

THE SAFE USE OF GAS CYLINDERS

INTRODUCTION

The following is based on guidance issued by the Health and Safety Executive (June 2004).

Accidents involving gas cylinders can cause serious injury or even death. This guidance provides simple practical advice on eliminating or reducing the risks associated with using gas cylinders.

The guidance is aimed at anyone who manufactures, owns, fills, repairs or uses gas cylinders at work, and especially at those who own or manage small businesses.

The legal term that covers gas cylinders is "pressure receptacle". This is a generic term covering a number of types of pressure receptacle: tube, pressure drum, cryogenic receptacle, bundle of cylinders as well as cylinders themselves, plus the valve(s) fitted directly to the receptacle. However for the purpose of this guidance, the term "gas cylinder" shall be taken to mean all these various types of pressure receptacle.

Gas cylinders used in adverse or extreme conditions, such as for breathing apparatus, may require special precautions. Although the advice in this guidance is valid for all uses of gas cylinders these special precautions, such as different frequencies for periodic inspections, are not covered.

As an employer or self-employed person, you have a duty to provide a safe workplace and safe work equipment. Designers, inspectors, manufacturers, suppliers, users and owners also have duties.

Employers have a further duty to consult any safety or employee representatives on health and safety matters. Where none are appointed, employers should consult the workforce directly.

Uses of Gas Cylinders

Gas cylinders are a convenient way to transport and store gases under pressure. These gases are used for many different purposes including:

- * chemical processes;
- * soldering, welding and flame cutting;
- * breathing (e.g. diving, emergency rescue);
- * medical and laboratory uses;
- * dispensing beverages;
- * fuel for vehicles (e.g. fork-lift trucks);
- * extinguishing fires;
- * heating and cooking;
- * water treatment.

The main hazards are:

- * impact from the blast of a gas cylinder explosion or rapid release of compressed gas;
- * impact from parts of gas cylinders or valves that fail, or any flying debris;
- * contact with the released gas or fluid (such as chlorine);
- * fire resulting from the escape of flammable gases or fluids (such as liquefied petroleum gas);
- * impact from falling cylinders;
- * manual handling injuries;

The main causes of accidents are:

- * inadequate training and supervision;
- * poor installation;
- * poor examination and maintenance;
- * faulty equipment and/or design (e.g. badly fitted valves and regulators);
- * poor handling;
- * poor storage;
- * inadequately ventilated working conditions;
- * incorrect filling procedures;
- * hidden damage.

HOW TO REDUCE THE RISKS

All gas cylinders must be designed and manufactured to an approved standard to withstand everyday use and to prevent danger (see Legislation, Page 7). They must be initially inspected before they are put into service to ensure they conform to the approved standard and be periodically examined at appropriate intervals to ensure that they remain safe while in service. To reduce the risks of failure you need to know, and act on, the following precautions.

Training

Anyone who examines, refurbishes, fills or uses a gas cylinder should be suitably trained and have the necessary skills to carry out their job safely. They should understand the risks associated with the gas cylinder and its contents.

In particular:

- * new employees should receive training and be supervised closely;
- * users should be able to carry out an external visual inspection of the gas cylinder, and any attachments (e.g. valves, flashback arresters, an regulators), to determine whether they are damaged. Visible indicators may include dents, bulges, evidence of fire damage (scorch marks) and severe grinding marks etc.;
- * valves should only be removed by trained personnel using procedures which ensure that either the cylinder does not contain any pressure or that the valve is captured during the removal process.

Manufacture and initial examination

The law requires that gas cylinders are:

- * manufactured to an appropriate standard approved under the relevant legislation (see Table on Pages 8/9); and
- * examined by "a relevant inspection body" (see Table) to verify that the cylinders are manufactured correctly and conform to the appropriate design standard.

Owners and fillers should satisfy themselves, that the manufacturing requirements have been carried out, by examining either:

- * the written certificate which accompanies the gas cylinder; or
- * the stamp or mark of the relevant inspection body on the gas cylinder itself (see Table).

Periodic examination

If you own or fill gas cylinders, to make sure that they are safe for continued use, **you** must ensure that they have been examined at the intervals set out in Tables 1 - 3 of Packaging Instruction P200 in ADR, as required by the Carriage Regulations, Regulation 18 and Regulation 21 for cylinders manufactured from 10 May 2004, or Schedule 2, paragraph 4, for cylinders manufactured before 10 May 2004.

The law requires that all gas cylinders and valves are:

- * examined and tested by the appropriate inspection body, in accordance with relevant regulations and at specified intervals (see Table); and
- * permanently marked by an appropriate inspection body to show the date of the last periodic examination.

Standards for Periodic Inspection and Testing of cylinders and valves, and for Specification and Testing for closures, can be found on the HSE web site at <http://www.hse.gov.uk/cdg/pressure.htm>

NOTE: Make sure that cylinders are empty and depressurized BEFORE removing the valve.

Repair

For old Transportable Pressure Receptacles (TPRs) there are legal requirements which prohibit modifications (with the exception of neck thread cutting) or major repairs to the body of seamless gas cylinders or cylinders which have contained acetylene. However, legal requirements allow for the modification and major repair (i.e. hot work) of other types of cylinders, subject to certain conditions. These include that a relevant inspection body (see Table) marks or certifies the cylinder as being fit for use.

For new TPRs repairs are prohibited to welds, cracks in the wall and leaks or other defects in the material of the wall, head or bottom of the cylinder. This allows the re-cutting of neck threads, BUT RESTRICTS hot work to de-denting operations only, and these must be carried out under the approval of a Notified or Approved Body.

Filling

Anyone carrying out the filling of gas cylinders should wear appropriate personal protective equipment. This may include safety shoes, protective overalls, gloves and ear and eye protection.

Standards for Inspection of Time of Fill should be followed. A current list of these standards, including standards for Pressure Drums, can be found on the HSE web site at <http://www.hse.gov.uk/cdg/pressure.htm>

Handling and Use

- * Use gas cylinders in a vertical position, unless specifically designed to be used otherwise;
- * Securely restrain cylinders to prevent them falling over;
- * Always **double check** that the cylinder/gas is the right one for the intended use;
- * Before connecting a gas cylinder to equipment or pipe-work make sure that the regulator and pipe-work are suitable for the type of gas and pressure being used.
- * When required, wear suitable safety shoes and other personal protective equipment when handling gas cylinders;
- * **Do not** use gas cylinders for any other purpose than the transport and storage of gas;
- * **Do not** drop, roll or drag gas cylinders.
- * Close the cylinder valve and replace dust caps, where provided, when a gas cylinder is not in use.
- * Where appropriate, fit cylinders with residual pressure valves (non-return valves) to reduce the risk of back flow of water or other materials into the cylinder during use that might corrode it (e.g. beer forced into an empty gas cylinder during cylinder change-over).
- * Ensure that the valve is protected by a valve cap, or collar, or that the valve has been designed to withstand impact if the cylinder is dropped.

Lifting

- * Use suitable cradles, slings, clamps or other effective means when lifting cylinders with a hoist or crane;
- * **Do not** use valves, shrouds and caps for lifting cylinders unless they have been designed and manufactured for this purpose;
- * Gas cylinders **should not** be raised or lowered on the forks of lift trucks unless adequate precautions are taken to prevent them from falling.

Transport

- * Fit suitable protective valve caps and covers to cylinders, when necessary, before transporting. **Caps and covers help prevent moisture and dirt from gathering in the valve of the cylinder, in addition to providing protection during transport**.
- * Securely stow gas cylinders to prevent them from moving or falling. This is normally in the vertical position, unless instructions for transport state otherwise.
- * Disconnect regulators and hoses from cylinders whenever practicable.
- * **Do not** let gas cylinders project beyond the sides or end of a vehicle (e.g. fork-lift trucks).

- * Ensure gas cylinders are clearly marked to show their contents (including their UN Number) and the danger signs associated with their contents.
- * It may be necessary to take special measures with certain types and quantities of compressed gases and fluids in order to ensure their safe carriage. If you have any doubts seek further guidance (see Further Advice on page11).
- * The transport of gas cylinders is subject to carriage requirements. For example, that:
 - the vehicle is suitable for the purpose;
 - the vehicle is suitably marked to show that it is carrying dangerous goods;
 - the driver is suitably trained; and
 - the driver carries the appropriate documentation about the nature of the gases being carried

Storage

- * Gas cylinders should not be stored for excessive periods of time. Only purchase sufficient quantities of gas to cover short-term needs.
- * Rotate stocks of gas cylinders to ensure first in is first used.
- * Store gas cylinders in a dry, safe place on a flat surface in the open air. If this is not reasonably practicable, store in an adequately ventilated building or part of a building specifically reserved for this purpose.
- * Gas cylinders containing flammable gas should not be stored in part of a building used for other purposes.
- * Protect gas cylinders from external heat sources that may adversely affect their mechanical integrity.
- * Gas cylinders should be stored away from sources of ignition and other flammable materials.
- * Avoid storing gas cylinders so that they stand or lie in water.
- * Ensure the valve is kept shut on empty cylinders to prevent contaminants getting in.
- * Store gas cylinders securely when they are not in use. They should be properly restrained, unless designed to be free-standing.
- * Gas cylinders must be clearly marked to show what they contain and the hazards associated with their contents.
- * Store cylinders where they are not vulnerable to hazards caused by impact, e.g. from vehicles such as fork-lift trucks.

LEGISLATION

The two main sets of Regulations covering gas cylinders are:

- * The Carriage of Dangerous Goods and Use of Transportable Pressure Equipment Regulations 2004 (the "Carriage Regulations") which came into force on 10 May 2004. The table provides more details but, in summary, these Regulations require that:

- ◆ "Old gas cylinders" (i.e. those built before the Carriage Regulations came into force) continue to comply with provisions in force prior to the Carriage Regulations. These provisions have been brought forward into Schedule 2 and require the cylinders to continue to meet old approved specifications and be periodically inspected at specified intervals. They will also apply to new fire extinguishers in certain circumstances (see Table);

- ◆ "New" pressure receptacles (i.e. those built on or after the Carriage Regulations came into force) comply with the requirements in Part 2 which applies to the provisions governing the construction, inspection and use of pressure receptacles contained in two international agreements governing the carriage of dangerous goods - ADR and RID. New gas cylinders must be built to meet new standards approved as meeting the construction requirements of RID and ADR, and initially assessed and periodically inspected by bodies appointed by HSE. These requirements will apply to pressure drums and bundles of cylinders made before 1 July 2007, new cylinders used in breathing appliances plus fire extinguishers in certain circumstances (see Table);
- ◆ Gas cylinders comply with the requirements of the Transportable Pressure Equipment Directive (TPED), which provides the basis for free movement of gas cylinders (other than fire extinguishers within the EU. TPED is implemented in Part 4 of the Carriage Regulations. It requires gas cylinders to be constructed to the approved standards meeting RID and ADR and to be assessed in conformity with those standards and periodically inspected in accordance with detailed inspection procedures by notified or approved bodies appointed by the HSE. In general, such cylinders are given a pi-mark to denote that they meet the provisions of TPED and can be freely moved across the EU. These requirements have been applied to all cylinders, tubes and cryogenic receptacles built from 1 July 2003 onwards. They will also apply in full to all pressure drums and bundles of cylinders built from 1 July 2007, although you will be able to choose to comply from 1 July 2005 onwards (see above). Part 4 of the Carriage Regulations also allows for the reassessment of old gas cylinders by notified or approved bodies.

* The Pressure Equipment Regulations 1999 (SI 1999/2001) (PER) cover within their scope the design, manufacture and initial integrity of cylinders used in breathing appliances and portable fire extinguishers, together with valves and other accessories used with these gas cylinders, which have a direct safety function.

These types of cylinder, built after the Carriage Regulations come into force, will also need to meet the requirements for "new" and "old" pressure receptacles in the Carriage Regulations in certain circumstances (see Table). The periodic examination of these cylinders is also governed by the requirements of the Carriage Regulations.

Table 1

Summary of the law						
Type of receptacle	Regulations	Conformity Assessment	Relevant inspection bodies	Manufacturing and design standards	Conformity Assessment	Cylinder markings
			Periodic examination		Reassessment	Periodic examination
Cylinders, Tubes and Cryogenic Receptacles built before 1 July 2003 and not conformity assessed or reassessed under Part 4 ¹	Carriage Regulations (Schedule 2)	Person approved by HSE (para 9, Schedule 2)	Not applicable	Competent Person (until 30 June 2006) or inspection body appointed by HSE (para 9, Schedule 2) ³	Standards approved under earlier Regulations now	Not applicable
Cylinders, Tubes and Cryogenic receptacles built from 1 July 2003 and not conformity assessed or reassessed under Part 4 ¹	Carriage Regulations (Part 4)	Notified or Approved body Appointed by HSE (Reg 44) ²	Notified or Approved body Appointed by HSE (Reg 44) ²	Notified or Approved Body ³ Appointed by HSE (Reg 44) ²	Either standards listed in 6.2 of RID/ADR or a standard approved in accordance with 6.2.3 of RID/ADR by HSE ⁴	Markings required by 6.2 EU and domestic market: π -mark and ID number of Notified or Approved body EU and domestic market: ID number of Notified or Approved body
Pressure Drums and Bundles of Cylinders built before 10 May 2004 and not reassessed under Part 4	Carriage Regulations (Schedule 2)	Person approved by HSE (para 9, Schedule 2)	Not applicable	Competent Person (until 30 June 2006) or inspection body appointed by HSE (para 9, Schedule 2) ³	Standards approved under earlier Regulations now	Not applicable
Pressure Drums and Bundles of cylinders built on or after 10 May 2004 until 30 June 2007 ⁵ and not reassessed under Part 4	Carriage Regulations (Part 2)	Appointed Person Appointed by HSE (Reg 29)	Not applicable	Appointed Person ³ Appointed by HSE (Reg 29)	Either standards listed in 6.2 of RID/ADR or a standard approved in accordance with 6.2.3 of RID/ADR by HSE ⁴	Markings required by 6.2 Not applicable
Pressure Drums and Bundles of cylinders built from 1 July 2005 ⁵ or before this if reassessed	Carriage Regulations (Part 4)	Notified or Approved body Appointed by HSE (Reg 44)	Notified or Approved body Appointed by HSE (Reg 44)	Notified or Approved body ³ Appointed by the Health and Safety Executive (Reg 44)	Either standards listed in 6.2 of RID/ADR or a standard approved in accordance with 6.2.3 of RID/ADR by HSE ⁴	Markings required by 6.2 EU and domestic market: a π -mark and ID number of Notified or Approved body under certain conditions ⁶ EU Market: a π -mark and ID number of a Notified body

Table 2

Type of pressure receptacle	Regulations	Summary of the law			Cylinder markings		
		Conformity Assessment	Relevant inspection bodies	Manufacturing and design standards		Conformity Assessment	Reassessment
Breathing Gas cylinders built before 10 May 2004 ⁶	PER and Carriage Regulations (Schedule 2)	Notified body or user inspectorates appointed by DTI	Not applicable	Competent Person (until 30 June 2006) or inspection body appointed by HSE (para 9, Schedule 2) ³	Construction requirements	CE Mark and ID number of Notified Body or user inspectorate	Date of examination
Breathing Gas cylinders built on or after 10 May 2004 ⁷	PER and Carriage Regulations (Part 2) PLUS Appointed Person appointed by HSE (Reg 29)	Notified body or user inspectorates appointed by DTI PLUS Appointed Person appointed by HSE (Reg 29)	Not applicable	Competent Person (until 30 June 2006) or inspection body appointed by HSE (para 9, Schedule 2) ³	Construction requirements PLUS Either standards listed in 6.2 of RID/ADR or a standard approved in accordance with 6.2.3 of RID/ADR by HSE ⁴	CE mark and ID number of notified body or user inspectorate plus Markings required by 6.2 of RID/ADR	Markings required by 6.2 of RID/ADR
Portable fire extinguishers built before 10 May 2004 ⁸	PER and Carriage Regulations	Notified body or user inspectorates appointed by DTI under PER	Not applicable	Competent Person (until 30 June 2006) or inspection body appointed by HSE (para 9, Schedule 2) ³	Construction requirements	CE Mark and ID number of Notified Body or user inspectorate	Markings required by 6.2 of RID/ADR
Portable fire extinguishers built on or after 10 May 2004 ⁹	PER and Carriage Regulations	Notified body or user inspectorates appointed by DTI (PER)	Not applicable	Competent Person (until 30 June 2006) or inspection body appointed by HSE (para 9, Schedule 2) ³	Construction requirements	CE Mark and ID number of Notified Body or user inspectorate	Markings required by 6.2 of RID/ADR

NOTES

1. From 1 July 2003, all new cylinders, tubes and cryogenic receptacles have needed to comply with the requirements of Part 4 of the Carriage Regulations. Prior to this, in the period 1 July 2001 to 30 June 2003, manufacturers or owners of cylinders, tubes and cryogenic receptacles were able to choose to comply with either those requirements now contained in Part 4, or those in Schedule 2.
2. EEC-type cylinders do not need to be reassessed. They can be pi-marked on their first periodic inspections in accordance with Part 4 of the Carriage Regulations.
3. Examination and testing to be carried out in accordance with Chapter 6.2 of the European Agreement concerning the international carriage of dangerous goods by road (ADR2003) or its rail equivalent (RID) and at the intervals specified in the relevant packing instruction (P200 or P203 in 4.1.4.1 of ADR2001).
4. HSE will charge an applicant or body a fee for the approval of a new standard, which meets the relevant requirements of Chapter 6.2 of ADR2001.
5. Pressure drums and bundles of cylinders built on or after 10 May 2004 will need to meet the requirements of Part 2 of the Carriage Regulations. From 1 July 2005, manufacturers may choose to comply with either the requirements of Part 4 or Part 2. However, any such pressure receptacles built on or after 1 July 2007 must meet the requirements of Part 4. Owners of pressure drums and bundles of cylinders built before then may have them reassessed in accordance with Part 4.
6. Gas cylinders used in breathing appliances and built before 10 May 2004 to the requirements of PER are deemed to have met the requirements in Schedule 2 governing construction and initial inspection. However, they will need to be used and periodically inspected in accordance with the other requirements of Schedule 2.
7. Gas cylinders used in breathing appliances and built on or after 10 May 2004 will need to meet the construction and initial inspection requirements of both PER and the requirements for "new" gas cylinders in the Carriage Regulations.
8. Portable fire extinguishers built before 10 May 2004 to the requirements of PER are deemed to have met the requirements in Schedule 2 governing construction and initial inspection. However, they will need to be used and periodically inspected in accordance with the other requirements of Schedule 2.
9. Portable fire extinguishers built after 10 My 2004 to the requirements of PER are deemed to have met the requirements in Schedule 2 governing construction and initial inspection. However, they will need to be used and periodically inspected in accordance with the other requirements of Schedule 2. This is on the assumption that manufacturers and owners take advantage of an exemption from the requirements of RID/ADR provided fire extinguishers are fitted with the means to prevent inadvertent discharge and are packaged in strong outer packagings when transported.

List of HSE notified and approved bodies and standards approved by HSE are available on the HSE web-site at: <http://www.hse.gov.uk/cdg/pressure.htm>

FURTHER ADVICE

- * The United Kingdom Accreditation Service (UKAS) can advise on the appointment of inspection bodies required under both PER and the Carriage Regulations. UKAS can be contacted at 21-47 High Street, Feltham, Middlesex TW13 4UN. Tel: 020 8917 8435, Fax: 020 8917 8499, or from their website at www.ukas.com

Related Regulations, guidance and further information

This guidance tells you about the main dangers of gas cylinders and of some of your legal responsibilities. For more detail you should refer to:

- * The Carriage of Dangerous Goods and Use of Transportable Pressure Equipment Regulations 2004 (SI 568/2004 The Stationery Office 2004 ISBN 0 11 0490630).
- * The Pressure Equipment Regulations 1999 (SI 1999/2001 The Stationery Office 1999 ISBN 0 11 082790 2
- * European Agreement concerning the international carriage of dangerous goods by road (ADR) and protocol of signature done at Geneva on 30 September 1957 (www.unece.org/trans/danger/publi/ADR/)
- * Regulations concerning the International Carriage of Dangerous Goods by Rail (RID)
- * *Guidelines on the appointment of conformity assessment bodies for transportable pressure vessels in Great Britain : The Carriage of Dangerous Goods and Use of Transportable Pressure Equipment Regulations 2004* (copies available from HSE at 020 7717 6303 or from HSE's web-site at <http://www.hse.gov.uk/cdg/pressure.htm>)
- * Approved construction standards are posted on HSE's web site <http://www.hse.gov.uk/cdg/pressure.htm>

Regulations are available from:

The Stationery Office (formerly HMSO), The Publications Centre, PO Box 276, London, SW8 5DT, Tel: 9870 600 5522, Fax: 0870 600 5533

Further guidance may be obtained from:

For information about health and safety ring HSE's InfoLine
Tel: 08701 545000, Fax: 02920 859260,
e-mail: Hseinformationservices@natbrit.com or write to HSE Information Services,
Caerphilly Business Park, Caerphilly CF83 3GG.
You can also visit HSE's web-site: www.hse.gov.uk