTE 3.	5 years from date of manufacture or manufacturer's recommendations. Replace with a new, or refurbished unit NOTE 1. NOTE 2.

REGULATORS and their integral protective devices (continued)

INTERVALS				
At assembly	**Before use**	**After use**	**Thorough Inspection**	**Replacement intervals**
Check condition of threads and sealing surfaces. Ensure no signs of PTFE tape. If fitted, check pressure gauges on regulator naturally face the front and are undamaged. If fitted, ensure pressure gauges reset to zero. No oil, grease or other contamination. Leak test all joints at working pressure.	If fitted, check the low-pressure gauge rises smoothly when setting the gas pressure. Leak test all joints at working pressure.			

COMPOSITE SAFETY DEVICES and their integral cut off valves. *Sections 6, 8.2, 9.7.*

INTERVALS				
At assembly	**Before use**	**After use**	**Thorough Inspection**	**Replacement intervals**
Check manufacturing standard. BS EN ISO 5175 [31]. Check correct gas and pressure rating. Ensure within life for use. Check condition of threads and sealing surfaces. Check the direction of flow is correct. Check the resettable pressure sensitive cut-off valve is not restricted / damaged / tied down. No oil, grease or other contamination. Leak test all joints at working pressure.	Check manufacturing standard. BS EN ISO 5175 [31]. Ensure within life for use. Where required, ensure composite safety devices are fitted. Check the resettable pressure sensitive cut-off valve is not restricted / damaged / tied down. Leak test all joints at working pressure.	Check for any damage, contamination, defects or faults.	Full visual inspection. Check manufacturing standard. BS EN ISO 5175 [31]. Use a reverse flow test to ensure correct operation of non-return valves. Where resettable pressure sensitive cut off valves are fitted, they shall operate at a pressure of no greater than 1.2 bar. Check life dates. Leak test. NOTE 3.	5 years from date of manufacture or manufacturer's recommendations. Replace with a new unit. NOTE 1. NOTE 2.

HOSE ASSEMBLIES *Sections 6, 8.3, 9.8.*
Including non-return valves (hose check valves)

INTERVALS				
At assembly	**Before use**	**After use**	**Thorough Inspection**	**Replacement intervals**
Check the manufacturing standard. Check suitability of hose colour, internal bore size and length Check threads and sealing surfaces. Check hoses condition for damage (e.g. kinking twisting or cracking). Ensure non-return valve (if fitted) and hose connections are secured using permanent ferrules or clips and are located in the correct place. Leak test of all joints at working pressure.	Check the manufacturing standard. Ensure all the gas hose is unwound from gas cylinder trolley prior to use. Check hoses condition for damage (e.g. kinking twisting or cracking). There should be no local repairs. Leak test of all joints at working pressure.	Check for any damage, contamination, defects or faults.	Check the manufacturing standard. Check hoses condition for damage (e.g. kinking twisting or cracking). There should be no local repairs. Use a reverse flow test to ensure correct operation of non-return valves, if fitted. For flexible hoses, bend hose in a tight radius to ensure reinforcement is not visible and there is no sign of collapse or distortion. For flexible small bore metallic tubing, carry out a visual inspection. Leak test. NOTE 3.	Follow manufacturer's guidance. Determined by local operating conditions. On condition. Replace as required.

NOTE 1: Components such as elastomers, seals and diaphragms, will wear and deteriorate from their date of manufacture whether in gas service or not. Items stored out of gas service for one year or over should receive checks in accordance with the annual requirements.

NOTE 2: Some equipment is marked to either identify the date it was manufactured or the date when it needs replacement or refurbishment. Refer to BCGA TIS 18 [56], *Date marking of gas accessories*.

NOTE 3: For the maximum external gas leakage rate, refer to BS EN ISO 9090 [35], *Gas tightness of equipment for gas welding and allied processes.*

British Compressed Gases Association

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