

Australian Standard™

Installation and use of inert gases for beverage dispensing



This Australian Standard was prepared by Committee ME-002, Gas Cylinders. It was approved on behalf of the Council of Standards Australia on 26 September 2005.

This Standard was published on 28 October 2005.

The following are represented on Committee ME-002:

Air Conditioning and Refrigeration Wholesalers Association
Australasian Institute of Engineer Surveyors
Australia New Zealand Industrial Gas Association
Australian Chamber of Commerce and Industry
Australian Industry Group
Australian Liquefied Petroleum Gas Association
Department for Administrative and Information Services, S.A.
Fire Protection Association of Australia
Institute of Materials Engineering Australasia
International Association for Natural Gas Vehicles
Pressure Equipment Association Incorporated
The Australian Gas Association
Victorian WorkCover Authority
Welding Technology Institute of Australia
WorkCover New South Wales

Keeping Standards up-to-date

Standards are living documents which reflect progress in science, technology and systems. To maintain their currency, all Standards are periodically reviewed, and new editions are published. Between editions, amendments may be issued. Standards may also be withdrawn. It is important that readers assure themselves they are using a current Standard, which should include any amendments which may have been published since the Standard was purchased.

Detailed information about Standards can be found by visiting the Standards Web Shop at www.standards.com.au and looking up the relevant Standard in the on-line catalogue.

Alternatively, the printed Catalogue provides information current at 1 January each year, and the monthly magazine, *The Global Standard*, has a full listing of revisions and amendments published each month.

Australian StandardsTM and other products and services developed by Standards Australia are published and distributed under contract by SAI Global, which operates the Standards Web Shop.

We also welcome suggestions for improvement in our Standards, and especially encourage readers to notify us immediately of any apparent inaccuracies or ambiguities. Contact us via email at mail@standards.org.au, or write to the Chief Executive, Standards Australia, GPO Box 476, Sydney, NSW 2001.

This Standard was issued in draft form for comment as DR 04405.

STANDARDS AUSTRALIA

RECONFIRMATION

OF

AS 5034—2005

Installation and use of inert gases for beverage dispensing

RECONFIRMATION NOTICE

Technical Committee ME-002 has reviewed the content of this publication and in accordance with Standards Australia procedures for reconfirmation, it has been determined that the publication is still valid and does not require change.

Certain documents referenced in the publication may have been amended since the original date of publication. Users are advised to ensure that they are using the latest versions of such documents as appropriate, unless advised otherwise in this Reconfirmation Notice.

Approved for reconfirmation in accordance with Standards Australia procedures for reconfirmation on 21 July 2016.

The following are represented on Technical Committee ME-002:

Australasian Fire and Emergency Service Authorities Council
Australia New Zealand Industrial Gas Association
Australian Chamber of Commerce and Industry
Engineers Australia
Environmental Protection Authority New Zealand
Fire Protection Association Australia
Gas Energy Australia
Gas Technical Regulators Committee
International Accreditation New Zealand
National Association of Testing Authorities Australia
SafeWork NSW
The Australian Gas Association
Welding Technology Institute of Australia
Worksafe New Zealand
WorkSafe Victoria

NOTES

Australian Standard™

Installation and use of inert gases for beverage dispensing

First published as AS 5034—2005.

COPYRIGHT

© Standards Australia

All rights are reserved. No part of this work may be reproduced or copied in any form or by any means, electronic or mechanical, including photocopying, without the written permission of the publisher.

Published by Standards Australia, GPO Box 476, Sydney, NSW 2001, Australia

ISBN 0 7337 6959 4

PREFACE

This Standard was prepared by the Australian members of the Joint Standards Australia/Standards New Zealand Committee ME-002, Gas Cylinders. After consultation with stakeholders in both countries, Standards Australia and Standards New Zealand decided to develop this Standard as an Australian, rather than an Australian/New Zealand Standard.

In the preparation of this Standard, significant input from the Beverage Dispensing Industry was made through direct participation in Working Group ME-002-05-03, Inert Gases.

The Committee recognized there was a need to give specific guidance to the designers, installers, users, maintainers, inspectors, hirers and owners of pressurized beverage equipment beyond the general principles of Risk Assessment required in the handling of Dangerous Goods.

The objective of this Standard is to ensure the safety of owners, hirers and users when operating compressed inert gas systems and equipment for beverage dispensing.

Users of this Standard are reminded that it has no legal authority in its own right, but acquires legal standing where adopted by government or other authority having jurisdiction, or if specified as part of a commercial contract.

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

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

NOTE THAT FULL COMPLIANCE WITH THIS STANDARD MAY NOT NECESSARILY FULFIL ALL LEGAL OBLIGATIONS.

CONTENTS

	<i>Page</i>
SECTION 1 SCOPE AND GENERAL	
1.1 SCOPE AND APPLICATION.....	4
1.2 REFERENCED DOCUMENTS	4
1.3 DEFINITIONS	5
SECTION 2 COMPRESSED INERT GAS SYSTEM DESIGN	
2.1 GENERAL AND BACKGROUND.....	8
2.2 REQUIREMENTS COMMON TO ALL INERT GAS SYSTEMS.....	8
2.3 SUPPLY SYSTEMS.....	11
2.4 DISTRIBUTION SYSTEMS	14
2.5 DISPENSING APPLICATIONS	15
SECTION 3 SAFETY OF GAS SUPPLY INSTALLATIONS	
3.1 HAZARDOUS PROPERTIES OF GASES.....	29
3.2 STORAGE AND HANDLING OF GAS CYLINDERS AND VESSELS	30
3.3 PERSONNEL	35
SECTION 4 LOCATION AND VENTILATION OF SUPPLY SYSTEMS	
4.1 GENERAL	37
4.2 NATURALLY VENTILATED AREAS	37
4.3 NON-NATURALLY VENTILATED AREAS	38
SECTION 5 INSTALLATION, TESTING AND COMMISSIONING OF THE SYSTEM	
5.1 INSTALLATION	42
5.2 TESTING	45
5.3 COMMISSIONING	45
5.4 CERTIFICATE OF COMPLIANCE.....	45
SECTION 6 SYSTEM OPERATION AND MAINTENANCE	
6.1 GENERAL	46
6.2 OPERATION.....	46
6.3 MAINTENANCE	47
6.4 REPAIRS AND CHANGES	48
APPENDICES	
A TEST PROCEDURES FOR COMPRESSED INERT GAS DISTRIBUTION PIPING INSTALLATIONS.....	49
B TYPICAL PIPING JOINT INSPECTION AND LEAK CHECK SHEET	53
C GENERAL CYLINDER SAFETY	54
D CYLINDER DIMENSIONS AND CAPACITIES	55

STANDARDS AUSTRALIA

Australian Standard**Installation and use of inert gases for beverage dispensing**

SECTION 1 SCOPE AND GENERAL

1.1 SCOPE AND APPLICATION**1.1.1 Scope**

This Standard specifies the requirements for the design, location and installation, testing, commissioning, safe use and maintenance of the compressed inert gas or refrigerated liquid equipment and reticulated and portable systems necessary to dispense beverages.

NOTE: This Standard does not supersede any 'duty of care' which may be prescribed on owners and users by regulation.

1.1.2 Application

In recognition of this Standard, existing equipment should be assessed for risk, and control measures should be implemented.

Current installed equipment should be updated to conform to this Standard. Compliance improvements should be made within a time frame that takes into consideration the cost of upgrading and the associated risk levels. Where compliance improvements are not associated with significant safety issues it is recommended that they should be implemented as follows:

- (a) Non-naturally ventilated areas, by end of 2007.
- (b) Gas operated pumps requiring exhausting to outside areas, by end of 2007.
- (c) All other areas requiring compliance improvements, by end of 2011.

1.2 REFERENCED DOCUMENTS

The following documents are referred to in this Standard:

AS

1210	Pressure vessels
1271	Safety valves, other valves, liquid level gauges and other fittings for boilers and unfired pressure vessels
1319	Safety signs for the occupational environment
1349	Bourdon tube pressure and vacuum gauges
1894	The storage and handling of non-flammable cryogenic and refrigerated liquids
2030	The verification filling, inspection, testing and maintenance of cylinders for storage and transport of compressed gases
2030.1	Part 1: Cylinders for compressed gases other than acetylene
2030.4	Part 4: Welded cylinders—Insulated
2441	Installation of fire hose reels
2473	Valves for compressed gas cylinders (threaded outlet)

AS

- 2832 Cathodic protection of metals
- 2832.1 Part 1: Pipes and cables
- 2971 Serially produced pressure vessels
- 3892 Pressure equipment—Installation
- 4041 Pressure piping
- 4267 Pressure regulators for use with industrial compressed gas cylinders
- 4332 The storage and handling of gases in cylinders
- 4484 Gas cylinders for industrial, scientific, medical and refrigerant use—Labelling and colour coding
- 4706 Pressure gauges for regulators used with compressed gas cylinders
- 4839 The safe use of portable and mobile oxy-fuel gas systems for welding, cutting, heating and allied processes
- 4840 Low pressure regulators for use in industrial compressed gas reticulation systems

AS/NZS

- 1221 Fire hose reels
- 1270 Acoustics—Hearing protectors
- 1337 Eye protectors for industrial applications
- 1596 The storage and handling of LP Gas
- 1680 Interior lighting
- 1680.2.4 Part 2.4: Industrial tasks and processes
- 1715 Selection, use and maintenance of respiratory protective devices
- 1716 Respiratory protective devices
- 2161 Occupational protective gloves (series)
- 2210 Occupational protective footwear
- 2210.1 Part 1: Guide to selection, care and use
- 2210.2 Part 2: Requirements and test methods
- 2430 Classification of hazardous areas (series)
- ACTDG (Australian Committee for the Transport of Dangerous Goods)
- ADG Code Australian Dangerous Good Code
- NOHSC National Occupational Health and Safety Commission
- 1003 Adopted National Exposure Standards for Atmospheric Contaminants in the Occupational Environment
- 1010 National Standard for Plant
- 3009 Guidance Note for Placarding Stores for Dangerous Goods and Specified Hazardous Substances

1.3 DEFINITIONS

For the purposes of this Standard, the definitions given in AS 2030.1 and those below apply.

1.3.1 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.

1.3.2 Asphyxiant

A gas or vapour which, when present in sufficient concentration, excludes oxygen and leads to asphyxia. Death may be almost immediate if all oxygen is excluded.

1.3.3 Bottled wine dispensing

A dispensing application for wine where an inert gas at low pressure is used to transfer the wine from its bottle to the dispensing valve.

1.3.4 Cellar

A general storage area for beer, ready to drink kegs and other materials.

1.3.5 Compressed air supply back up

An alternative to compressed air supply, usually carbon dioxide under regulated pressure.

1.3.6 Cool room

A refrigerated, enclosed room used to chill beer and ready to drink kegs. Also known as a cold room.

1.3.7 FCB (frozen carbonated beverage)

A dispensing application for soft drinks which mixes and freezes a syrup and water containing carbon dioxide dissolved under pressure.

1.3.8 Gas mixer

Equipment supplied with two or more inert gases and intended to deliver a mixed gas in a desired ratio.

1.3.9 High pressure

Pressure in excess of 2400 kPa used for supply systems, e.g. gas cylinder pressures and those in certain storage tanks.

1.3.10 Inert gas

A non-toxic, non-flammable gas in Class 2.2 in the ADG Code, without any subsidiary risk. This definition is deemed to include carbon dioxide, nitrogen, argon and air.

1.3.11 Low pressure

In this Standard, regulated pressures not exceeding 2400 kPa used for distribution systems.

1.3.12 Multiple cylinder supply

An inert gas supply system consisting of two or more compressed gas cylinders or a bundle of cylinders connected together and control equipment intended to supply a distribution system according to this Standard.

1.3.13 On site gas generation

An inert gas supply system consisting of nitrogen generators, gas mixers, and control equipment intended to supply a distribution system according to this Standard.

1.3.14 Post-mix

A dispensing application for beverages which mixes at the dispensing valve a syrup with water containing carbon dioxide dissolved under pressure and where the carbon dioxide also provides the pressure to transfer the water to the dispensing valves.

1.3.15 Pressurized beverage storage vessel

A dispensing application where the beverage is held in a keg pressurized with an inert gas or gas mixture to maintain carbonation, and where the inert gas or gas mixture also provides the pressure to transfer the beverage to the dispensing valves. The beverage may be beer or other ready to drink beverage in kegs.

1.3.16 Ready to drink (pre-mix)

A dispensing application for beverages which mixes in a tank a syrup with water containing carbon dioxide dissolved under pressure before piping it by action of the carbon dioxide pressure to the dispensing valve.

1.3.17 Refrigerated liquid CO₂ supply

An inert gas supply system consisting of a refrigerated liquid CO₂ storage tank, vaporizer and control equipment intended to supply CO₂ gas to a distribution system according to this Standard.

NOTE: In this Standard, cryogenic storage vessels are included in this definition.

1.3.18 Regulator board

Part of a distribution system consisting of two or more pressure regulators with high pressure supply and where each regulator supplies its own regulated low pressure pipe system.

1.3.19 Shall

Indicates that a statement is mandatory.

1.3.20 Should

Indicates a recommendation.

1.3.21 Single cylinder supply

An inert gas supply system consisting of a single compressed gas cylinder and control equipment intended to supply a distribution system according to this Standard.

SECTION 2 COMPRESSED INERT GAS SYSTEM DESIGN

2.1 GENERAL AND BACKGROUND

Accidents have occurred in the dispensing of beverages due to lack of understanding of the potential damage high pressure inert gases can cause. High pressure cylinders in the supply systems for beverage dispensing can apply pressures up to 24 000 kPa. Without well designed, installed, managed and maintained pressure regulation systems and pressure relief devices, and use in accordance with safe practices, such systems could be dangerous or difficult to operate safely.

NOTE: The gas supply industry refers to the pressure in a gas cylinder under 'settled' conditions at a temperature of 15°C. However, the pressure in a full compressed gas cylinder or in a partially full liquefied gas cylinder can be higher if it is exposed to higher ambient temperatures or directly to the sun for several hours. A nitrogen cylinder filled to a maximum pressure of 20 000 kPa at 15°C may exert about 24 000 kPa at 50°C and this is used as the maximum working pressure (MWP). For carbon dioxide, a liquefied gas, this effect is higher, and although at 15°C the pressure in the cylinder is about 5000 kPa, a MWP of 21 000 kPa needs to be used. See Clause 2.3.1.2.

Due to all gas systems being under pressure, it is possible that the system and equipment connections may develop leaks, causing a build up of inert gases in cellars and low level areas with the real possibility of asphyxia leading to collapse and death of personnel working in these areas.

For the purposes of this Standard, compressed inert gas systems have been divided into supply systems (Clause 2.3), distributions systems (Clause 2.4) and dispensing applications (Clause 2.5), according to Table 2.1.

TABLE 2.1
INERT GAS SYSTEMS FOR BEVERAGE DISPENSING

Supply systems (Operation at gas cylinder or storage tank pressure, see Clauses 2.3.1.2 and 2.3.2.2)	Distribution systems (Operation at regulated pressure not exceeding 2400 kPa, see Clause 2.4.1.2)	Dispensing applications (Operation at regulated pressure not exceeding 800 kPa for post-mix or 400 kPa for beer dispensing, see Clause 2.5.1.2)
Cylinders (single and multiple)	Regulator boards	Post mix
Refrigerated liquid CO ₂ supply	Safety devices	FCB (frozen carbonated beverages)
On-site gas generation and mixing	Piping	Ready to drink (pre-mix)
Compressed air		Bottled wine dispensing
		Draught beer and ready to drink kegs

NOTE: Separation between systems is at the respective pressure reduction points.

2.2 REQUIREMENTS COMMON TO ALL INERT GAS SYSTEMS

2.2.1 Materials for inert gas systems

2.2.1.1 Material specification

Materials used in cylinder supply systems shall be compatible with the supply gas at the maximum developed pressure and temperature of the cylinder contents.

2.2.1.2 Piping

All piping shall be copper or copper alloys, stainless steel or other materials that have been proven suitable for service with the supply gas at the maximum working pressure.

Distribution piping for inert gas systems shall be selected from the following:

- (a) Stainless steel (cleaned and degreased).
- (b) Copper and copper alloys (refrigeration grade).
- (c) Food grade polymers (UV stabilized where appropriate, e.g. in sun-affected areas).

NOTE: Materials should be clean for food service.

2.2.1.3 Non-metallic materials

All non-metallic materials used in the construction of inert gas and inert gas mixture supply systems shall be chosen with extreme care due the effect these inert gases, especially carbon dioxide at high pressure, have on certain materials, such as leaching of plasticizers and explosive decompression.

2.2.1.4 Jointing materials

All jointing material used shall be suitable for use with the supply gas at the maximum working pressure, e.g. oil-free PTFE tape. Joints may be silver-soldered for high pressure service, or silver-soldered or brazed for low pressure service. Consideration should be given to the use of fluxless brazing or a post-installation cleaning operation.

2.2.2 Operating temperature

The operating temperature range for all materials and equipment used in the system shall be -20°C to 50°C .

NOTE: Where Refrigerated Liquid CO_2 prior to vaporization is involved, a minimum temperature of -80°C should be assumed.

2.2.3 Pressure relief devices

2.2.3.1 General

A pressure relief device shall be provided for the low pressure side of all supply systems to protect connected equipment.

NOTE: The position of the pressure relief device depends on the particular application.

Pressure relief devices for the high pressure side of the cylinder supply system are optional.

NOTE: Pressure regulators may be fitted with pressure relief devices to protect them against minor component failures. Such devices should not be considered pressure relief devices for the protection of downstream equipment, including the equipment to which they are attached.

2.2.3.2 Design

Pressure relief devices shall be designed, manufactured and installed in order to minimize tampering, maladjustment or the fitting of inferior replacement parts. Pressure relief devices shall comply with AS 1271.

Pressure relief devices shall not start to open below 1.1 times the maximum working pressure (MWP) of the piping system to which they are connected and shall be fully open at 1.25 times the MWP.

Pressure relief devices shall be sized so that they are capable of venting excess gas in order to ensure that the pressure of the piping system to which they are connected does not exceed 1.25 times the MWP for the maximum flow in failed condition at maximum supply pressure of the pressure regulator feeding the piping system.

NOTE: The maximum flow in failed condition of the pressure regulator should be obtained from the manufacturer.

Where pressure relief devices are located in non-naturally ventilated areas, consideration shall be given to their discharge to an outside safe area. If vent piping is used, it shall be sized in a way that will not decrease the rated capacity of the pressure relief devices.

2.2.3.3 Pressure relief devices for beer and keg systems

For the protection of the beverage dispensing system each pressurized beverage storage vessel shall be provided with a pressure relief device fitted in the piping system and adjacent to the pressure regulator (see Clause 2.5.2.5).

The pressure relief device shall not start to open below 1.1 times the MWP of the piping system supplying the beer and keg system, which for the purpose of this Standard is 400 kPa or 0.8 times the design pressure of the beverage storage vessel, whichever is the lesser, and shall be fully open at a pressure not exceeding 1.1 times the design pressure of the beverage storage vessel (see Table 2.2).

TABLE 2.2
PRESSURE RELIEF DEVICE SETTINGS

Pressures as percentage of the beverage storage vessel design pressure	
Maximum full discharge of the pressure relief device	110%
Design pressure of the beverage storage vessel	100%
Minimum opening pressure of the pressure relief device	88%
Maximum working pressure of the piping system	80%

The capacity of the pressure relief device shall be such that at the maximum inlet pressure of the supply system and for the maximum flow in failed condition of the pressure regulator supplying the piping system, the pressure in the beverage storage vessel shall not exceed 1.1 times its design pressure as required in AS 2971.

NOTE: The maximum flow in failed condition of the pressure regulator should be obtained from the manufacturer.

The pressure relief device shall be capable of preventing overpressure to the beverage storage vessel taking into account the possible freezing and consequent clogging which can occur in the piping system during the operation of a beverage dispensing system.

2.2.3.4 Installation, testing and certification

The manufacturer or supplier shall provide a proof certificate of the performance of the pressure relief device to the owner.

The installation of pressure relief devices shall be in accordance with AS 3892 or manufacturer's recommendations. Each pressure relief device shall be given a unique identification and its location within the inert gas system shall be recorded.

New or serviced pressure relief devices shall be assessed by a competent person prior to installation and assembly in the piping system to ensure that the device integrity has not changed during transport or storage.

2.2.4 Pressure regulators

Pressure regulators shall comply with AS 4267 for connection to gas cylinders or with AS 4840 for connection to regulated pressure supply not exceeding 2400 kPa.

High pressure regulators supplying a low pressure regulator shall not deliver a pressure in excess of 2400 kPa.

Regulators supplying a distribution system or gas line without further pressure reduction stages shall NOT be capable of being adjusted to deliver a pressure in excess of 400 kPa (beer and keg systems, see Clauses 2.2.3.3 and 2.5.1.2) or 800 kPa (post-mix systems, see Clause 2.5.1.2).

Low pressure outlet connections from the high pressure supply and inlet connections to piping shall be such that the direct connection of high pressure gas to low pressure piping systems cannot occur.

NOTE: Connections which can be made or unmade in the normal operation of the system should be those from AS 2473 for the respective gas at cylinder pressure and from AS 4840 for the respective gas at lower pressure.

2.2.5 Pressure gauges

Bourdon tube gauges shall comply with either AS 1349 or AS 4706.

2.2.6 Installation and labelling

Manufactured sub-systems and components of the inert gas system shall be delivered from their manufacturer or supplier cleaned, sealed and intended for use with the supply gas.

All inert gas systems shall be installed according to the requirements of Section 5 and commissioned prior to first use or following any modification or change made to them.

Labels shall be affixed on or near the different parts of the inert gas system which are in accordance with NOHSC 1010.

2.2.7 Operation and maintenance

Supply systems shall be operated and maintained in accordance with Section 6.

2.3 SUPPLY SYSTEMS

2.3.1 Cylinder supply, single and multiple

2.3.1.1 General

Cylinder supply systems may be single- or multi-cylinder, single or double bank, with automatic, semi-automatic, or manual changeover, may be fitted with single or multiple primary regulating devices and be connected to cylinders directly or by means of flexible connectors.

The outlet pressure of a cylinder supply system to the distribution system shall be regulated. The pressure regulating devices may be built into the supply system or the supply system may be fitted with a high pressure outlet which complies with AS 2473 for direct fitment of separate pressure regulators. However, once the supply system is installed and commissioned, all pressure regulators attached to such an outlet becomes an integral part of the supply system.

Systems shall comply generally with Figures 2.1 or 2.2 as appropriate.

2.3.1.2 Maximum working pressure (MWP)

The maximum working pressure (MWP) of the cylinder supply system shall be not less than 21 000 kPa for systems for carbon dioxide and carbon dioxide mixtures with CO₂ content equal to 40% or greater, and 24 000 kPa for systems for nitrogen and carbon dioxide mixtures with CO₂ content less than 40% and for other compressed inert gases.

NOTE: The above pressures are consistent with AS 2473 and AS 4267. See Note to Clause 2.1.

2.3.1.3 Burst pressure

All components in direct contact with the contents of cylinders shall have a minimum burst pressure of 3 times the MWP.

2.3.1.4 *Connections*

Any cylinder connection which can be made or unmade in the normal operation of the supply system shall comply with AS 2473 for the respective gas or gas mixture.

2.3.1.5 *Non-return devices*

Where more than one cylinder is to be connected, a non-return device shall be fitted to each flexible connector attachment point on the supply system to minimize loss of supply in case of a flexible connector failure or rapid backflow to an inadvertently connected empty cylinder (see Figure 2.2). This non-return device is optional for single cylinder supply. The maximum return flow allowed at the maximum inlet pressure is 0.5 L/min.

NOTE: A non-return device should be fitted to the outlet of the primary regulating devices of some dispensing applications to prevent the possible backflow of syrups or beer (see Figures 2.7, 2.8, 2.9, 2.10, 2.12 and 2.13).

2.3.1.6 *Isolation valves*

For multiple cylinder supply, there shall be a manual isolation valve between each cylinder bank and the primary pressure regulating device or devices (see Figure 2.2). For single cylinder supply, if the cylinder is connected to the primary regulating device via a flexible lead there should be a manual isolation valve between the flexible lead and the primary regulating device (see Figure 2.1).

2.3.1.7 *High pressure flexible connectors*

High pressure flexible connectors shall not exceed 2 m in length for cylinder supply and 3 m for bundle/pack supply. They shall be fitted with protection against whipping in case of rupture, e.g. safety cables.

NOTE: Consideration should be made of fitting inlet filters to high pressure flexible leads to minimize carrying particles and contamination towards pressure regulator seat mechanisms. A maximum opening of 63 µm for such filters has been found acceptable.

2.3.1.8 *Supply system dimensions*

For single cylinder supply, the pipe length between any cylinder and the supply system isolation valve if fitted, or the primary regulator if no isolation valve is fitted, inclusive of the flexible connector, shall not exceed 5 m.

For multiple cylinder supply, the pipe length between any cylinder and the supply system isolation valve, inclusive of the flexible connector, shall not exceed 5 m.

2.3.1.9 *Pressure regulation*

All supply systems shall provide either a means for pressure regulation or an outlet connection designed for fitment of a pressure regulator.

The outlet of the primary pressure regulator and inlet connections to piping shall be such that the direct connection of high pressure gas to low pressure piping cannot occur.

2.3.1.10 *Testing*

The assembled supply system shall be tested pneumatically at a pressure between 85% and 100% of the MWP of the supply system using oil-free inert gas or oil-free air. There shall be no discernible leakage when using a suitable leak-detection solution.

Any connection made or unmade prior to the use of a new supply system shall be tested in accordance with this Clause.

2.3.2 Refrigerated liquid carbon dioxide supply

2.3.2.1 General

A refrigerated liquid carbon dioxide supply system shall deliver a regulated pressure to the distribution system.

Systems should comply generally with Figure 2.3.

2.3.2.2 Maximum working pressure

The maximum working pressure (MWP) of all equipment connected to the refrigerated liquid storage system shall be not less than the rated pressure of the pressure relief device fitted to the system.

2.3.2.3 Isolation valve

There shall be a manual isolation valve between the refrigerated liquid carbon dioxide system and either the primary pressure regulating device, if one is fitted, or the distribution system.

NOTE: The use of an automatic low-temperature shutoff valve or a maximum flow restriction system downstream of the vaporizer is recommended to prevent damage to downstream equipment. A risk assessment should determine whether it is required.

2.3.2.4 Pressure regulation

If the outlet pressure from the supply system can exceed 2400 kPa a pressure regulator not capable of being adjusted to deliver an outlet pressure exceeding 2400 kPa shall be fitted to the outlet of the supply system. The outlet of the pressure regulator and inlet connections to piping shall be such that the direct connection of high pressure gas to low pressure piping cannot occur.

If the outlet pressure from the supply system is controlled within the system not to exceed 2400 kPa, and the distribution system incorporates a downstream pressure reduction stage, the supply system may be connected directly to the distribution system without the need for an intermediate high pressure regulator.

If the supply system is connected to a distribution system without further pressure reduction stages it shall NOT be capable of being adjusted to deliver a pressure in excess of 400 kPa (beer and keg systems, see Clauses 2.2.3.3 and 2.5.1.2) or 800 kPa (post-mix systems, see Clause 2.5.1.2).

2.3.2.5 Pressure relief device

A pressure relief device shall be incorporated in the supply system to ensure the outlet pressure does not exceed the pressure according to Clause 2.3.2.4.

Pressure relief devices shall be vented according to Clause 5.1.3.7.

2.3.2.6 Testing

The assembled supply system shall be tested pneumatically at the MWP of the assembled supply system using oil-free inert gas or oil-free air. There shall be no discernible leakage when using a suitable leak-detection solution.

2.3.3 On site gas generation and mixing

Systems should comply generally with Figure 2.4.

Cylinder supply, if used, shall comply with Clause 2.3.1. Refrigerated liquid CO₂ supply, if used, shall comply with Clause 2.3.2.

The outlet pressure of the gas mixer shall comply with Clause 2.3.2.4.

2.3.4 Compressed air

Systems should comply generally with Figure 2.5 and be installed according to the instructions of the manufacturer or supplier.

In systems with backup from a carbon dioxide supply, a three way valve shall be used to connect the backup supply to avoid feeding carbon dioxide to the air receiver or air into the carbon dioxide supply system. The exhaust from any beverage dispensing pump which may be driven by carbon dioxide shall be vented to a safe, naturally well ventilated location.

2.4 DISTRIBUTION SYSTEMS

2.4.1 Regulator boards

2.4.1.1 *General design*

Regulator boards may have high inlet pressure supply or low inlet pressure supply and shall comply generally with Figure 2.6. If high inlet pressure supply is used, it shall comply with Clause 2.3.1.

All inlet and outlet connections in the regulator board shall be such that direct connection of high pressure gas to low pressure piping or gas lines cannot occur.

NOTE: Connections which can be made or unmade in the normal operation of the system should be those from AS 2473 for the respective gas at cylinder pressure and from AS 4840 for the respective gas at lower pressure

2.4.1.2 *Pressure regulation*

High inlet pressure regulators supplying a low inlet pressure regulator shall not deliver a pressure in excess of 2400 kPa.

Regulators supplying a piping system without further pressure reduction stages shall NOT be capable of being adjusted to deliver a pressure in excess of 400 kPa (beer and keg systems, see Clause 2.2.3.3) or 800 kPa (post-mix systems).

2.4.1.3 *Interconnection piping*

All pressure piping in the board shall comply with AS 4041, e.g. pipes and pipe fitting should be rated for the maximum working pressure and certified by the manufacturer. Special consideration should be given to leak testing when high pressure compression fittings are used.

2.4.2 Distribution piping

2.4.2.1 *Design*

Pipe diameters shall be chosen so as to keep the pressure drop as low as practicable in order not to restrict the maximum flow from the system.

2.4.2.2 *Maximum working pressure*

If the piping system supplies a second pressure reduction stage, its maximum working pressure (MWP) shall be 2400 kPa.

If the piping system supplies beverage dispensing equipment directly without a second pressure reduction stage, its maximum working pressure (MWP) shall be 400 kPa (beer and keg systems, see Clause 2.2.3.3) or 800 kPa (post-mix systems).

2.4.2.3 Inlet connection

The inlet connection to the piping system, where it is intended to be connected to the supply system or control arrangement, shall be such that connection of high pressure gas to low pressure gas cannot occur.

NOTE: Connections which can be made or unmade in the normal operation of the system should be those from AS 2473 for the respective gas at cylinder pressure gas and from AS 4840 for the respective gas at lower pressure.

2.4.2.4 Isolation valves

Isolation valves shall be fitted at the beginning of a main line or a principal branch, shall be positioned to enable ease of operation and shall be identified as to its use.

NOTE: All valves installed should be of a type suitable for use with the supply gas.

2.4.2.5 Labelling

The piping systems shall be identified (see Clause 3.2.6.4).

2.5 DISPENSING APPLICATIONS

2.5.1 Requirements common to all dispensing applications

2.5.1.1 Design

Each dispensing application connection point to the distribution system shall be provided with a manual isolation valve suitable for service with the supply gas at the pipeline maximum working pressure.

If the distribution system supplies gas at pressures greater than 400 kPa (beer and keg systems, see Clause 2.2.3.3) or 800 kPa (post-mix systems), the connection to the distribution system shall incorporate a pressure regulator.

If the distribution system supplies gas at pressures less than 400 kPa (beer and keg systems, see Clause 2.2.3.3) or 800 kPa (post-mix systems), the dispensing application connection to the distribution system should comply with AS 4840.

2.5.1.2 Pressure regulation

Pressure regulators shall NOT be capable of being adjusted to deliver a pressure in excess of 400 kPa (beer and keg systems, see Clause 2.2.3.3) or 800 kPa (post-mix systems).

If a low inlet pressure regulator is not intended to be readily detachable, its inlet connection may be other than that specified in AS 4840 but in no case shall it be a high pressure connection or those specified in AS 2473 for the supply gas, i.e. not to Types 10, 30, 50 or 60.

2.5.1.3 Pressure relief devices

If a dispensing application unit is connected to pressurized beverage storage vessels, each vessel shall be protected by a pressure relief device appropriate to the vessel design pressure (see Clause 2.2.3.3).

2.5.2 Particular requirements for dispensing applications

2.5.2.1 Post mix (mixed at the point of dispensing)

Post mix applications should comply generally with Figures 2.7 and 2.8 as appropriate.

The CO₂ supply to the carbonator shall be fitted with at least one non-return device, either inline or built into the carbonator.

The exhaust from any pump where carbon dioxide may be used as the supply gas shall be vented to a safe location.

2.5.2.2 *FCB (frozen carbonated beverage) applications*

FCB applications should comply generally with Figure 2.9 and where appropriate, with Clause 2.5.2.1.

2.5.2.3 *Ready to drink (pre-mix)*

Ready to drink applications should comply generally with Figure 2.10.

The CO₂ supply to the pre-mix tank shall be fitted with a non-return device and an isolation valve.

The pre-mix tank shall be supplied with its own pressure relief device.

The exhaust from any pump where carbon dioxide may be used as the supply gas shall be vented to a safe location.

2.5.2.4 *Bottled wine dispensing*

Bottled wine dispensing applications should comply generally with Figure 2.11.

A pressure relief device set no higher than 10 kPa shall be fitted to the piping system supplying the wine bottles.

2.5.2.5 *Draught beer and ready to drink kegs*

Draught beer and ready to drink kegs should comply generally with Figures 2.12 and 2.13 as appropriate.

The outlet of the pressure regulator shall be fitted with a pressure relief device (see Clause 2.5.1.3) and a non-return valve. An isolation valve shall be fitted to the supply to each keg or set of kegs, either at the inlet of the pressure regulator or between the non-return valve and the keg coupling.

If the pressure regulator supplies multiple kegs, the lines to each keg shall be fitted with additional isolation valves.