Gas Handling systems are a means of safely controlling the movement of gases from a source, (usually a cylinder), to an experiment.

This is achieved by the use of additional components such as regulators, transporting lines, needle valves and mechanical fittings.

There are inherent dangers and processes involved in using compressed gas cylinders and building supplied gases. You have associated hazards, flammability, toxic, corrosive, oxidizers, asphyxiants, explosive, labeling, MSDS, risk assessments, manual handling.
Gases are usually supplied in cylinders stored under pressure ranging from 13,000 to 30,000 kpa dependent on the gas.

As an example a car tyre is pressurised to about 200kpa

New installations will require risk assessment, SOP’s and existing installations require continual update of all risk assessments and procedures.

**Industrial Gases**

Industrial gases such as oxygen, nitrogen, argon and hydrogen are stored as a compressed gas in cylinders.

An exception is acetylene, which is stored as a liquid absorbed into a solvent then compressed inside the cylinder. Other examples are carbon dioxide and LPG which will be part liquid and part gas in the cylinder.

Cylinders are given a letter such as C D E G which relate to their size/volume.

G = 50ltr, E = 22ltr, D = 10ltr, E = 8ltr

Vacuum insulated vessels also carry gases in cryogenic form such as liquid helium, liquid nitrogen, sometimes used to supply large volumes of gas at low pressure.

The University uses liquid nitrogen primarily in cold traps on vacuum systems and in conjunction liquid Helium with NMR’s for cooling the electro-magnet cores.

The nitrogen gaseous blow off from our on-site Liquid Nitrogen tank is piped throughout the building and is used for various experimental purposes eg inert atmospheres to avoid oxidation.
Scientific & Specialty Gases

Specialty & Scientific gases are generally not stocked but can be purchased as a mixed ratio's to your requirements.

Examples of gases that require special attention are flammables, such as Hydrogen, Acetylene, Methane, Butane, Propane and Oxygen. Most of these gases are now required to be stored external to the laboratory and your lab supervisor will advise you about how such gases are to be used in experiments. They will also have a dedicated regulator with a specific cylinder connection and a flash back arrestor.
**Cylinder Connections**

New standards have evolved regarding cylinder connections. The necks of the cylinders have a different style of connection to avoid the possibility of connecting an incompatible regulator.

You will encounter male, female, internal, external, left hand and right hand thread connections using Teflon washers, O-rings and metal on metal for sealing.

So it’s important to inspect at cylinder installation and change over the condition of seals, sealing surfaces and that you have the right regulator with the right connection.
Regulators

Gas Cylinders require a regulator to be fitted to safely control the flow of gas from the cylinder to the experiment being conducted.

There are several variations in Regulators which fit into a category for gas regulation, and a category for the type of gas they will control. Clockwise to adjust for a higher pressure, and after you have finished rotate anti clockwise to and isolate the main cylinders shut off valve.

- Single Stage Regulators work by an adjustable spring-loaded diaphragm that takes the gas from the regulator’s high-pressure inlet chamber and as spring tension is applied the diaphragm opens a valve seat.

  You adjust the spring tension till you balance the required pressure. If you use this style of regulator on a closed system it will equalise the pressure and the spring actually closes the valve seat off till the line is opened at the delivery end.

  As you use gas from the cylinder the Inlet pressure falls, acting on the diaphragm and the outlet flow will increase. This regulator requires continual monitoring to maintain an even pressure; it is the most common regulator in use in your workplace.
Dual Stage Regulators have two diaphragms one with a fixed pre-loaded spring acting against the diaphragm in the first stage and a second with an adjustable spring.

The first stage provides a steady gas flow at an intermediate pressure to the second stage, which once the second stage is adjusted to the desired pressure, will stay constant across the cylinder use as it sees only minor variations in pressure.

It is the most desirable choice.

Regulators can be sourced in high ranges up to 20,000 – 40,000kpa, low ranges 0- 13kpa & 0-100kpa, The common upper limit for diaphragms is approximately 3,500kpa.

Regulators and their diaphragms are specific to the type of gas being used, eg a corrosive gas may require a stainless steel body and SS diaphragm, Teflon, Teflon coated stainless steel, Monel, and or Viton.
Connecting Up

Connecting your regulator to your experiments will also require that you consider the type of gas transportation line that you use. It will be dependent on the gas, environment, and re usage.

Common choices of tubing are stainless steel, nylon and copper, you will need to know how the gas you want to put through the tube reacts with it. Charts of chemical compatibility are available to help you make your choices.

To maintain a leak-proof system, use only commercial fittings such as “Swagelok” brand. All installations using corrosive or toxic gases will require such an installation to be correctly installed by qualified staff and a leak test of the system with an inert gas first using “Snoop”. A further leak test must be performed after the required gas is fitted.

Manual Handling of Gas Cylinders

Manual handling of cylinders requires careful consideration due to their size and weights. Always seek assistance with the manual handling of gas cylinders whatever their size. e.g. a G size cylinder can weigh up to 75 kg empty.

Transport all cylinders on cylinder trolleys that have securing chains, and get assistance to install them. Cylinders must be restrained or held in the upright position using straps, chains or brackets. The location should be in the lowest risk area of your lab. The transportation trolley is not suitable for or to be used for cylinder storage.

If securing methods are not available, your supervisor will arrange for proper mounting of the cylinders. You should not proceed till this has occurred.
**Cylinder Change Over**

If you require a cylinder to be changed over, firstly bring the new full cylinder from the store to your facility. You will be required to advise a store person of the location and the cylinder you are changing out.

Ensure that the existing gas cylinder valve is turned off, and release the regulator adjustment.

Proceed to remove the regulator and have a second person support the regulator whilst you unchain the cylinder and move the new cylinder into its place. This may require disconnecting the delivery line.

Check the connection point is free of grit/grime, check the regulator O-ring or connection stub.

If it is an inert gas, once the regulator is installed, gently “crack” open the cylinder valve, watching for leaks. Next close the cylinder valve, monitoring your gauge to see if they fall away. You can then regulate your system / line pressure to the desired pressure.

Return the empty cylinder to the stores for replacement.

**General Information**

A cylinder that becomes ruptured releases forces equivalent to an 180kmh vehicle impact.

How far do you open the Cylinder’s isolation valve? Just gently crack the valve and open it about a 1/3rd of a turn.

Toxic gases may/will require the use of monitored alarms, specific emergency action plans and equipment, antidotes and MSDS’s.

Where Oxygen is being used, make sure that the system is free of flammable lubricants and particles like dust. Never use lubricants or grease on the connections and open cylinder valves slowly adjusting regulator pressures slowly.

**Examples of Flammable and Toxic Gases (ppm)MSDS**

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<tr>
<th>Gas</th>
<th>TWA</th>
<th>STEL</th>
<th>IDLH</th>
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<td>1</td>
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<td>200</td>
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</table>

TWA = time weighted average
STEL = short term exposure limit (15mins, 4 times a day @ 60 min intervals)
IDLH = immediate danger life health

**Dangerous Goods Symbols**

DG 2.1 - flammable gases, labelled with a **RED** diamond

DG 2.2 - non flammable non toxic, gases labelled with a **GREEN** diamond

DG 2.3 – poisonous gases, labelled with a **WHITE** diamond

**Liquid Nitrogen**

Liquid Nitrogen is provided for use from either the Mechanical workshop Rm# 3202 or smaller Dewar’s located in common work areas. LN stored in Dewar’s is stored under pressure. Liquid nitrogen is a cryogenic liquid and in its liquid form is -196°C. When handling LN you must wear appropriate PPE, Gloves, Eye Protection, footwear and exercise extreme caution. LN has a SOP developed to assist you and is available on the shared drive safety folder.

**Transporting LN**

There is a procedure in place for transporting a large Dewar between floors using the lift. You must not ride with the Dewar between floors or enter the lift if a Dewar is being transported from another level. A retractable barrier is placed across the lift to warn persons not to enter the lift. Then you have to use the stairs to get to your delivery level and remove the Dewar, this is best done with two persons.
Transportation of small Dewar’s require that the vessel has its lid in place and that you to wear appropriate PPE, clothing, footwear, Eye protection and gloves.

If you are required to fill a large Dewar of LN for your group / project then the Dewar’s are filled on Mondays, Wednesdays and Fridays from 11:00AM, exceptions being Public Holidays. When entering any of the workshop areas you are required to have appropriate footwear and eye protection.

Remember that consultation time for all workshops is up to 10:30AM. Emergency situations are exempted from this time frame.

- Swagelok fittings and valves
- BOC Gas Cylinder safety PDF - pages 4,6-8,11,12, 20, 26, 27, 29
- BOC Cylinder Labeling
- BOC Cylinder Safety
- LN SOP
Scott Web site:  www.scottgas.com then chose products, gas handling, open pdf.

*Figure 1, Front View – Typical Cylinder Pressure Regulator*
Gas Compatibility

The compatibility data shown on the following pages has been compiled to assist in evaluating the appropriate materials to use in handling various gases. Prepared for use with dry (non-hygroscopic) gases at normal operating temperature of 70°F (21°C), information may vary if different operating conditions exist.

It is extremely important that all gas control equipment be compatible with the gas being passed through it. The use of a device that is not compatible with the service gas may damage the unit and cause a risk that could result in property damage or personal injury. To reduce potentially hazardous situations, always check for compatibility of materials before using any gases in your gas control equipment. Systems and equipment used in oxidizer gas service (i.e. oxygen in nitrous oxide) must be cleaned for oxidizer service. Since combinations of gases are virtually unlimited, mixtures (except for Nitrous Oxide/Oxygen and Ethylene Oxide/CO2 sterilizing gas mixtures) are not listed in the Compatibility Chart. Before using a gas mixture or any gas not listed in the chart, please refer to the Scott Reference Guide or contact your Scott Representative for more information.

**Directions:**
- Locate the gas you are using in the first column.
- Compare the materials of construction for the equipment you intend to use with the materials of construction shown in the Compatibility Chart. Then use the Key to Materials Compatibility to determine compatibility.

| Common Name | Chemical Formula | Metals | Plastics | Rubber | Glass | Resistance | Acetylene | C2H2 | C1 | U | U | U | U | C2 | C2 | C2 | C2 |
|-------------|------------------|--------|----------|--------|-------|------------|-----------|------|----|---|---|---|---|----|----|----|---|---|
| Air         | N2              | C1     | U        | U      |       |             |           |      |    |   |   |   |   |    |    |    |   |   |
| Argon       | Ar              |        |          |        |       |             |           |      |    |   |   |   |   |    |    |    |   |   |
| Boron       | B               | C1     | U        | U      |       |             |           |      |    |   |   |   |   |    |    |    |   |   |
| Boron Nitride| BN             | C1     | U        | U      |       |             |           |      |    |   |   |   |   |    |    |    |   |   |
| Iodine      | IO3             | C1     | U        | U      |       |             |           |      |    |   |   |   |   |    |    |    |   |   |
| Iodine Halides| CDI         | C1     | U        | U      |       |             |           |      |    |   |   |   |   |    |    |    |   |   |
| Iodine Halides| BrI            | C1     | U        | U      |       |             |           |      |    |   |   |   |   |    |    |    |   |   |
| Iodine Halides| CI             | C1     | U        | U      |       |             |           |      |    |   |   |   |   |    |    |    |   |   |
| Iodine Halides| ClI             | C1     | U        | U      |       |             |           |      |    |   |   |   |   |    |    |    |   |   |
| Iodine Halides| BrI             | C1     | U        | U      |       |             |           |      |    |   |   |   |   |    |    |    |   |   |
| Iodine Halides| ClI             | C1     | U        | U      |       |             |           |      |    |   |   |   |   |    |    |    |   |   |
| Iodine Halides| BrI             | C1     | U        | U      |       |             |           |      |    |   |   |   |   |    |    |    |   |   |
| Iodine Halides| ClI             | C1     | U        | U      |       |             |           |      |    |   |   |   |   |    |    |    |   |   |
| Iodine Halides| BrI             | C1     | U        | U      |       |             |           |      |    |   |   |   |   |    |    |    |   |   |
| Iodine Halides| ClI             | C1     | U        | U      |       |             |           |      |    |   |   |   |   |    |    |    |   |   |
| Iodine Halides| BrI             | C1     | U        | U      |       |             |           |      |    |   |   |   |   |    |    |    |   |   |
| Iodine Halides| ClI             | C1     | U        | U      |       |             |           |      |    |   |   |   |   |    |    |    |   |   |
| Iodine Halides| BrI             | C1     | U        | U      |       |             |           |      |    |   |   |   |   |    |    |    |   |   |
| Iodine Halides| ClI             | C1     | U        | U      |       |             |           |      |    |   |   |   |   |    |    |    |   |   |
| Iodine Halides| BrI             | C1     | U        | U      |       |             |           |      |    |   |   |   |   |    |    |    |   |   |
| Iodine Halides| ClI             | C1     | U        | U      |       |             |           |      |    |   |   |   |   |    |    |    |   |   |
| Iodine Halides| BrI             | C1     | U        | U      |       |             |           |      |    |   |   |   |   |    |    |    |   |   |
### Gas Compatibility

**Continued**

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* Satisfactory for use with EPDM (Ethylene Propylene Rubber) and EPDM. See page 9 for more information.
## Compatibility Guide

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<th>Metals</th>
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<td>Isobutene</td>
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<td>Isopentane</td>
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<td>Leptron</td>
<td>N₂</td>
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<td>Methyl Chloride</td>
<td>CH₃Cl</td>
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<tr>
<td>Methyl Mercaptan</td>
<td>CH₃SH</td>
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<tr>
<td>Nitric Oxide</td>
<td>NO</td>
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<td>Nitrogen</td>
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<td>Nitrogen Dioxide</td>
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<tr>
<td>Nitrous Oxide</td>
<td>N₂O</td>
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<tr>
<td>Oxygen</td>
<td>O₂</td>
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<tr>
<td>Paraffin Compounds</td>
<td>C₅H₁₀</td>
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<tr>
<td>Phosphine</td>
<td>PH₃</td>
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<tr>
<td>Phosphorus Pentoxide</td>
<td>P₅O₁₀</td>
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<tr>
<td>Propylene</td>
<td>C₃H₆</td>
<td>U</td>
<td>U</td>
<td>U</td>
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<td>?</td>
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</tr>
<tr>
<td>Propylene Oxide</td>
<td>C₅H₄O</td>
<td>U</td>
<td>U</td>
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<td>?</td>
<td>?</td>
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<tr>
<td>Stainless Steel</td>
<td>SS</td>
<td>U</td>
<td>U</td>
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</tbody>
</table>

See key on page 2 for more information.
Pressure Regulators: Maintenance

Regulator maintenance is an important part of maximizing your system’s performance and extending the service life of system components. A maintenance schedule is the frequency at which recommended maintenance operations should be performed. Adherence to a maintenance schedule should result in minimizing downtime due to regulator failure as well as enhancing safety in the work area. Regulator service defines the gas service in which the regulator is installed in terms of its corrosive nature. There are three categories: noncorrosive, mildly corrosive and corrosive. Establishing the category a regulator fits into can be difficult. Consult your Scott Representative.

Recommended Schedule – This schedule should be used as a general guide. Be sure to follow the manufacturer instructions supplied with your regulator.

<table>
<thead>
<tr>
<th>Service</th>
<th>Leak Check</th>
<th>Creep Test</th>
<th>Inert Purge</th>
<th>Overhaul</th>
<th>Replace*</th>
</tr>
</thead>
<tbody>
<tr>
<td>Noncorrosive</td>
<td>Monthly</td>
<td>Annually</td>
<td>NA</td>
<td>5 years</td>
<td>10 years</td>
</tr>
<tr>
<td>Mildly corrosive</td>
<td>2x month</td>
<td>6 months</td>
<td>at shutdown</td>
<td>2 years **</td>
<td>4 years **</td>
</tr>
<tr>
<td>Corrosive</td>
<td>2x month</td>
<td>3 months</td>
<td>at shutdown</td>
<td>1-2 years**</td>
<td>3-4 years**</td>
</tr>
</tbody>
</table>

* More frequent servicing or replacement may be required for regulators installed in a corrosive atmosphere.
** If regulators are not properly installed or used, or if a poor grade of gas is used, or if purging is not properly done, servicing and replacement may be required more frequently than indicated.
† For regulators used in toxic or inert gas applications, cross should be taken to ensure proper precautions and safety, as recommended by Scott.
NA: Not applicable

Leak Check – With a regulator under pressure (both high and low pressure side) check all connections for leaks using a gas leak detector (Scott Model 46, B Series) or Snooper®. If a leak is detected, shut down the gas source, reduce pressure to atmospheric, and tighten or redo the leaking connection. Repeat if leak persists; contact Scott.

Warning: If the connection must be redone (i.e., to replace a compression fitting), regulators used on toxic or corrosive gases must first be purged with an inert gas such as nitrogen. Consult Scott or the regulator manufacturer for specific purging instructions.

---

To Process

Diagram:

Recommended configuration for proper dilution purging.
1. Read labels and Material Safety Data Sheet (MSDS) before use.

2. Store upright and use in well ventilated, secure areas away from pedestrian or vehicle thoroughfare.

3. Guard cylinders against being knocked violently or allowed to fall.

4. Wear safety shoes, glasses and gloves when handling & connecting cylinders.

5. Always move cylinders securely with an appropriate trolley. Take care not to turn the valve on when moving a cylinder.

6. Keep in a cool, well ventilated area, away from heat sources, sources of ignition and combustible materials, especially flammable gases.

7. Keep full and empty cylinders separate.

8. Keep ammonia based leak detection solutions, oil and grease away from cylinders and valves.

9. Never use force when opening or closing valves.

10. Don’t repaint or disguise markings and damage. If damaged, return to BOC immediately.

Further details regarding these steps and other actions you can take for safer storage and handling are on the back of this flyer.
Safety is of paramount importance to BOC - there are no higher priorities for us than the health and safety of our employees, customers, suppliers and the community. This poster provides important information on the safe handling and storage of gas cylinders. Please display it prominently near your cylinder storage area.

Remember, always read the label & Material Safety Data Sheet (MSDS) before use.

**Storage of cylinders**

All cylinders should be considered and treated as full, regardless of their content. This means:

- Keep cylinders away from artificial heat sources (eg. flames or heaters).
- Do not store cylinders near combustible materials or flammable liquids.
- Keep flammable gases away from sources of ignition.
- Keep cylinders in well drained areas, out of water pools or ponds.
- The storage area should be kept well ventilated and clean at all times. Ideally do not store in confined spaces.
- Avoid below ground storage, where possible. Where impractical, consider enclosed space risks.
- There should be good access to the storage area for delivery vehicles. The ground surface should be reasonably level and firm (preferably concrete).
- Storage area should be designed to prevent unauthorised entry, to protect untrained people from hazards and guard cylinders from theft.
- Different types of gases must be stored separately, in accordance with State Dangerous Goods legislation. Also refer to AS4332 (The Storage and Handling of Gases in Cylinders).
- Stores must clearly show signage in accordance with state Dangerous Goods regulations. This includes Class Diamonds; HAZCHEM; no smoking and naked flame warning signs.
- Full and empty cylinders should be kept separate.
- Toxic and corrosive gases should be stored separately from all other gases.
- Liquefied flammable cylinders must be stored upright on a firm, level floor (ideally concrete). This is also preferable for most other gas cylinders.
- Store cylinders away from heavy traffic and emergency exits.
- Rotate stock of full cylinders, and use cylinders on a ‘first in, first out’ basis.
- Never repaint or obscure cylinder label, even if cylinder is rusty, dirty or damaged. This can result in unsafe situations.
- Never apply any unauthorised labels or markings to cylinders, unless advised by BOC to identify faulty cylinders.
- Avoid storing cylinders below 0°C. Some mixtures may separate below this.
- Regularly check for leaks and faults.
- Keep ammonia based leak detection solutions, oil and grease away from cylinders and valves.
- Never use force when opening or closing valves.

**Handling of cylinders**

When handling gas cylinders, and in line with current manual handling regulations, it is advisable that the following precautions are followed:

- Larger cylinders are heavy. Manual handling risk assessments and training should be undertaken.
- Safety shoes, glasses and gloves should be worn when handling and connecting cylinders
- Cylinders should be handled with care and not knocked violently or allowed to fall.
- Cylinders should be moved with the appropriate size and type of trolley.
- Ensure you do not inadvertently turn the cylinder valve on when moving a cylinder.
- Cylinder valves must be closed when moving cylinders and equipment should be detached.
- Only people trained in cylinder manual handling should move cylinders over short distance.
- Over longer distances, use appropriate trolleys or pallets, and firmly secure cylinders into them.
- Never roll cylinders along the ground as this may cause the valve to open accidentally. It may also damage the cylinder, label and paintwork.

**PLAN FOR EMERGENCIES**

- If a cylinder is damaged contact BOC immediately.
- Those people with a responsibility for storing or using gas cylinders should be trained and familiar with the procedures to be followed in case of an emergency.
- Storage area layouts and emergency procedures should be carefully planned, recognising the possibility of an emergency arising.

In case of emergency, call 000 and BOC on 1800 653 572

BOC is a leading provider of gases and related products, services and solutions in the South Pacific.

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10 Julius Ave, North Ryde
NSW 2113
PH: 131 262
www.boc.com.au

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Gases in General

The primary means of identification of the contents of any cylinder is the label affixed to the shoulder of the cylinder.

**TYPICAL CONTENTS LABEL:**

1. Gas contained in cylinder.
2. Grade of gas.
3. Cylinder size.
4. Cylinder contents at standard temperature and pressure.
5. United Nations (UN) number relating to the safe handling, transport, and storage of dangerous goods.
6. Class diamond.
7. Caution - main hazards.
8. Safety information.
The gas or gas mixture is further identified by the colour of the cylinder.

**PURE GASES:**
Specific colours under AS 4484
eg: Nitrogen - pewter
Argon - peacock blue
Oxygen - black

**GAS MIXTURES:**
Gas mixtures are identified by:
- Cylinder body colour:
  - indicating the major component.
- Colour bands on the cylinder shoulder:
  - indicating the minor components.

Generally the following colours apply:
- Hues of brown, green & dull blue - Non flammable, non toxic gases
- Hues of red - Flammable gases
- Hues of yellow - Toxic gases
- Hues of black and bright blue - Oxidizing gases
- Silver - Hydrocarbons (eg. LPG)
- Claret - Acetylene

**CAUTION**
Always ascertain identity of the gas before using it. Cylinder colour code should **NOT** be the only criterion used.

Do not remove or deface labels provided by the supplier for the identification of the cylinder contents.

Do not use a cylinder without a label. Return any unlabelled cylinder to the supplier.
Associated risks and hazards of handling gases
Since gases are invisible their presence is not readily identifiable and they have the potential to asphyxiate, burn or harm users.

Each year in Australia, there are incidents which involve the use of compressed or liquefied gases.

Many of these could have been avoided if the user had followed information contained in the Material Safety Data Sheet (MSDS) or had referenced this document or other similar freely available information.

Label
The label is the primary means of identification of the cylinder contents (see next page).

If the label is illegible or missing, DO NOT use the cylinder but return it to the gas company for a satisfactory replacement.

Cylinder colour
Cylinder colour is the secondary means of identification of the nature of the cylinder contents and the nature of the hazard associated with the gas contained in the cylinder.

Additional information
In the interests of personal safety, customers MUST familiarise themselves with:

- The respective MSDS
- Gas equipment operation and manual

Copies of current MSDSs for each of the gases stored and used must be collated and kept in a convenient location for quick reference in relation to:

- Storage
- Handling
- Transport issues
- Personal Protective Equipment
- Incident response

For MSDS please visit www.boc.com.au or contact 131 262.

Main gases hazard classifications. Special precautions when handling.

<table>
<thead>
<tr>
<th>Class</th>
<th>Australian Standards Definition</th>
<th>Cylinder Colour Identification*</th>
</tr>
</thead>
<tbody>
<tr>
<td>Diamonds</td>
<td>A gas that is known to be a) toxic or corrosive to humans as to pose a hazard to health; or b) presumed to be toxic or corrosive to humans because it has an LC 50 value equal to or less than 5000 ml/m³ (ppm).</td>
<td>Hues of Yellow</td>
</tr>
<tr>
<td>Toxic</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Flammable</td>
<td>A gas which will burn in air at a pressure of 101.3 kPa absolute.</td>
<td>Hues of Red</td>
</tr>
<tr>
<td>Oxidising</td>
<td>A gas which gives up oxygen readily, removes hydrogen from a compound, or readily accepts electrons.</td>
<td>Hues of Black, White, or bright Blue</td>
</tr>
<tr>
<td>Non-flammable, non-toxic</td>
<td>A gas which is non-flammable, non-toxic, non-oxidising, and is resistant to chemical action under normally encountered conditions.</td>
<td>Hues of Brown, Green or dark Blue</td>
</tr>
</tbody>
</table>

*For non imported gases
BOC cylinder and pack identification label

1. Gas name and grade
2. United Nations numbering system for safe handling, transport and storage
3. Dangerous Goods Classification
4. BOC gas code and cylinder size
5. Contents of cylinder at standard temperature and pressure i.e. (15°C @ 101.3kPa)
6. Nominal filling pressure at standard conditions (for permanent gas)
7. Caution – indicated major hazards*
8. General safety information*

*Always refer to Material Safety Data Sheet (MSDS)

Labels vary in shape, size and their positioning on cylinders and packs (indicated by red arrows).
### Primary hazards for commonly used industrial gases are given below:

<table>
<thead>
<tr>
<th>Major Hazard</th>
<th>Gas</th>
<th>Cylinder Colour</th>
<th>Characteristics</th>
</tr>
</thead>
<tbody>
<tr>
<td>Asphyxiant</td>
<td>Carbon dioxide</td>
<td>Green Grey AS No. N32</td>
<td>Can cause the nose to sting. Will collect in ducts, drains and low lying areas, e.g. cellars. At high concentrations, instant unconsciousness may occur, followed by death. Much heavier than air.</td>
</tr>
<tr>
<td>Asphyxiant</td>
<td>Argon</td>
<td>Peacock Blue AS No. T53</td>
<td>Odourless. No warning signs before unconsciousness occurs. At high concentrations, almost instant unconsciousness may occur, followed by death. Heavier than air. Does not burn. Inert.</td>
</tr>
<tr>
<td>Asphyxiant</td>
<td>Helium Balloon Gas</td>
<td>Brown AS No. X54</td>
<td>Inert but asphyxiant at high concentrations; lighter than air. DO NOT INHALE UNDER ANY CIRCUMSTANCES.</td>
</tr>
</tbody>
</table>

| Flammable | LPG | Silver, grey or galvanised | LPG is ‘stenched’ (odourised) and has a distinctive odour. It will ignite and burn instantly from a spark or piece of hot metal. Is heavier than air and will collect in ducts, drains etc., and low lying areas. Fire and explosion hazard. Highly flammable. Eliminate all ignition sources. |
| Flammable | Acetylene | Claret AS No. R55 | Distinctive garlic smell. Fire and explosion hazards are greater than LPG but it is slightly lighter than air and less likely to collect in ducts and drains. Requires minimal energy to ignite in air or oxygen. Do not use with copper, high copper or brass alloys because copper materials form explosive compounds with Acetylene. |
| Oxidising | Oxygen  | Black AS No. N61         | Odourless. Generally considered non-toxic at atmospheric pressure. Will not burn, but supports and accelerates combustion. Materials not normally considered combustible may be ignited by sparks in oxygen rich atmospheres. No oil, grease or lubricants should come into contact with oxygen. |

Illustrations above are intended to be typical only showing colour and label location. They neither reflect the size or shape of cylinders, nor show the cylinder valve or guard (where fitted). This list identifies primary hazards only. Other hazards may apply.
**BOC industrial and refrigeration gas cylinder colour identification**

### Air Based Gases

<table>
<thead>
<tr>
<th>Gas</th>
<th>Grade</th>
<th>Color Identification</th>
</tr>
</thead>
<tbody>
<tr>
<td>Air</td>
<td>Industrial Grade</td>
<td>Black/Peewter</td>
</tr>
<tr>
<td>nitrogen</td>
<td>Industrial Grade</td>
<td>Pewter</td>
</tr>
<tr>
<td>Oxygen</td>
<td>Industrial Grade</td>
<td>Black</td>
</tr>
<tr>
<td>Argon</td>
<td>Welding Grade</td>
<td>Peacock Blue</td>
</tr>
<tr>
<td>Carbon dioxide</td>
<td>Industrial Grade</td>
<td>Green Grey</td>
</tr>
</tbody>
</table>

### Fabrication Gases

<table>
<thead>
<tr>
<th>Gas</th>
<th>Grade</th>
<th>Color Identification</th>
</tr>
</thead>
<tbody>
<tr>
<td>Air</td>
<td>Industrial Grade</td>
<td>Black/Peewter</td>
</tr>
<tr>
<td>nitrogen</td>
<td>Industrial Grade</td>
<td>Pewter</td>
</tr>
<tr>
<td>Oxygen</td>
<td>Industrial Grade</td>
<td>Black</td>
</tr>
<tr>
<td>Argon</td>
<td>Welding Grade</td>
<td>Peacock Blue</td>
</tr>
<tr>
<td>Carbon dioxide</td>
<td>Industrial Grade</td>
<td>Green Grey</td>
</tr>
</tbody>
</table>

### Shielding Gases

<table>
<thead>
<tr>
<th>Name</th>
<th>Grade</th>
<th>Color Identification</th>
</tr>
</thead>
<tbody>
<tr>
<td>Argoshield®</td>
<td>Light 060</td>
<td>Black/Green Grey/Peacock Blue</td>
</tr>
<tr>
<td>Argoshield®</td>
<td>Universal 065</td>
<td>Black/Green Grey/Peacock Blue</td>
</tr>
<tr>
<td>Argoshield®</td>
<td>Heavy 064</td>
<td>Black/Green Grey/Peacock Blue</td>
</tr>
<tr>
<td>Argoshield®</td>
<td>40 068</td>
<td>Black/Green Grey/Peacock Blue</td>
</tr>
<tr>
<td>Argoshield®</td>
<td>52 070</td>
<td>Black/Green Grey/Peacock Blue</td>
</tr>
<tr>
<td>Argoshield®</td>
<td>54 071</td>
<td>Black/Green Grey/Peacock Blue</td>
</tr>
<tr>
<td>Argoshield®</td>
<td>100 095</td>
<td>Black/Green Grey/Peacock Blue</td>
</tr>
</tbody>
</table>

### Stainshield®

<table>
<thead>
<tr>
<th>Name</th>
<th>Grade</th>
<th>Color Identification</th>
</tr>
</thead>
<tbody>
<tr>
<td>075</td>
<td></td>
<td>Black/Green Grey/Peacock Blue</td>
</tr>
<tr>
<td>69 094</td>
<td></td>
<td>Black/Brown/Peacock Blue</td>
</tr>
</tbody>
</table>

### Alushield®

<table>
<thead>
<tr>
<th>Name</th>
<th>Grade</th>
<th>Color Identification</th>
</tr>
</thead>
<tbody>
<tr>
<td>079</td>
<td></td>
<td>Black/Brown/Peacock Blue</td>
</tr>
<tr>
<td>69 092</td>
<td></td>
<td>Black/Green Grey/Peacock Blue</td>
</tr>
<tr>
<td>69 093</td>
<td></td>
<td>Black/Green Grey/Peacock Blue</td>
</tr>
</tbody>
</table>

### Fuel Gases

<table>
<thead>
<tr>
<th>Gas</th>
<th>Grade</th>
<th>Color Identification</th>
</tr>
</thead>
<tbody>
<tr>
<td>Acetylene</td>
<td>Industrial Grade</td>
<td>Claret</td>
</tr>
<tr>
<td>Handigas™ IP G</td>
<td>Industrial Grade</td>
<td>Silver Grey/Galvanised</td>
</tr>
<tr>
<td>Handigas™ IP G</td>
<td>Gas withdrawal</td>
<td>Silver Grey/Galvanised</td>
</tr>
<tr>
<td>Handigas™ IP G</td>
<td>Liquid withdrawal</td>
<td>Signal Red</td>
</tr>
<tr>
<td>Hydrogen</td>
<td>Industrial Grade</td>
<td>Royal Blue</td>
</tr>
</tbody>
</table>

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*BOC industrial and refrigeration gas cylinder colour identification*
BOC industrial and refrigeration gas cylinder colour identification (cont)

### Laser Gases

<table>
<thead>
<tr>
<th>Gas</th>
<th>Laser Grade</th>
<th>Colour</th>
</tr>
</thead>
<tbody>
<tr>
<td>Carbon dioxide</td>
<td>131</td>
<td>Green Grey</td>
</tr>
<tr>
<td>Oxygen</td>
<td>128</td>
<td>Black</td>
</tr>
<tr>
<td>Helium</td>
<td>120</td>
<td>Brown</td>
</tr>
<tr>
<td>Nitrogen</td>
<td>129</td>
<td>Pewter</td>
</tr>
<tr>
<td>Nitrogen</td>
<td>234</td>
<td>Pewter</td>
</tr>
</tbody>
</table>

### Refrigeration Gases

<table>
<thead>
<tr>
<th>Refrigerant</th>
<th>Code/Name</th>
<th>Colour</th>
</tr>
</thead>
<tbody>
<tr>
<td>r134a</td>
<td>155</td>
<td>Aqua/Galvanised or White</td>
</tr>
<tr>
<td>r22</td>
<td>158</td>
<td>Moss Green/Galvanised or White</td>
</tr>
<tr>
<td>r409A</td>
<td>246</td>
<td>Brown/Galvanised or White</td>
</tr>
<tr>
<td>r410A</td>
<td>168</td>
<td>Brown/Galvanised or White</td>
</tr>
<tr>
<td>Fr12™</td>
<td>r416A</td>
<td>Brown/Galvanised or White</td>
</tr>
<tr>
<td>r507</td>
<td>250</td>
<td>Slate/Galvanised or White</td>
</tr>
<tr>
<td>r717</td>
<td>178</td>
<td>Brown/Galvanised or White</td>
</tr>
</tbody>
</table>

### Class Diamonds

- **Oxidising Gas**
  - Class 2.2 / 5.1
  - Diamond: Yellow
  - Lettering: Black

- **Flammable Gas**
  - Class 2.1
  - Diamond: Red
  - Lettering: Black

- **Toxic Gas**
  - Class 2.3
  - Diamond: White
  - Lettering: Black

- **Non-Flammable, Non-Toxic Gas**
  - Class 2.2
  - Diamond: Green
  - Lettering: Black

### General Definitions

- **Oxidising**
  - Many materials which will not burn in air may readily ignite and or burn in the presence of an oxidising gas — e.g. oxygen. This includes work clothing and many materials considered non flammable.

- **Flammable Gas**
  - Flammable gas in the presence of the correct mix of air and an ignition source will lead to combustion.

- **Toxic Gas**
  - A gas that is known to be so toxic or corrosive to humans as to pose a hazard to health.

### Notes

1. Colour names and reference numbers refer to AS 2700
2. Designated cylinder colours comply with AS 4484:2004
3. Numbers in red are BOC’s Gas Code
4. Cylinder valves not shown
5. Refer to Australian Standard definitions
Guidelines for Gas Cylinder Safety

About your cylinders and valves

design and construction of gas cylinders
BOC gas cylinders are designed and constructed in accordance with Australian and International Standards as applicable. These Standards define the cylinder’s:
- Material
- Method of manufacture
- Test pressure
- Maximum permissible filled pressure and
- Method of periodic inspection

Compressed gas cylinder sizes

single cylinders
BOC offers a wide range of single high pressure cylinders suitable for small volumes of gas, available in many sizes and pressures.

BOC cylinder sizes are denoted by a letter code. The gas content of cylinders is measured in cubic metres, litres or kilograms. If volume unit is given, it refers to standard temperature and pressure of 15°C (101.3 kPa).

Cylinder sizes, capacities and physical dimensions are shown below and on the following pages. Not all products are available in all sizes listed, please consult BOC 131 262 for details.

Manifolded Cylinder Pack (Pack or Bundle)
Cylinders are normally used individually or collectively. A Manifolded Cylinder Pack (see pic on next page) describes cylinders used collectively, interconnected by a manifold – a portable frame. These are often bundled in packs of 4, 9 or 15 cylinders. Collective use of cylinders is necessary for customers who require larger quantities of gas.

Where customers do not have adequate handling facilities for on and off loading from the delivery vehicle, BOC can deliver on vehicles with suitable manual handling equipment.

Never remove individual cylinders from Manifolded Cylinder Packs.

These are designed and supplied as integral units with gas content labels to suit. Removal of individual cylinders renders the label contents incorrect and may have safety implications.
**Guidelines for Gas Cylinder Safety**

**Typical permanent identification marks on cylinders**
For seamless cylinders, permanent identification markings are usually found on the shoulder or base of the cylinders. For fabricated cylinders, markings are found on the valve protection ring (VPR).

**Maintenance and testing of gas cylinders**
In most cases BOC is the owner of the cylinder. As the owner, BOC is responsible for complying with the statutory requirements relating to maintenance and periodic testing of cylinders.

Australian Standard AS 2030 details the statutory requirements in respect to design, manufacture, inspection and filling.

**Cylinder contents identification**
All BOC cylinders are labelled in accordance with the requirements of the Australian Dangerous Goods Code (ADG Code) for transport of dangerous goods by road and rail.

Cylinder labels identify the gas contents of the cylinder and provide basic safety information (see page 6).

Never use any cylinder or pack unless it is clearly labelled and can be positively identified.

Never change a cylinder’s contents from what was otherwise intended
Never repaint a cylinder
Never change a cylinder’s markings or identification

It is dangerous to change the contents or external colour of a cylinder.
Cylinder valves

All BOC cylinders containing gas under pressure are fitted with a cylinder valve which MUST NOT be removed or tampered with at any time as this will compromise the safety of the cylinder. Removing fittings under pressure may result in serious personal injury as fittings may be projected at high velocity.

Each valve outlet is specially threaded to receive commercially available pressure regulators. They can be obtained from BOC Gas & Gear centres and agents. Regulators are first screwed in fully to the cylinder valve outlet by hand and then tightened using the regulator spanner.

Valve outlets threaded

For safety reasons, flammable gases and non-flammable gases have their cylinder valve outlets threaded opposite hand. This prevents the connection of the incorrect regulator to cylinder valve outlets.

Valve outlets for flammable gases are screwed LEFT-HAND (anti-clockwise to tighten), identifiable by its notched appearance. Cylinders containing flammable gases like acetylene, hydrogen, propane and mixtures containing fuel gas all have left-hand threads.

Valve outlets for non-flammable gases are screwed RIGHT-HAND (clockwise to tighten). Cylinders containing non-flammable/non-toxic gases all have conventional right-hand threads. Non-flammable gases can be oxidising e.g. oxygen; or non-flammable, non-toxic e.g. nitrogen, argon and air.

The only exception to this rule are cylinders used on forklift trucks. These cylinders have RIGHT-HAND thread valve outlets.

Valve guards and valve protection caps

Some cylinders are fitted with valve guards or valve protection caps. DO NOT remove valve guards. DO replace valve protection caps whenever the cylinder is not secured or not in use. DO return your cylinder to BOC with the valve in the closed position and with the protection cap on (refer to “Opening or Closing cylinder valves” on next page).

Valve guards and valve protection caps

Some cylinders are fitted with valve guards or valve protection caps. DO NOT remove valve guards. DO replace valve protection caps whenever the cylinder is not secured or not in use. DO return your cylinder to BOC with the valve in the closed position and with the protection cap on (refer to “Opening or Closing cylinder valves” on next page).
Before operating a cylinder valve

**OPENing or CLOSING cylinder valves**

OPEN by turning the handwheel or cylinder valve key anti-clockwise. Only use reasonable force.

CLOSE by turning the handwheel or cylinder valve key clockwise. Only use reasonable force.

When in use, cylinder valves used in the fully open position may become stuck in this open position. To prevent this ensure that the handwheel or cylinder valve key is turned back half a turn.

Cylinder valves with an integrated regulator (applicable currently to 300 bar filled cylinders and MCPs e.g. nitrogen, shielding gases)

BOC cylinders are filled to a variety of pressures e.g. sub 200 bar – 137, 163, 175 and 200 bar. The largest capacity cylinders are filled to 300 bar to allow more gas to be filled at a higher pressure in an equivalent sized cylinder. Controlling the pressure within these 300 bar cylinders to operating level (i.e. 200 bar or less) is a tiny integral pressure regulator. The cylinder valve complete with this regulator is known as a Valve Integrated Pressure Regulator (VIPR).

BOC’s 300 bar cylinder valves come fitted with VIPRs. This VIPR is typically set to a maximum output of 60-80 bar pressure at any given time. Therefore an existing regulator of 200 bar or less can be used with these 300 bar cylinders.

As a result of the VIPR, when a 200 bar regulator is fitted, the gauge on this 200 bar regulator will only display a 60/80 bar inlet pressure even though the cylinder has actually been filled to 300 bar.

The only exception to this are the Laser MCPs which come fitted with a high flow rate 300 bar regulator. This regulates the outlet of the cylinder MCP to the selected outlet pressure which is adjustable from 0 to 35 bar.

Handy hints for identifying the cylinder contents pressure

- **300 bar MCPs** have a centrally mounted pressure gauge which indicates the MCP’s contents pressure (approx. 300 bar when full)
- **For J cylinders** the contents label indicates the pressure when full
- **For cylinders filled to 200 bar or less**, the contents label initially indicates the cylinder contents pressure when full. Thereafter, as gas is consumed, the regulator inlet pressure gauge will show the cylinder contents pressure.

To convert from MPa/kPa/psi to bar refer to the pressure cross reference chart in the glossary. Alternatively contact BOC 131 262.

Note: Gauges are to be used for indication purposes only.

Pressure relief devices

Most cylinders or manifoded cylinder packs are fitted with a relief device. In a situation where excess pressure is encountered, this is designed to discharge cylinder contents either completely or only discharge the excess pressure. This is accompanied by a high pitched noise. There are three types of commonly used pressure relief devices:

- burst disc (most common)
- fusible plug (e.g. acetylene)
- pressure relief valve (e.g. LPG)

**Burst disc**

In the event of overpressure, this is designed to burst, leaving an open passage for gas contents to escape completely.

e.g. Carbon Dioxide (CO₂) cylinders are fitted with a burst disc which operates at approximately 207 bar and is fitted on the cylinder valve.

**Fusible plug**

This plug is designed to melt, releasing contents completely.

e.g. Acetylene cylinders are fitted with fusible plugs which melt at approximately 100°C.

**Pressure relief valves**

This valve is designed to relieve excess pressure and close again after relieving the excess pressure.

e.g. BOC Handigas™ (LPG) cylinders are fitted with pressure relief valves which operate at approximately 26 bar.

Safety tip

Cylinders can be dangerous and can release contents given the right circumstances. BOC recommends proper Personal Protective Equipment (PPE) be worn at all times, consult your Occupational Health & Safety officer or BOC 131 262 for further details. Storage guidelines appropriate to the gas specified must be adhered to. In the event your cylinder activates any of these devices contact BOC 1800 653 572 and Emergency Services ‘000’. 
Guidelines for Gas Cylinder Safety

securing cylinders

Cylinder trolley  Cylinder wall brackets  Cylinder bracket on welding machine

Handling gas cylinders — general safety

dO use mechanical aids (ramps, trolleys, forklifts, scissor lifts) in preference to direct manual handling of cylinders.
dO remove any connected equipment (e.g. regulator) AND refit any supplied valve protection cap and/or valve outlet gas tight cap/plug prior to moving cylinders.
dO ensure cylinders are positively secured to mechanical lifting/handling devices prior to movement.
dO familiarise yourself with and observe appropriate safe lifting techniques/postures prior to manually handling heavy or large gas cylinders.
dO assess the load weight and dimensions before attempting any lift.
dO use suitable personal protective equipment (PPE) – wear safety footwear and leather gloves to protect against falling/slipping cylinders crushing hands or feet during moving.
dO ensure a positive hand grip prior to commencing a manual lift.
dO ensure that loads are equally shared when attempting two-person lifts.
dO note environmental conditions prior to handling cylinders — wet, hot or cold cylinders may diminish the quality of hand grip and footing may be compromised.

do nOt bear-hug cylinders to effect a lift.
do nOt lift or lower cylinders where the operators hands are above shoulder height or below mid-thigh height.
do nOt edge-roll cylinders up or down steps of 250 mm or higher.
do nOt edge-roll cylinders over discontinuous or soft surfaces.
do nOt attempt to catch or restrain a falling cylinder.
do nOt attempt to handle cylinders if you are fatigued, physically compromised or under the adverse influence of medication or alcohol.
do nOt drop cylinders as a method of transfer — this may seriously damage the cylinder or its valve, resulting in their failure and product release.

Recommendation under Manual Handling Gas Cylinder, as endorsed by ANZIGA (Australia and New Zealand Industrial Gas Association).
 Guidelines for Gas Cylinder Safety

Storing your cylinder safely

**storage locations**

Small quantities of cylinders may be stored in a variety of locations, provided Dangerous Goods and local government regulations and the principles given in the following paragraphs are followed.

Larger quantities of cylinders should be kept in a purpose-designed store or storage area, following the same principles.

**Ideal storage**

Full or empty compressed gas cylinders should be stored in a well-ventilated area, preferably in the open, with some weather protection.

The area on which cylinders are stored must be well-drained to prevent corrosion of cylinder bases. The location must be free from the risk of fire and well away from sources of heat or ignition.

**store cylinders standing vertically and secure them**

1. It is recommended to store cylinders vertically.
2. Vertically stored cylinders must always be secured or under your direct control. When standing or rotating 'walking' cylinders about their vertical axis, be aware of the hazards of uneven sloping, slippery and unstable surfaces as well as loose surfaces. Secure cylinders to prevent them falling as unsecured cylinders are a potential hazard to users and passers-by should they inadvertently bump them.
3. Acetylene and LPG must never be stacked horizontally in storage or in use.
4. Whenever possible use a cylinder trolley for transporting cylinders higher than one's waist height.

**Plan for emergencies**

**ensure free and clear access to cylinder storage areas**

All persons with a responsibility for storage or use of gas cylinders must be familiar with the emergency procedures. Store layouts and emergency procedures need to be structured accordingly and to cater for such possible incidents.

**Cylinders should be stored in dedicated cylinder-only areas**

You must not store any other products in a cylinder store, particularly oil, paint or corrosive liquids.

**rotate your stock**

Your storage arrangements should ensure adequate turn around of stock. Do not store empty cylinders longer than necessary; return them to BOC as soon as possible. This applies particularly to cylinders which normally contain flammable or toxic gases.

**Wear the correct Personal Protective equipment (PPE)**

All persons handling gas cylinders must wear the correct PPE. Safety shoes, safety glasses plus ear protection are essential. The correct grade of gloves (where appropriate) may also be required.

In many places, safety signs will designate where and what PPE is to be worn. Loose clothing and hair is an entanglement hazard, and steps must be taken to avoid this.

**storage and segregation of cylinders**

Within the storage area, oxidising gases such as oxygen must be stored at least 3 metres away from fuel gas cylinders (refer to pg 8 for types). The use of an appropriately fire rated wall may provide the required separation.

Full cylinders must be stored separately from the empty cylinders, and cylinders of different gases whether full or empty must be segregated from each other.

Where security is an issue, there is available a wide variety of Gas Cylinder Storage Systems which satisfy the cylinder storage requirements of AS 4332.

Contact BOC on 131 262 for details.

**storage of toxic gases**

Toxic gases must be stored separately from all other gases and the detailed instructions on the individual BOC Material Safety Data Sheets (MSDS) must be followed.

It is essential that when handling or storing cylinders containing toxic gases that the cylinder valve outlet threaded plug or cap is always replaced in the valve outlet when the cylinder is not in use or connected to a manifold or regulator. The cylinder valve outlet threaded plug or cap acts as a secondary valve to the valve itself and provides increased safety against leakage.

In an emergency involving toxic gas or other BOC Special Gases product, contact BOC Emergency Assistance on 1800 653 572.

For full details of local storage requirements consult the State Dangerous Goods regulations, and AS 4332.
storing your cylinders safely

All cylinders should be considered and treated as full, regardless of their content. This means:

- Keep cylinders away from artificial heat sources (e.g., flames or heaters).
- Do not store cylinders near combustible materials or flammable liquids.
- Keep flammable gases away from sources of ignition.
- Keep cylinders in well-drained areas, out of water pools or ponds.
- The storage area should be kept well ventilated and clean at all times.
- Do not store in confined spaces.
- Avoid below-ground storage where possible. Where impractical, consider enclosed space risks.
- There should be good access to the storage area for delivery vehicles. The ground surface should be reasonably level and firm (preferably concrete).
- The storage area should be designed to prevent unauthorised entry, to protect untrained people from hazards and to guard cylinders from theft.
- Different types of gases must be stored separately, in accordance with State Dangerous Goods legislation (Hazardous Substances Legislation in NZ). Also refer to AS 4332 (The Storage and Handling of Gases in Cylinders).

Stores must clearly show signage in accordance with state Dangerous Goods regulations. This includes Class Diamonds; HAZCHEM; no smoking and naked flame warning signs.

Full and empty cylinders should be kept separate. Toxic and corrosive gases should be stored separately, away from all other gases. Liquefied flammable cylinders must be stored upright, to keep the safety devices in the vapour phase, on a firm, level floor (ideally concrete). This is also preferable for most other gas cylinders.

Store cylinders away from heavy traffic and emergency exits. Rotate stock of full cylinders, and use cylinders on a ‘first in, first out’ basis.

Never repaint or obscure a cylinder label, even if the cylinder is rusty, dirty or damaged. This can result in unsafe situations.

Never apply any unauthorised labels or markings to cylinders, unless advised by BOC to identify faulty cylinders.

Avoid storing cylinders below 0°C. Some mixtures may separate below this temperature.

Regularly check for leaks and faults, only with approved leak detection fluid.

Keep ammonia-based leak detection solutions, oil and grease away from cylinders and valves.

Never use force when opening or closing valves.

storage of fuel gases

Within the storage area, oxygen should be stored at least 3 metres from fuel gases cylinders. The use of a fire wall may provide the required separation. If volume is greater than 200 m³, a separation distance of 5 metres needs to be executed.

Note: wall must be a minimum of one metre higher than the tallest cylinder.
Most accidents are avoidable
The majority of accidents involving compressed gas cylinders are avoidable with increased training and awareness of safety issues.

Cylinders need to be kept cool
do not store cylinders at temperatures greater than 65°C.
All efforts should be made to keep the cylinders well below the maximum ambient air temperature. Under extreme temperatures every effort should be made to keep the cylinders in the shade.

excessive heat – results in an increase in internal pressure.
Excessive heat can reduce the strength of the cylinder resulting in localised bulging at the source of the heat and in extreme cases cylinder rupture. Care must be taken with an oxy-fuel gas torch when in use. do not allow the flame from an oxy-fuel gas torch or other appliance to point onto cylinders.
The plastic Test Date Tags (TDTs) fitted by BOC on the cylinder valve inlet connection distort or melt at a predetermined temperature as shown when heat affected. This is to alert BOC gas cylinder re-fillers (and customers) of any heat damage to the cylinder. Any such heat affected cylinders are sent to our cylinder test shops to check if the cylinder can be returned back into gas service or be scrapped.

Handle cylinders carefully
damage – take care in handling cylinders to avoid impact damage. Do not drop cylinders off vehicles or docks when unloading or allow heavy objects to fall on them.
Impact damage can potentially reduce the cylinder wall thickness, which could lead to premature cylinder rupture.

Barcodes – are to alert the fillers and operators when the cylinders are due for re-test, and for identification purposes.
DO NOT under any circumstances tamper with or remove these.

Keep cylinders away from electric welding tools, red-hot metals, furnaces or any heat sources
Keep electrical welding equipment well away from cylinders. Do not allow welding torches to contact or get near to cylinders.
An accidental arc between the tool and the cylinder could cause localised overheating of the cylinder wall and thereby weaken the cylinder.

Anything hot must be kept away from cylinders.
Take care not to allow welding and cutting sparks, flames or red hot slag to make contact with the exterior of cylinders, or their associated cutting equipment and / or hoses. Keep cylinders a safe distance from potential accidental spillages of molten metal.

Items reach an acetylene cylinder, it will melt the fusible plugs and cause a release of acetylene gas and fire from the cylinder.

Before

After

Heat indicator test date tags (view from tag underside – without markings)
Guidelines for Gas Cylinder Safety

**neVer**
NEVER let oil or grease contact your cylinder or its valve and fittings; use sealants or lubricants when connecting gas fittings or equipment.
NEVER use cylinders as support structures.
NEVER roll them along the ground.
NEVER lubricate cylinder valves and fittings.
NEVER apply sealants (liquid or tape form) or lubricants to any cylinder valves or connecting fittings.

High pressure oxygen will react violently with oils and grease and cause a violent explosion or localised ignition leading to injury of the user and damage to equipment.

Oxygen equipment is at most risk from oil and grease so keep greasy hands, rags and gloves away from any part of the cylinder and fittings.
Wipe hands clean and try to minimise hand contact with surfaces which might be subject to oxygen under pressure.

**Keeping cylinder valves clean**
Cylinders are supplied with their cylinder valve outlets capped or plugged and in some cases PVC shrink wrapped.
The purpose of this is two fold:
1. To indicate the cylinder is full and
2. To keep the outlet clean and contamination free.
Top outlet valves, are particularly prone to dirt getting in the outlet.

If grit, dirt, oil or dirty water enters the cylinder valve outlet, this may cause damage to the valve internals and result in leakage.
Before assembling regulators and fittings make sure there are no particles of dirt in the cylinder valve outlet. If a supply of clean compressed oil free air or nitrogen is available, then, whilst wearing appropriate eye and ear protection, use this to blow out any loose particles of dirt from the valve outlet.
If a supply of clean compressed oil free air or nitrogen is unavailable, then use a clean lint free rag to clean the cylinder valve outlet, in particular the sealing surfaces.

**neVer attempt to repair a cylinder**
If a cylinder is involved in an incident (especially cylinders involved in fires) it must be:
withdrawn from service
set aside and made clearly identifiable
identified to the supplier – contact BOC (See also pages 32–34)

**neVer disguise damage to cylinders**
If a cylinder has been involved in a fire, never paint over the discoloured or heat affected areas. Heat damaged cylinders must be drawn to the attention of the Gas company so that detailed examination can be carried out to determine whether the cylinder(s) concerned can be repaired or need to be condemned.
Incidents have occurred where third parties have disguised damage to a cylinder which has resulted in a rupture of the cylinder when next refilled.
Cylinders must never be tampered with or relabelled by anyone other than the cylinder owner.

**neVer mix gases in a cylinder**
Users must never mix gases in a cylinder; this must only be undertaken by an authorised competent gas specialist personnel with suitable equipment and facilities under controlled conditions.

**neVer transfer gas to another cylinder**
Never transfer, transfill or siphon gas from one cylinder to another.

**neVer scrap a cylinder you do not own**
Most gas cylinders are owned by gas companies. There are however small numbers of privately owned cylinders (POCs). These can be individuals, companies or Government institutions. Ownership is indicated by the cylinder label. If the label is missing, ownership can be established by the permanent stampings on the cylinder shoulder. If BOC discovers a cylinder to be defective and must be condemned, BOC will contact the owner for their permission to scrap it.
Scrap metal merchants and recyclers must never buy gas cylinders as scrap metal unless the cylinders have been condemned by an AS authorised Test Shop.
If intact valved cylinders are discovered amongst recycled scrap, these must be set aside and the owner contacted with relevant particulars (i.e. colour, service, number and markings, in most cases this will be one of the gas companies) to make arrangements for their collection and return.

**neVer use equipment with cylinders for which they are not intended**
Do not attempt to make any adaptors or pipework to cross connect cylinders as this is potentially dangerous.
Only use equipment that is fit for purpose

The gas cylinder and outlet valve are designed to supply gas through pressure regulators that meet the requirements of the relevant Australian Standards.

Pressure regulators thread directly to the cylinder valve outlet (also applies to cylinder packs) so it is vital that the size and tolerance are to specification and meet the specified machining tolerance.

Never install additional piping or fittings between regulators and the outlet valves of cylinder packs.

When individual cylinders of the same gas are manifolded together to a common outlet, the pressure regulator must be connected to this single manifolded outlet.

Use the adjustment valves downstream of the pressure regulator only and not those fitted upstream, as this will starve the regulator of flow.

Pressure regulators: check the inlet spigot connection first

Make sure the pressure regulator is designed for use with high pressure gas cylinders and that the inlet spigot thread matches the cylinder valve outlet and that the O-ring or seal is in place, clean and undamaged.

Never force any regulator connection that does not fit. Regulator connections can be fully threaded in by hand and then only require a fraction of a turn to achieve a gas tight seal. Regulators must be maintained in accordance with the manufacturer’s instructions.

Do not attempt to repair or modify the regulator. Take it to the manufacturer’s authorised service centre.

Release (i.e. turn anti-clockwise, ‘back off’) the regulator adjusting knob before attaching the pressure regulator.

Before connecting a pressure regulator to a full cylinder always screw out (anticlockwise) the pressure adjusting knob so that there can be no flow through the regulator when the cylinder valve is initially opened.

Only use the gas for the intended purpose.

Gas cylinders with their associated regulator and reticulation equipment are supplied for use in their intended application.

These uses are covered in gas supplier catalogues.

Do not experiment with gas or gases. If in doubt and expert assistance is required then please consult with our Technical Service desk on 131 262.
**Guidelines for Gas Cylinder Safety**

**do not use oil or packing on any regulator – oxygen or not**

Never try to ease any regulator threads with oil: do not use PTFE tape. This advice applies to all gas cylinders and regulators.

Never pack out or use any connection that appears worn when tightening or loose when fully screwed home.

**Fuel gas (Hydrogen, Handigas™ (LPG), Acetylene): use only the regulator designed for the gas**

Do not interchange left-hand threaded pressure regulators between gases. Each is designed for use with a specific gas, and to interchange them could be hazardous. Remember the cylinder pressure and properties are different for each gas.

Do not use left-hand to right-hand adaptors.

**Fit flashback arrestor**

To prevent flames travelling back into cylinders, devices known as flashback arrestors should be fitted downstream of pressure regulators in Oxygen, Acetylene, Handigas™(LPG) and Hydrogen systems where flammable mixtures can occur.

**does your manifold have the right regulators and flashback arrestors?**

Where cylinders are connected to a manifold the system must be properly designed for the task and installed by a competent trained technician. It must be fitted with one or more pressure regulators. Acetylene manifolds must also be fitted with a flashback arrestor.

Selection from the BOC Flashback Arrestors’ range.