



GAS cylinders and fittings

Cylinder Valves and Connections

Compressed gas cylinders must be connected only to **regulators and equipment designed for the gas in the cylinder**. Since connecting the wrong equipment can be dangerous, a number of different standard cylinder valve outlets are available for different classes of gas. For example, these standard connections prevent the valve connection for a flammable gas from fitting the connections for an incompatible gas, such as an oxidizing gas.

Most compressed gas cylinders have valve caps or some other method of protecting the valve from damage during handling and transportation. A dust cap may be placed over the valve outlet itself to help keep it clean.

What are cylinder safety devices?

Most cylinders have one or more safety-relief devices. These devices can prevent rupture of the cylinder if internal pressure builds up to levels exceeding design limits. Pressure can become dangerously high if a cylinder is exposed to fire or heat, including high storage temperatures.

There are three types of safety-relief devices. Each relieves excessive gas pressures in a different way:

- **Safety- or Pressure-Relief Valves:** These valves are usually a part of the cylinder. They are normally held closed by a spring. The force holding the valve closed is set according to the type of gas in the cylinder. The valve opens if the cylinder pressure exceeds the set safety limit. Gas is released until the cylinder pressure drops back to the safety limit. The valve then closes and retains the remaining gas in the cylinder.
- **Rupture Discs (also known as frangible or bursting discs):** These discs are usually made from metal. They burst or rupture at a certain pressure, releasing the gas in the cylinder. The bursting pressure is designed so that the disc ruptures before the cylinder test pressure is reached. These devices cannot be reclosed, so the entire contents of the cylinder are released.

What should I do when I receive cylinders?

Inspect all incoming cylinders before storing to ensure they are undamaged and properly labelled. Do not accept delivery of defective cylinders. Be sure they are not giving off



odours, visible fumes or hissing sounds. **Check that the cylinder was last tested within the required time (usually 10 years).**

Also check that the cylinder labels are intact and that they match other identifying markings on the cylinder. Do not rely on cylinder colour to identify the gas. Different suppliers may use different colours for cylinders of the same gas. In addition, colours appear different under artificial lights and some people are colour blind. Gases that cannot be clearly identified should not be used.

How do I transport or move cylinders?

Always transport cylinders with **valve caps or other valve protection in place**. Pulling cylinders by their valve caps, rolling them on their sides or dragging or sliding them can cause damage. Rolling cylinders on their bottom edge ("milk churning") may be acceptable for short distances. Never lift cylinders with magnets or chain or wire rope slings. Transport cylinders on specially built trolleys or other devices designed for this. All transport devices should have some way of securing cylinders to prevent them from falling.

What should I know about the compressed gas storage area?

Always **chain or securely restrain cylinders** in an upright position to a wall, rack or other solid structure wherever they are stored, handled or used. Securing each cylinder individually is best. Stacking of groups of cylinders together offers some protection, but if this is done improperly, the entire group or individual cylinders could fall.

Store compressed gas cylinders in areas which are:

- Well-ventilated and dry.
- Accessible at all times, but away from elevators, staircases or main traffic routes where cylinders may be dangerous obstacles.
- Labelled with suitable warning signs.

Always store full cylinders separately from empty cylinders.

What should I know about compressed gas storage temperatures?

Store compressed gas cylinders in dry, cool areas, **out of direct sunlight** and away from steam pipes, boilers or other heat sources.



Follow the gas supplier's recommendations for storage and use temperatures. To prevent excessive pressure buildup, never expose cylinders to temperatures above 52°C (125°F). Do not subject them to temperatures below -29°C (-20°F), unless they are designed for this.

What should I know about using and discharging compressed gas cylinders?

General precautions

When moving cylinders, securely fasten them to a suitable cylinder transporting device. At the site, chain or otherwise secure the cylinder in place. Remove the valve cap only after the cylinder has been safely installed then check the cylinder valve and fixture. Remove any dirt or rust. Grit, dirt, oil or dirty water can cause gas leaks if they get into the cylinder valve or gas connection.

Never open a damaged valve. Contact your gas supplier for advice.

There are four standard types of cylinder valve outlets to prevent interchanges of gas handling equipment between incompatible gases. Use only the proper equipment for discharging a particular gas from its cylinder. Never use homemade adaptors or force connections between the cylinder valve outlet and gas handling equipment.

Whether a compressed gas is a liquefied, non-liquefied or dissolved gas, the gas supplier can give the best advice on the most suitable gas discharge equipment and the safest way to use it for a specific job.

In general, do not lubricate any cylinder valves, fittings, or regulator threads, or apply jointing compounds and tape. Use only lubricants and sealants recommended by the gas supplier.

Always open valves on all gas discharge equipment slowly. Rapid opening of valves results in rapid compression of the gas in the high-pressure passages leading to the seats. The rapid compression can lead to temperatures high enough to burn out the regulator and valve seats. Many accidents involving oxidizing gases result from burned out regulator and valve seats, usually caused by opening valves too quickly.

Do not use excessive force when opening cylinder valves--use no more than three quarters of a turn if possible. If a problem develops, the valve can then be closed quickly.

Do not use excessive force when opening or closing a cylinder valve. When closing, turn it just enough to stop the gas flow completely. Never force the valve shut.

Close cylinder valves when the cylinder is not actually in use. Do not stop the gas flow from a cylinder by just backing off on the regulator. Regulators can develop seat leaks,



allowing pressure to build up in equipment attached to the regulator. Also if the cylinder valve is left open, foreign matter can enter the cylinder if the cylinder pressure drops lower than the pressure in attached equipment. Close the cylinder valve first and then close the regulator.

Non-Liquefied and Dissolved Gases

Use automatic pressure regulators to reduce gas pressure from the high levels in the cylinder to safe levels for a particular job.

There are two basic types of automatic pressure regulators: single-stage, and **double- or two-stage**. Generally, two-stage regulators deliver a more constant pressure under more precise conditions than single-stage regulators. Sometimes, manual flow controls are used on non-liquefied gases. Fine flow control can be obtained, but an operator must be present at all times. Manual flow controls do not automatically adjust to pressure buildups in blocked systems.

What are some guidelines for safe handling and use?

Use the smallest practical cylinder size for a particular job. Do not keep cylinders longer than the supplier recommends. Compressed gas cylinders are mainly shipping containers. They are built to be as light as possible while remaining safe and durable. Do not drop cylinders or otherwise allow them to strike each other. Rough handling, including using cylinders as hammers or as rollers to move equipment, can seriously damage them.

Do not strike an electric arc on a cylinder. Arc burns can make the metal brittle and weaken the cylinder.

Never tamper with cylinders in any way. Do not repaint them, change markings or identification, or interfere with valve threads or safety devices.

Apart from the fact that it is illegal, it can be dangerous for non-specialists to refill cylinders or to change their contents. Explosions, cylinder contamination or corrosion can result.

What should I know about equipment associated with compressed gases?

All equipment used with compressed gases must be clean, properly designed and maintained, and made from materials compatible with the gas used.



Always follow the correct procedures for assembling and disassembling compressed gas equipment. Check that all the connections are clean and do not leak. Check for leaks, using the gas suppliers recommended method, after assembling and before starting to use equipment. Never use old clips or twisted wire for hose connections. If a hose works loose and flails around, serious injury could result. Poor hose connections are a common cause of accidents.

Can I use compressed gases in confined spaces?

Always comply with applicable occupational health and safety laws when working in a confined space. When using compressed gases, including inert gases, in a confined space, be sure to check that all equipment connections are leak-tight. Remove cylinders or connected equipment that are not in use from confined spaces, even during short breaks. Check the air for oxygen levels (high and low). Also check for any possible toxic, corrosive or flammable gases before entering confined spaces and during prolonged work periods. Never work alone.

How do I handle and store "empty" cylinders?

Non-Liquefied and Dissolved Gases

The amount of material remaining in a non-liquefied or dissolved gas cylinder is directly proportional to the cylinder pressure gauge reading. As the gas is used, the reading on the cylinder pressure gauge drops. When the cylinder pressure gauge reads zero, the cylinder is not really empty. The cylinder still contains gas at atmospheric pressure. Keep a slight positive pressure in the cylinder. Consider it "empty" when the cylinder pressure gauge reads about 172 Kpa or when the cylinder will not deliver at least 172 Kpa to the outlet pressure gauge.

Liquefied Gases

The pressure in liquefied gas cylinders remains constant at a given temperature as long as any liquid remains in the cylinder. The only way to know how much material remains in a liquefied gas cylinder is to weigh the cylinder. The empty (tare) weight of the cylinder is stamped on its neck or valve stem. Record the net weight of the cylinder contents on a card attached to it. As with non-liquefied and dissolved gases, never empty the cylinder completely. Keep a small amount of material in the cylinder to maintain a slight positive pressure.



What are general precautions for "empty" cylinders?

Keeping a positive pressure in an "empty" compressed gas cylinder helps to prevent back flow or suck back. This back flow is the drawing-back into the cylinder of contaminants or moist air from a higher pressure system or the atmosphere.

Keep the valves on all "empty" cylinders closed. This practice maintains a positive pressure in them. "Empty" cylinders with open valves can "breathe". Temperature increases or drops in atmospheric pressure can force gas out of the open valve of an empty cylinder. This release could result in hazardous conditions depending on the gas and how much is forced out. Temperature drops or increases in atmospheric pressure can cause air to be drawn in through the open valve. Air could cause a serious contamination and corrosion problem inside the cylinder. When a compressed gas cylinder is "empty," handle it as though it is full since it does contain gas.

Always:

- Close the cylinder valve before removing the gas discharge equipment.
- Clearly mark or label the cylinder "empty" or "MT."
- Place the cylinder in a storage area separate from that used for full cylinders.
- Keep incompatible materials away from the cylinder.
- Notify the gas supplier if the cylinder or any part of it is damaged or defective, contaminated, or may have been exposed to a possibly hazardous condition such as a fire or electric arc.

Take care when scrapping unserviceable cylinders. Before scrapping, first destroy the cylinder as a pressure vessel. Contact the gas supplier for advice on disposing of unserviceable cylinders.

What are some good housekeeping rules for working with compressed gas cylinders?

Maintain good housekeeping at all times in the workplace:

- Never hang clothes or equipment over a compressed gas cylinder.*
- Never use nitrogen or even compressed air to remove dust from clothing or equipment.
- Properly and promptly dispose of "empty" or unlabelled cylinders.

Why is equipment maintenance important?



Regular workplace inspections can help to spot situations where compressed gases are stored, handled, or used in potentially hazardous ways.

Regular inspection of equipment can provide a warning of potential hazards:

- Examine regulators, pressure relief valves and cylinder connections.
- Ensure that cylinders are free of corrosion, leakage, pitting, dents or gouges.
- Regular equipment maintenance can prevent hazardous conditions in the workplace.

Ensure that maintenance personnel:

- Know the possible hazards of the materials they may encounter and any special procedures and precautions before they begin to work.
- Carry out repairs to equipment properly, using equipment suitable for the contents of the compressed gas cylinder.
- Avoid forcing connections, using homemade adaptors or tampering with cylinders in any way.
- Comply with applicable regulations and contact the gas supplier for advice.

What should I know about Personal Protective Equipment?

If other methods, such as engineering controls, are not available or effective in controlling exposure to compressed gases, wear suitable personal protective equipment (PPE). Choosing the right PPE for a particular job is essential. Material Safety Data Sheets (MSDSs) should provide general guidance. Also obtain help from someone who knows how to evaluate the hazards of the job and how to select the proper PPE.

Protect Your Eyes and Face

Always wear eye protection when working with compressed gases. Avoid ordinary safety glasses. Use chemical safety goggles instead. In some cases, you should also wear a face shield (with safety glasses or goggles) to protect your face.

What are basic safe practices when working with compressed gases?

Following these basic general safe practices will help protect you from the hazards of compressed gases:

- Read the MSDSs and labels for all of the materials you work with.



- Know all of the hazards (fire/explosion, health, chemical reactivity, corrosivity, pressure) of the materials you work with.
- Know which of the materials you work with are compressed gases and check the label, not the cylinder colour, to identify the gas.
- Store compressed gas cylinders in cool, dry, well-ventilated areas, away from incompatible materials and ignition sources. Ensure that the storage temperature does not exceed 52°C
- Store, handle and use compressed gas cylinders securely fastened in place in the upright position. Never roll, drag, or drop cylinders or permit them to strike each other.
- Move cylinders in handcarts or other devices designed for moving cylinders.
- Leave the cylinder valve protection cap in place until the cylinder is secured and ready for use.
- Discharge compressed gases safely using devices, such as pressure regulators, approved for the particular gas.
- Never force connections or use homemade adaptors.
- Ensure that equipment is compatible with cylinder pressure and contents.
- Carefully check all cylinder-to-equipment connections before use and periodically during use, to be sure they are tight, clean, in good condition and not leaking.
- Carefully open all valves, slowly, pointed away from you and others, using the proper tools.
- Close all valves when cylinders are not in use.
- Never tamper with safety devices in cylinders, valves or equipment.
- Do not allow flames to contact cylinders and do not strike an electric arc on cylinders.
- Always use cylinders in cool well-ventilated areas.
- Handle "empty" cylinders safely: leave a slight positive pressure in them, close cylinder valves, disassemble equipment properly, replace cylinder valve protection caps, mark cylinders "empty" or "MT," and store them separately from full cylinders.
- Wear the proper personal protective equipment for each of the jobs you do.
- Know how to handle emergencies such as leaks or personal injury.
- Follow the health and safety rules that apply to your job.

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