

Australian Standard™

The storage and handling of gases in cylinders



This Australian Standard was prepared by Committee CH-009, Safe Handling of Chemicals. It was approved on behalf of the Council of Standards Australia on 10 March 2004. This Standard was published on 30 April 2004.

The following are represented on Committee CH-009:

- Australasian Fire Authorities Council
- Australasian Railways Association
- Australian Consumer and Specialty Products Association
- Australian Institute of Petroleum
- Australian Paint Manufacturers Federation
- Avcare
- Consumers' Federation of Australia
- Department for Administrative and Information Services, S.A.
- Department of Emergency Services, Qld.
- Department of Environment and Conservation, N.S.W.
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- Institution of Engineers Australia
- New Zealand Chemical Industry Council
- New Zealand Fire Service
- Plastics and Chemicals Industry Association, Australia
- Tranz Rail, New Zealand
- Victorian WorkCover Authority
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Additional Interests:

- Australian Industrial Gas Manufacturers Association
- Australian Liquefied Petroleum Gas Association
- Metropolitan Fire and Emergency Services Board, Melbourne
- Consultants to the dangerous goods industry

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Australian Standard™

The storage and handling of gases in cylinders

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PREFACE

This Standard was prepared by the Australian members of the Joint Standards Australia/Standards New Zealand Committee CH-009, Safe Handling of Chemicals, to supersede AS 4332—1995. This revision was commenced following advice from the Australian Industrial Gas Manufacturers' Association that several technical and safety matters needed further consideration and revision.

This Standard incorporates Amendment No. 1 (August 2005). The changes required by the Amendment are indicated in the text by a marginal bar and amendment number against the clause, note, table, figure or part thereof affected.

After consultation with stakeholders in both countries, Standards Australia and Standards New Zealand decided to develop this Standard as an Australian Standard, rather than an Australian/New Zealand Standard.

This Standard deals with Class 2 substances, as classified in the ADG Code.

The series of Standards covering the storage and handling of dangerous goods and gas systems presently comprises the following Standards:

AS

- | | |
|------|---|
| 1894 | The storage and handling of non-flammable cryogenic and refrigerated liquids |
| 1940 | The storage and handling of flammable and combustible liquids |
| 2507 | The storage and handling of agricultural and veterinary chemicals |
| 2714 | The storage and handling of hazardous chemicals—Class 5.2 substances (organic peroxides) |
| 2931 | Selection and use of emergency procedure guides for the transport of dangerous goods |
| 3780 | The storage and handling of corrosive substances |
| 3846 | The handling and transport of dangerous cargoes in port areas |
| 3961 | Liquefied natural gas—Storage and handling |
| 4289 | Oxygen and acetylene reticulation systems |
| 4326 | The storage and handling of oxidizing agents |
| 4839 | The safe use of portable and mobile oxy-fuel gas systems for welding, cutting, heating and allied processes |

AS/NZS

- | | |
|------|---|
| 1596 | The storage and handling of LP Gas |
| 2022 | Anhydrous ammonia—Storage and handling |
| 2927 | The storage and handling of liquefied chlorine gas |
| 3833 | The storage and handling of mixed classes of dangerous goods in packages and intermediate bulk containers |
| 4081 | The storage and handling of liquid and liquefied polyfunctional isocyanates |
| 4452 | The storage and handling of toxic substances |
| 4681 | The storage and handling of Class 9 (miscellaneous) dangerous goods and articles |

Attention is also drawn to the AS 2030 series, *The verification, filling, inspection, testing and maintenance of cylinders for storage and transport of compressed gases*, in particular Part 1: *Cylinders for compressed gases other than acetylene*.

The terms ‘normative’ and ‘informative’ have been used in this Standard to define the application of appendices to which they apply. A ‘normative’ appendix is an integral part of a Standard, whereas an ‘informative’ appendix is for information and guidance only.

Statements expressed in mandatory terms in notes and footnotes to tables are deemed to be requirements of this Standard.

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STANDARDS AUSTRALIA

Australian Standard**The storage and handling of gases in cylinders**

SECTION 1 SCOPE AND GENERAL

1.1 SCOPE**1.1.1 General**

This Standard sets out requirements and recommendations for the safe storage and handling, in cylinders, of gases that are classified as Class 2 substances in the ADG Code (i.e. gases that are compressed, liquefied or dissolved under pressure, including refrigerated liquefied gases, mixtures of one or more gases with vapours or liquids of substances of other classes, articles charged with a gas and aerosols having a capacity of greater than 1 L). The Standard applies to all locations; however, they will generally be industrial, commercial or rural in nature.

Residential premises storing less than 10% of the maximum quantities allowable for minor storage shall be exempt from the requirements of this Standard.

NOTES:

- 1 Advice supplementary to that provided in this Standard may need to be sought from the gas supplier.
- 2 A discussion of the hazards presented by gases in cylinders is provided in Appendix A.

For the purposes of this Standard, all cylinders are regarded as full unless gas-freed by the manufacturer or not containing a valve.

1.1.2 Where this Standard is intended to apply

This Standard applies to the following situations:

- (a) The storage of gases in cylinders, where those cylinders are not connected to any system intended for the transport, filling or consumption of the gas, with the exception of minor storage (see Section 2).
- (b) The storage of bundled (manifolded) cylinders if they are not connected to any point of use.

1.1.3 Where this Standard does not apply

This Standard does not apply to the following situations:

- (a) Gases in dewar flasks, drums, or any containers not covered by the AS 2030 series of Standards.
- (b) Cylinders in filling, testing or sorting areas.
- (c) Cylinders that are connected for use, with the exception of minor storage (see Section 2).

NOTE: Many of the precautions given in this Standard may be applied to situations where gases in cylinders are connected for use.

- (d) Cylinders of oxygen and acetylene that are connected to a reticulation system, in which case AS 4289 applies.
- (e) Portable or mobile oxy-fuel gas systems, which are covered by AS 4839.
- (f) Cylinders that form part of a fire extinguishment or fire suppression system.

1.2 APPLICATION

The storage and handling of some specific gases is dealt with in other Australian Standards, as follows:

- (a) Anhydrous ammonia..... AS/NZS 2022.
- (b) Non-flammable cryogenic and refrigerated liquids..... AS 1894.
- (c) Liquefied chlorine AS/NZS 2927.
- (d) Liquefied natural gas AS 3961.
- (e) Liquefied petroleum gas AS/NZS 1596.

Where just one of the above gases is kept or stored, the appropriate Standard as listed above applies in lieu of this Standard. Where any of the above gases form the major proportion kept or stored with other gases, the more stringent Standard shall take precedence. However, if less than 10% of the total quantity of gases stored is covered by one of the specific Standards listed above, then the requirements of this Standard shall apply. Where a gas other than one of the above is kept or stored either alone or with a variety of gases, this Standard shall apply.

NOTE: For laboratory applications involving gas cylinders, reference should also be made to AS/NZS 2243.2, AS 2243.6 and AS 2243.10.

For minor storage of gases in cylinders (as defined in Clause 1.4.18), only Sections 1, 2, 8, and some clauses of Section 5 (as indicated in Section 2) of this Standard apply. Sections 4, 6 and the remainder of Section 5 of this Standard deal with construction and safety matters that may be pertinent to minor storage but which, for the purposes of such, may be regarded as advisory.

For transit storage of gases in cylinders (as defined in Clause 1.4.32), only Sections 1, 3, 6, 7 and 8 apply. Section 5 of this Standard deals with safety matters that may be pertinent to transit storage but may be regarded as advisory.

NOTES:

- 1 A store may come under the regulatory control of several authorities having differing areas of responsibility, and an approval from one authority does not necessarily constitute an approval from others.
- 2 Cognizance of the relevant requirements of the Building Code of Australia (BCA) is necessary for all matters relating to building works.

1.3 REFERENCED DOCUMENTS

A list of documents referred to in this Standard is provided in Appendix B.

1.4 DEFINITIONS

For the purpose of this Standard, the definitions below apply.

1.4.1 Access

A means by which a person or vehicle can approach and leave a specific location; includes walkways, platforms, stairways, ladders, roads and all other provisions for convenient entry and exit.

1.4.2 Asphyxia

The condition that arises when the blood is deprived of an adequate supply of oxygen; loss of consciousness and death can result from the brain being starved of oxygen.

1.4.3 Asphyxiant

A gas or vapour which has no toxic properties but which, when present in sufficient concentrations, excludes oxygen and leads to asphyxia. Death may be almost immediate if all oxygen is excluded.

1.4.4 Combustible materials

Materials of a type and quantity sufficient to constitute a significant heat radiation hazard in the event of a fire in those materials.

1.4.5 Cylinder

A rigid packaging, as referenced in the AS 2030 series, that is designed as a portable pressure vessel for the storage and handling of gases under pressure.

NOTE: Cylinders should be designed in accordance with the requirements of the AS 2030 series of Standards.

1.4.6 Cylinder in use

A cylinder that is connected to a system.

NOTE: This term includes stand-by cylinders.

1.4.7 Fire damper

A device, installed in an air distribution system, designed to close automatically upon detection of heat, to interrupt migratory air flow and to restrict the passage of flame.

1.4.8 Fire-resistance level (FRL)

The grading period, in minutes, determined in accordance with AS 1530.4 for—

- (a) structural adequacy;
- (b) integrity; and
- (c) insulation;

and expressed in that order (e.g. 60/60/30).

NOTE: Where an FRL is required, reference should be made to the Building Code of Australia (BCA) for guidance.

1.4.9 Flammable

Capable of being ignited and of burning.

1.4.10 Flammable (explosive) range

The range of concentration of flammable gas or vapour in which fire or explosion can occur upon ignition.

1.4.11 Flammable limits

The limits of the flammable (explosive) range.

NOTE: The limits are usually expressed as 'lower flammable limit' (LFL) and 'upper flammable limit' (UFL). These terms are synonymous with 'lower explosive limit' (LEL) and 'upper explosive limit' (UEL).

1.4.12 Hazardous area

An area in which an explosive atmosphere is present, or may be expected to be present, in quantities such as to require special precautions for the construction, installation and use of potential ignition sources.

NOTE: A classification system for hazardous areas is given in AS 2430.1.

1.4.13 Ignition source

A source of energy sufficient to ignite a flammable atmosphere and which may include a naked flame, exposed incandescent material, an electrical welding arc, a mechanical or static spark and electrical or mechanical equipment not approved for use in hazardous locations.

1.4.14 Incompatible

In relation to substances or the containers in which such substances are kept, having the ability to react or combine with another in a manner that increases the hazard of an individual substance, that could cause deterioration of any of those substances or containers and increase the hazards presented by them, that could increase the hazards in the event of fire, or that could increase the likelihood of contamination by toxic gas.

NOTES:

- 1 Gas cylinders with acids, toxic gases with foodstuffs, and flammable gases with Class 4.3 'dangerous when wet' substances are examples of incompatibility.
- 2 Other examples of dangerous goods that are incompatible with various types of gases may be identified from the ADG Code.

1.4.15 Liquefied gas

A gas which when packaged under pressure for transport is partially liquid at temperatures above -50°C .

1.4.16 Material safety data sheet (MSDS)

A document that provides information on the identification, health and environmental hazards, precautions for use and the safe handling of a specific chemical product and which complies with NOHSC: 2011.

1.4.17 May

Indicates the existence of an option.

1.4.18 Minor storage

The storage of gases in accordance with the criteria given in Clause 2.3 of this Standard.

1.4.19 On-site protected places

Buildings where people are employed within the property boundary, including offices, warehouses, manufacturing areas and amenities that are not directly associated with the store.

NOTE: Any small office within the storage area that is directly associated with the storage is not considered an on-site protected place.

1.4.20 Pneumatic shock (adiabatic compression)

An increase in the temperature of a gas associated with a rapid increase in its pressure.

1.4.21 Protected place

Any of the following:

- (a) A dwelling, place of worship, public building, school or college, child care facility, hospital, theatre, or any building or open area in which people are accustomed to assemble, whether within or outside the property boundary of the installation.
- (b) A factory, workshop, office, store, warehouse, shop, or building where people are employed, that is outside the property boundary of the installation.
- (c) A ship lying at permanent berthing facilities.

- (d) Any storage facility for dangerous goods outside the property boundary of the installation.

1.4.22 Public place

Any place, other than private property, open to the public and including a street or road. Parking areas for commercial and public buildings are not considered public places.

1.4.23 Regulator

A device used to reduce and control the pressure of gas entering pipelines and direct application equipment.

1.4.24 Restricted area

An area to which access is only available to such persons as are authorized by the occupier. A gas cylinder store is regarded as a restricted area.

1.4.25 Risk analysis

A systematic analysis which identifies all credible hazards and assesses the likelihood of occurrences and the severity of their consequences.

1.4.26 Screen wall

A structurally sound wall that—

- (a) has a fire-resistance level (FRL);
- (b) is impervious to liquid and vapour; and
- (c) is constructed of materials that are substantially resistant to attack by the substances being separated.

1.4.27 Segregation

The isolation of incompatible goods from each other within a store.

1.4.28 Separation

The isolation of dangerous goods stores from protected places, on site facilities, boundaries, other dangerous goods stores or filling and decanting points.

1.4.29 Shall

Indicates that a statement is mandatory.

1.4.30 Should

Indicates a recommendation.

1.4.31 Static electricity

Electrical charging of materials by such processes as physical contact, separation, electrostatic induction and the deposition of charged particles.

1.4.32 Transit storage

Storage of gases in cylinders, in accordance with Section 3 of this Standard, held in transit for not less than 12 h and not more than three normal working days.

1.4.33 Vapour barrier

An impervious, non-combustible barrier constructed and placed with the object of preventing the passage of vapour from any one place to another.

1.4.34 Water capacity (WC)

The total internal volumetric capacity of a cylinder.

NOTES:

- 1 In this Standard, water capacity is expressed in litres.
- 2 One litre of water nominally weighs 1 kg.
- 3 Nominal dimensions and water capacities of cylinders are given in Appendix C.

1.5 CLASSIFICATION

Gases that are compressed, liquefied or dissolved under pressure are classified in the ADG Code as dangerous goods of Class 2. Class 2 includes refrigerated liquefied gases, mixtures of one or more gases with vapours of substances of other classes, articles charged with a gas, and aerosols. Class 2 is subdivided as follows:

- (a) Class 2.1 flammable gases.
- (b) Class 2.2 non-flammable, non-toxic gases.
- (c) Class 2.2/5.1 non-flammable, oxidizing gases
- (d) Class 2.3 toxic gases.

NOTES:

- 1 Where appropriate, the ADG Code has allocated Subsidiary Risks to Class 2 substances. For example, oxygen, being a gas with oxidizing properties, is classified as Class 2.2 with a Class 5.1 Subsidiary Risk. Similarly, anhydrous ammonia is a toxic, corrosive gas and is classified as Class 2.3 with a Class 8 Subsidiary Risk.
- 2 Where doubt exists as to the correct classification of a substance that is not listed in the ADG Code, the relevant regulatory authority should be consulted.
- 3 The terms 'Division' or 'Subclass' are often used for Classes 2.1, 2.2 and 2.3.

1.6 CYLINDER IDENTIFICATION

Cylinders shall be marked and labelled in accordance with the ADG Code, NOHSC and other relevant regulatory requirements. Where there is doubt about their contents, cylinders should be referred to the supplier.

NOTE: Reference should also be made to AS 4484.

1.7 SECURITY OF STORAGE AREAS

All storage areas shall be appropriately protected from access by unauthorized persons.

SECTION 2 MINOR STORAGE

2.1 SCOPE OF SECTION

This Section specifies the criteria for ‘minor storage’ classification for gases, as defined in Clause 1.4.18, and the requirements for such storage.

NOTE: The underlying concept of minor storage is that quantities below a certain level are so small, or are so scattered and separated, that they present little real risk, add little to a building’s fire load, are generally unlikely to play a significant part in spreading a fire from place to place and in an emergency will not unduly hinder the activities of emergency personnel or contaminate the surrounding area by the release of toxic gases.

2.2 APPLICATION OF MINOR STORAGE

Where gases in cylinders are stored as ‘minor storage’, this Section and Sections 1 and 8 of this Standard apply. Some clauses of Section 5 (as indicated in this Section) also apply. Sections 4, 6 and the remainder of Section 5 deal with construction, operational and safety matters that may be pertinent to minor storage but which may be regarded as advisory for such storage.

2.3 CRITERIA FOR CLASSIFICATION AS MINOR STORAGE

Storage of gases in cylinders, in quantities not exceeding those in Table 2.1, shall be classified as minor storage.

TABLE 2.1
MAXIMUM QUANTITIES OF GASES PERMISSIBLE
FOR CLASSIFICATION AS MINOR STORAGE

Class of gas	Maximum aggregate water capacity, L
2.1	500
2.2	2 000
2.2, with Class 5.1 Subsidiary Risk	1 000
2.3	50

NOTE: See Clause 1.4.34 for the definition of water capacity and Appendix C for typical cylinder sizes.

2.4 MINOR STORAGE OF MIXED GASES

Where gases of mixed classes are kept in minor storage, the aggregate quantity of all gases shall not exceed 2000 L and the quantity of each subclass shall not exceed that given in Table 2.1.

2.5 PRECAUTIONS FOR THE STORAGE OF GASES IN MINOR QUANTITIES

The following precautions shall be observed when storing and handling gases in cylinders:

- (a) Areas in which cylinders are kept shall be—
 - (i) away from any artificial sources of heat, e.g. radiators, boilers or steam pipes, except when there has been prior consultation with the cylinder supplier on the particular circumstances; and
 - (ii) kept clear of combustible materials, vegetation and refuse for a distance of not less than 3 m from any cylinder.

- (b) All cylinder stores shall be provided with adequate ventilation at all times.

NOTES:

- 1 Ventilation should be adequate to maintain exposure levels to any gases in the store below recommended workplace exposure standards and lower explosive limits, and to maintain safe oxygen levels.
 - 2 Reference should be made to AS 1668.2 for requirements for mechanical ventilation of enclosures.
- (c) The precautions stated in Clause 5.2 and training described in Clause 5.3 shall apply to the storage of gases in cylinders in minor quantities, as appropriate to the types of gases being stored.
- (d) Classes of gases shall be segregated within the store, but need not be separated.
- NOTE: Appendix D provides guidance on dealing with leaks.
- (e) The floor should be flat, solid, and constructed from non-combustible materials. It should drain away from the cylinders. Concrete flooring is preferred (see also Clause 4.2(b)).

2.6 OUTDOOR MINOR STORAGE

Outdoor minor stores of Class 2 gases in cylinders shall be separated from other dangerous goods stores by a minimum distance of 3 m. They shall be located not less than 1 m from any door, window, air vent or duct.

2.7 INDOOR MINOR STORAGE

2.7.1 General

The indoor use and storage of gas cylinders should be avoided wherever possible. Where it is impractical to provide an outdoor cylinder store, the keeping of cylinders indoors shall be restricted as follows:

- (a) The total capacity of gas in cylinders allowed for any particular indoor location shall include cylinders in use, spare cylinders not in use, and used cylinders awaiting removal.
- (b) The total capacity of the gases kept shall not exceed one minor storage quantity per 200 m² of floor area. Where the floor area exceeds 200 m² any arrangement that could result in an undue concentration of cylinders shall be avoided.
- (c) Indoor minor stores of gases in cylinders shall be separated from other minor stores of gases or other dangerous goods stores by a minimum distance of 5 m.
- (d) Except for Class 2.2 gases having no subsidiary risks, there shall be no minor storage in basements.
- (e) Where cylinders are kept inside a building or a confined area, e.g. a shipping container, that building or area shall be adequately ventilated. Such ventilation shall be achieved by natural air movement or equivalent.

NOTE: Section 4 of this Standard provides guidance on the construction and ventilation of stores.

2.7.2 Indoor storage in retail areas

2.7.2.1 General

The following requirements apply to the indoor storage of cylinders in retail areas (e.g. shopping complexes) in addition to the requirements of this Section (Section 2):

- (a) Only Class 2.2 (non-flammable, non-toxic) gases with no subsidiary risks shall be stored or used in retail areas that potentially have public access.

NOTE: Where non-refillable Class 2.1 containers are stored or used, AS/NZS 1596 should be consulted.

- (b) The filling of small cylinders from large cylinders ('transfilling') shall not be carried out in areas accessible to the public.
- (c) Except where needed for immediate use or resale during the day's trading, cylinders should be stored in secure areas away from the retail area.
- (d) At all times, cylinders shall be protected from public access by holding in back areas. Access to such areas shall be restricted.
- (e) Large cylinders ('G', 'F' and 'E' sizes) shall be protected from being accidentally knocked over.
- (f) Cylinders shall not be stored near any sources of artificial heat, or in areas containing, or near, combustible materials.
- (g) The area where cylinders are held shall have natural or mechanical ventilation sufficient to maintain the oxygen level at or above 18% if the largest cylinder fully discharges.
- (h) The retail area shall have adequate fire protection. A 9 kg dry powder extinguisher shall be provided as a minimum.

2.7.2.2 *Movement of cylinders*

Cylinders should only be moved outside of normal trading hours. Appropriate manual handling procedures, including the use of trolleys, shall be employed.

Clear access and egress passages shall be maintained.

2.7.2.3 *Cylinder quantities*

The total quantity of cylinders in use, as stand-by or empty, shall be minimized as far as possible and in any case restricted to half the 'minor quantity' volumes given in Table 2.1.

Additionally, no more than the equivalent water capacity of two 'G' size cylinders, one for use and one as a stand-by, should be near the retail area at any time.

2.8 FIRST AID

Except in residential premises, a first aid kit should be provided in a clean area.

2.9 FIRE PROTECTION FOR MINOR STORES

2.9.1 Fire protection equipment

Fire protection equipment shall be provided in accordance with Table 2.2. Minor stores having an aggregate capacity of less than 1000 L may be protected with a single, permanently connected water hose, provided that it is capable of depositing water on any part of the store.

2.9.2 Action in the event of fire

NOTE: Reference should also be made to Appendix E.

Do not continue to use any cylinder that has been heated or involved in a fire. Any such cylinder shall be labelled 'DO NOT USE—HEATED' or similar. The supplier shall be contacted for further safety advice and to arrange a specialised pick-up and return of the affected cylinders.

TABLE 2.2
MINIMUM FIRE PROTECTION REQUIREMENTS
FOR MINOR STORES

Aggregate capacity, L	Minimum fire protection equipment required
< 1000	Water hose connection, no specific requirements
1000 to 2000	One hose reel; or One 2A 60B(E) fire extinguisher and a water hose connection

NOTE: Hose reels shall comply with AS/NZS 1221 and be installed in accordance with AS 2441.

SECTION 3 TRANSIT STORAGE

3.1 SCOPE OF SECTION

This Section specifies requirements for the temporary storage of gases in cylinders and of other dangerous goods being held in the storage area with them, when in transit.

3.2 DELINEATION OF TRANSIT STORAGE AREAS

Two or more transit storage areas shall be deemed to be separate if apart from each other by at least 15 m.

3.3 REQUIREMENTS FOR TRANSIT STORAGE

The following requirements apply to the storage of gas cylinders and of other dangerous goods being held in the storage area with them:

- (a) The total quantity of gas cylinders held in each transit storage area shall not exceed 200 t, gross mass. In addition, where gas cylinders are held in the one area with other dangerous goods, the aggregate quantity of all dangerous goods kept shall not exceed 200 t, gross mass.
 - (b) The maximum quantity of each bank, pallet or store in the transit storage area shall not exceed 25 t, gross mass. Such banks, pallets or stores shall be at least 5 m apart.
 - (c) The segregation requirements from other classes of dangerous goods to Class 2 given in the ADG Code shall be observed.
 - (d) Transit storage areas shall be separated in accordance with the distances in Table 4.1.
 - (e) Parked road vehicles loaded with gas cylinders shall be separated from any other loaded vehicles by at least 3 m, and from any other dangerous goods stores within the area by at least 5 m.
 - (f) Access and egress routes shall be clearly defined and kept clear.
 - (g) Specific facilities, which could include a designated area, shall be provided at the site for dealing with cylinders that are—
 - (i) leaking;
 - (ii) damaged and likely to leak as a result of such damage; or
 - (iii) are awaiting disposal.
- NOTE: Except in emergencies, cylinders that are leaking, or are damaged and may spill or leak, should not be loaded on a vehicle.
- (h) The requirements of this Section and Sections 1, 6, 7 and 8 shall be observed.
 - (i) Where relevant and in emergencies, appropriate personal protective equipment (see Clause 5.4) shall be used.

SECTION 4 CONSTRUCTION AND LOCATION OF STORES

4.1 SCOPE OF SECTION

This Section sets out requirements and recommendations for the construction and location of stores for gases in cylinders, in quantities greater than those given for minor storage.

NOTES:

- 1 This Section does not apply where Section 3 is applicable (see Clause 1.2).
- 2 For indoor storage of gases in minor quantities, reference should be made to Section 2 of this Standard.

4.2 REQUIREMENTS FOR THE CONSTRUCTION OF STORES

4.2.1 General

A store for cylinders may be either indoor or outdoor.

The indoor storage of gas cylinders shall be avoided wherever possible.

NOTE: A wall of wire mesh, or of fixed louvres, lattice or the like having at least 50% of its area as openings, would be considered to be fully open, for the purposes of this Standard.

The following requirements apply to the construction of stores:

- (a) Stores shall be located on the ground floor.
- (b) The base or floor shall be—
 - (i) level or, where appropriate, suitably sloped to ensure adequate drainage without compromising cylinder stability; and
 - (ii) constructed of non-combustible materials, e.g. paved or constructed of suitable material which can maintain its integrity under all weather conditions.

NOTES:

- 1 Non-combustible materials are those deemed to be non-combustible when tested in accordance with AS 1530.1.
 - 2 For the purpose of Item (b)(ii), hardwood is deemed to be non-combustible.
 - 3 Surfaces that are prone to indentation over time, e.g. bitumen, is not suitable except in temporary situations.
- (c) Any space between the ground floor and the ground itself shall either be completely filled with non-combustible, solid material or be completely open on at least two opposite sides. Materials shall not be kept or be allowed to accumulate in such a space.
 - (d) Any store for gases in cylinders that is attached to, or located within a building shall be separated from the remainder of the building by one or more walls, each having an FRL of at least 240/240/240.
 - (e) The floor above any store in a multi-storey building shall be constructed of materials having an FRL of not less than 180/180/180.

NOTE: Where an FRL is required, reference should be made to the *Building Code of Australia* (BCA) for guidance.

- (f) The walls and roof, if fitted, shall be clad with non-combustible materials. Where practicable, the supporting structure shall also be constructed of non-combustible materials.

- (g) Where any penetrations through a wall or barrier are required, the fire resistance level of the wall or barrier shall not be compromised. Any openings shall be vapour tight.
- (h) Any opening through a wall that incorporates a cavity, or is made of bricks or blocks that incorporate cavities, shall be provided with a metal sleeve for the thickness of the wall, of a type that will prevent leakage of gas into the cavities.
- (i) Lighting shall comply with Clause 4.2.2.
- (j) Bollards, crash barriers or other suitable protective devices shall be installed where there is a risk of cylinders being damaged by vehicular impact.
- (k) All electrical fittings shall be installed in such a manner as to prevent the possibility of their being subject to impact by cylinders.
- (l) Electrical equipment to be used within a store containing flammable gases shall comply with, and be installed in accordance with, AS/NZS 3000.
- (m) Ignition sources shall not be located in a store containing flammable gases.
NOTE: AS 2430.1 should be consulted.
- (n) The possible generation of static electricity in a store containing flammable gases shall be controlled in accordance with AS/NZS 1020.
- (o) Clause 6.2.1 shall be met.
- (p) The doors in gas cylinder stores shall open outwards or be of a ventilated roller type that can be opened from inside the store.
- (q) Outdoor stores for Class 2 gases in cylinders shall be at least 1 m from any door, window, air vent or duct.

4.2.2 Lighting

The following requirements and recommendations apply whenever people are in an area where gases are kept:

- (a) Lighting, of sufficient luminance as to enable a person to easily read all markings on cylinders, signs, instruments and other necessary items, shall be available in areas where people are working.
- (b) Interior lighting shall be of at least the luminance specified in the relevant part of the AS 1680 series.
- (c) Sufficient lighting shall be available on the internal roads that lead to areas, rooms or buildings where gases are kept or handled and which may be used by people in the course of their work at the premises.
- (d) If in a hazardous zone, or where an explosive atmosphere could be present, reference should be made to the relevant part of the AS/NZS 2430 series.

4.2.3 Outdoor stores

An outdoor store is deemed to be one that—

- (a) is fenced and secured against unauthorized access;
- (b) is free standing;
- (c) has not less than 40% of its wall area fully open;
- (d) may or may not have a roof.