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RCSI DEVELOPING HEALTHCARE LEADERS WHO MAKE A DIFFERENCE WORLDWIDE

Compressed gases may present both physical and health hazards if handling and used incorrectly. The exact nature of these hazards depend on the type of gas, quantity, and procedure/apparatus in which it is used. The information in this document will set out how to connect and disconnect gas cylinders from their manifold safely and correctly.

1. Type of Hazards

➤ High Pressure

The pressure contained within the gas cylinder creates a special hazard if the cylinder integrity is at all compromised. The pressure is generally sufficient to forcefully propel the cylinder in the case of sudden pressure release.

➤ Improper Cylinder Handling

Gas cylinders can be quite heavy and can cause significant injuries if they fall during handling. Additionally, cylinders can be damaged during falls, which can compromise cylinder integrity and lead to sudden pressure release.

➤ Asphyxiation

Sudden release of pressure from gas cylinders can rapidly displace oxygen leading to the possibility of suffocation.

➤ Fire or Explosion

Flammable and pyrophoric gases pose a risk of fire or explosion if there is possibility for contact with a source of ignition and/or reaction with air. Oxidizing gases can promote rapid combustion in organic materials, even in materials that might not burn under ordinary circumstances.

➤ Health Effects

Some gases can be toxic even in very low concentrations. Other gases can be corrosive to tissue or produce other deleterious health issues.

Given the many hazards, it is important that high pressure gases be handled, stored, used, and removed from service in ways that will mitigate these hazards. The following provides guidance to aid in this process:

- Gas cylinders can have a variety of safety features and markings, which identify the contents and various properties of the cylinder and contents. See next section below for this information.
- All cylinders have a *main cylinder valve* that opens or closes the cylinder.
 - This valve does not regulate the pressure coming out of the cylinder.
 - A pressure regulator is typically used to control the outlet pressure.
 - When regulators are not attached to cylinders, the cylinder cap must be in place on the cylinder to prevent damage to the main cylinder valve.
 - If this valve were to be damaged in any way, uncontrolled release of gas may result.
 - If a cap is stuck on a cylinder, never insert rods, wrenches, or other objects through the cylinder cap to open. Try using a strap wrench or cylinder hand wheel wrench.
 - If the cap is still stuck, return the gas to the supplier and request a replacement.



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- Most gases (with notable exceptions being pyrophoric and toxic gases) also have safety pressure relief valves, which are meant to vent cylinder pressure above a particular value to prevent catastrophic cylinder failure in the event of a fire or overfilling.

2. Industrial Gas Cylinder Colours

➤ Cylinder Shoulder Color Coding

Please make yourself familiar with the colour codes on **cylinder shoulders** below. The colour applied to the shoulder, or curved part at the top of the cylinder signifies the European standard colour coding for gas cylinders.

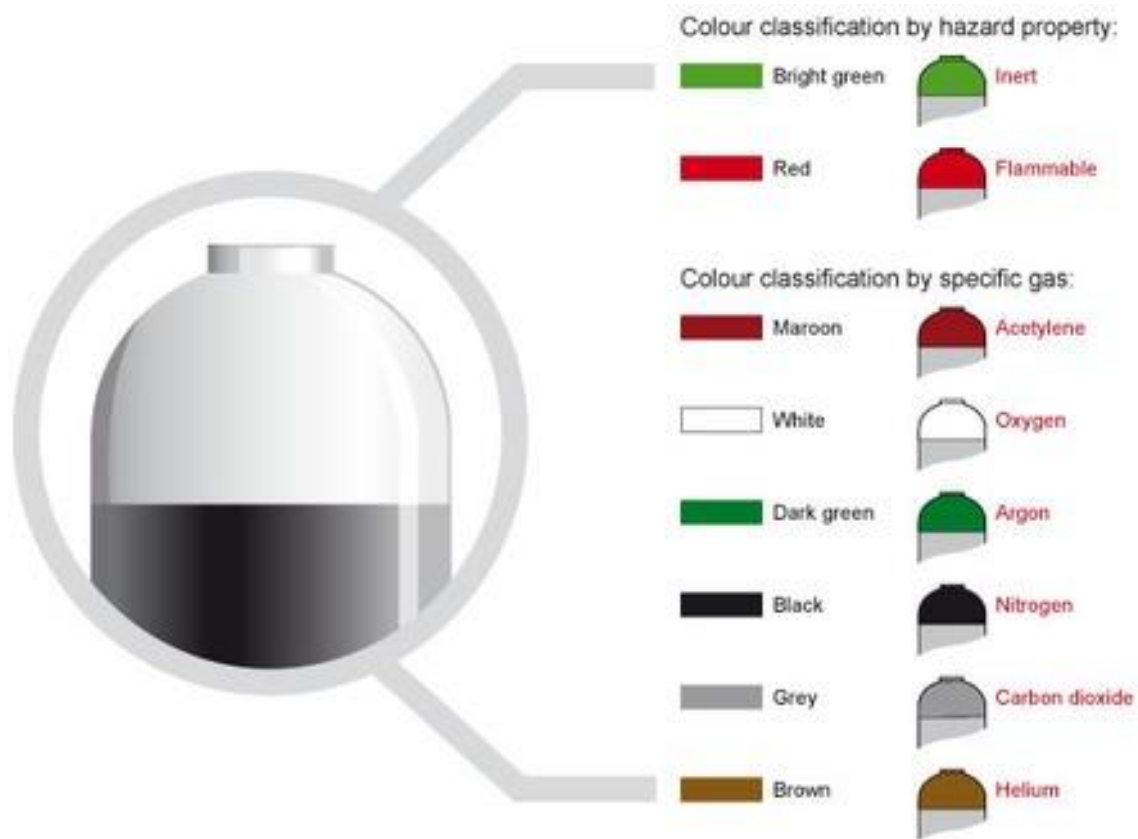


Figure 1

Below you will find the colour coding for the **body** of BOC cylinders. BOC are RCSI gas cylinder provider. *(The colour of the body of the cylinder may differ for the same gas among different gas companies).* The BOC cylinder body colours are displayed below.



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Figure 2

3. Typical cylinders used in RCSI

CO₂ - Carbon Dioxide



N₂ – Nitrogen



O₂ – Oxygen



- Other cylinders such as carbon dioxide & oxygen mix and helium also used.
- Gas cylinders are typically leased from the gas supplier (BOC) and are returned when they are empty.



- Gas cylinders should be stored in the designated cylinder store (on the ground floor of York House gas cage and the gas cages at Back Moate, 123 SSG).
- Cylinders must be stored in an upright position.
- Full cylinders must be stored separately from empties.

4. Before Changing a Cylinder

- Only trained RCSI personnel can change a gas cylinder. List of trained personnel are with Security at reception desk in York House, Control Room in 123 SSG & reception in Beaumont Smurfit Building.
- Trained personnel must also have up to date manual handling training.
- Key to gas cages are kept with Security in above locations and must be signed out / in by trained personnel only.
- A minimum of 2 trained personnel at all times while changing cylinders.
- Both personnel must wear appropriate personnel protective equipment i.e. protective gloves and protective footwear and safety glasses
- Appreciate and understand the safety precautions required in handling cylinders

5. Handling and using cylinders

- Avoid where possible having cylinders inside a building in a laboratory. Where this is required, please liaise with [Estate and Support Services Dept](#) for advice.
- If cylinders are stored inside they must be supported & secured in a suitable trolley.
- When cylinders not in use the valve must be closed.
- Check regulator, equipment and pipe work for suitability for the type and pressure of gas being used.
- Transport:
 - Cylinder valves must always be shut before transportation.
 - Transport cylinders in correct cylinder trolleys.
 - Never carry or roll cylinders for distances more than a few feet.
 - Never drop cylinders, or allow them to collide with each other or with other objects in a violent way.
- Always use the correct valve outlet.
- Combustible gas cylinders have left-handed screws, non-combustible cylinders right-handed screws.
- All valves are opened by turning anti-clockwise and closed by turning clockwise. Cylinders are colour coded to indicate the gas they contain.
- Opening valves:
 - Never open a valve more than three revolutions. One is usually enough.
 - Always use the correct key
 - Open valves slowly, and with hand pressure alone
 - Never tamper with or try to adjust safety devices on valves or cylinders
 - Never use grease on valves or threads
- Before assembling regulators and fittings ensure that there are no particles of dirt in the cylinder outlet.
- No cylinder should be subjected to a temperature of greater than 53°C.
- Do not place cylinders where they can become part of an electric circuit.
- Do not smoke, wear oily or greasy clothes, or use a naked flame in areas where cylinders are stored. Oil or grease will ignite violently in the presence of oxygen, which may cause an explosion.
- Keep cylinders and valves away from possible sources of contamination
- Dangerous conditions can result from suck back if an empty cylinder is attached to a pressurised system.
- Never attempt to fill an empty cylinder from a full one.



6. Removing the empty cylinder

- If dealing with a changeover manifold, move the lever to point at the cylinders that you are not working with. This will allow for a continuous supply of gas when the cylinders are being changed.
- Close the empty cylinder's spindle valve using a spindle key or spanner with spindle valve insert. This step is the most important as **the cylinder valve must be closed before attempting to remove the regulator or hose connector.**
- Close the block valve.
- Release any residual pressure in the line by opening the vent valve. When the residual gas has been released, close this valve again.
- Unscrew the regulator/hose connector from the cylinder using a suitable spanner/wrench (Note: flammable gases and some mixed gases are reverse threaded).
- Release the chain securing the cylinder and transport empty cylinder to the gas cage using a gas trolley.

7. Attaching a new cylinder

- Move new full cylinders to the manifold and secure in place.
- Remove cylinder caps and inspect cylinder valves for water or particle ingress. Wipe with a clean cloth if necessary
- Reconnect the regulator/hose connector and tighten nuts as much as possible.
- Making sure that the vent valve is closed beforehand, slowly open the first cylinder (spindle valve) to equalise pressure in the header, repeat for other cylinders, if fitted.
- Use a leak detector spray to test for any leaks. If you see a leak, close the spindle valve, then release the line pressure by opening the vent valve. Close this valve again, and then remove and refit the hose connector. Try to keep the bull nose fitting straight and pressed down against the cylinder as you tighten the hose connector. This is where the seal is made on the connection so it is important that the bull nose is positioned correctly and not at an angle.
- Once you are satisfied that there are no leaks, open the block valve again to fill the line with gas. Check the output pressure is set at the correct level for what you need. Typically, gases going to labs are set at 1-5 bar.



Appendix 1

RCSI Personnel Trained & Authorised to Change Cylinders

Please note Security in both York House and 123 SSG have the same list for identification purposes when signing in / out keys and tool kits.

Department	Name
BRF	Joyce Rubotham
	Virginia Garcia Sanchez
	James Grehan
	Sara Gutierrez Llana
TERG Anatomy	Vincent McDonagh
	Patrick Conlon
PBS	Sophie Cassidy
	Seamus McDonald
	Emma Halpin
	Colin McElduff
	Jim Slattery
	Sarah Lynch
Chemistry	Emmet Campion
	Graeme Kelly
Physiology	Ian Miller
	Ina Woods
	Luise Halang
	Heiko Dussmann
	Andrew Roe
	Steven Fagan
Beaumont Smurfit Building	
Estates SSG	Darren O'Leary
	Billy Cahill
	John Doyle