Saint Mary's University

Electron Microscopy Centre

Title: **SAFELY USE OF GAS REGULATOR**

Equipments: 1. **COLD STAGE OPERATING ON LEO 1450VP**
2. SPUTTER COATER -- GOLD

Revision: **1.0**

Effective Date: **30/09/2005**

Author: **X. Yang**

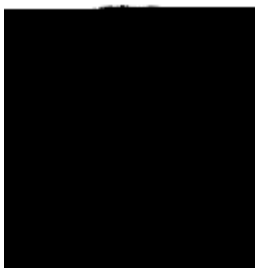
Introduction

There are typically a wide variety of gas regulators in average chemistry, physics and biology labs. The majority of these are single stage and two stage regulators.

The advantage of a two stage regulator is that the pressure flow remains consistent until the tank is nearly empty. Therefore, you might want to use a double stage regulator on a gas chromatograph (GC), but for a typical Schlenk line a single stage regulator would suffice.

Two other common types of "regulators" that you might encounter are actually called **flow control valves**. Unlike a regulator, these DO NOT control pressure, only flow. However, they permit one to easily dispense gas from a cylinder. As they lack gauges, be extremely cautious when hooking a flow valve up to a vacuum line!!

The manual flow control valve shown below on the left is usually used on small cylinders (carbon dioxide, ethylene etc.) and the one on the right is typically used on lecture bottles. Small single and double stage lecture bottle regulators are also available.



Finally, note that you should **NEVER** use grease or oil on a regulator. Not only will it gunk up the inside and contaminate your reaction system, but these organic materials can react with the gas being dispensed. **Never** use an oxygen regulator for other gases. Cross-contamination of internal parts (especially with grease or oil) could cause a rapid oxidation and fire.

How to select a proper gas regulator

Not all regulators can be used on all cylinders. For example, flammable gases such as hydrogen require brass fittings. The Compre

Screw it clockwise until it seats. Do not over-tighten it or you can damage the valve seat.

5. Make sure that the regulator control valve (**B**) is shut. Screw it **counterclockwise**

- If necessary, follow the purge instructions for corrosive or reactive gases as shown above.

8. Open the tank valve slowly (counterclockwise). Watch the tank pressure on the regulator (**C**).
9. Slowly turn the regulator control valve (**B**) until the regulator pressure (**D**) is at the desired level.
10. Open the regulator outlet valve (**A**). You can regulate flow with this valve, but the ultimate pressure depends on the setting of the regulator control valve!
11. Check your system for leaks using Snoop (a commercial product) or some soapy water. Snoop is preferred since it leaves no residue. If you find leaks and tightening the connections does not help ask your instructor for assistance.

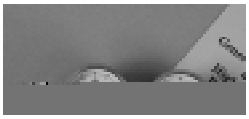
Reminder: Do not use Teflon tape on Swagelock ferrule compression fittings.

Disconnecting a Regulator

1. Shut the tank valve on the gas cylinder.
2. Slowly open the outlet valve (**A**) on the regulator.
3. Watch the pressure gauges **C** and **D** drop to zero.
4. Open the regulator control valve (**B**) (turn it clockwise) to ensure that all pressure has been released.
5. If you were using a corrosive gas, purge the system with a dry inert gas.
6. Using a wrench (not pliers!) disconnect the regulator from the gas cylinder. Replace the protective cylinder cap immediately.
7. If your regulator was used with a corrosive gas, purge it again with dry air or nitrogen in the hood for several minutes.
8. If your cylinder is empty, it must be properly labeled and then returned to the manufacturer or distributor (in many cases, this is your school or company stockroom). Do not store empty gas cylinders in the laboratory.

Reminder: Make sure the tank valve is closed whenever you are not dispensing gas through the regulator.

Appendix:



Equipment used in this Bulletin

Brass lecture bottle regulator (Figure 1)
Single stage, for use with noncorrosive gases. Compact, chromeplated brass body with CGA 180 inlet connection and needle valve with I in. NPTM outlet. Includes CGA adapter, Z14,730-3. Requires Teflon sealing washer, Z14,699-4. Maximum inlet pressure: 3000 psig. Operating temperature: -40 to 140°F.

Delivery pressure (psig)	Gauge (psig)	Cat. No.
0-100	0-150	**Z14,670-6**
0-15	0-30	**Z14,671-4**

SS lecture bottle regulator (Figure 2)
Single stage, for use with most corrosive and halogenated gases and high-purity applications. 316 SS body and gauges with Teflon seals and inner friction sleeves. CGA 180 inlet connection and needle valve with I in. NPTM outlet. Includes CGA adapter, Z14,730-3. Requires Teflon sealing washer, Z14,699-4. Maximum inlet pressure: 3000 psig. Operating temperature: -40 to 140°F. K in. 27 NPTF remote bonnet-vent.

Delivery pressure (psig)	Gauge (psig)	Cat. No.
0-15	0-30	**Z14,850-4**
0-50	0-100	**Z14,851-2**

Special brass cylinder adapter (Figure 3)
Used to attach Aldrich regulators to cylinders. I in. NPTF valve outlet and a 180M CGA. **Z14,730-3**

Bonnet vent tube connector (Figure 4)
316 SS. Used to attach vent tube to remote vent fitting found on regulators. K in. NPTM.

Compression fitting	Cat. No.
I in. o.d. tube	**Z17,357-6**
K in. o.d. tube	**Z17,358-4**

Check valve (Figures 6 & 8)
Max. pressure 3000 psig, I in. NPTF to I in. NPTF. Attaches to the outlet side of regulator to prevent back streaming of liquids and gases into regulator or cylinder.

Type	O-ring	Cat. No.
Brass	Viton®	**Z14,684-6**
SS	EPR	**Z14,685-4**
SS	neoprene	**Z14,686-2**
SS	Viton	**Z14,687-0**

Hose adapter (Figure 3)
I in. NPTF to

Regulator Operation

1. Close the regulator by turning the regulator adjusting knob off (counter clockwise). This must be done **before** the cylinder valve is opened.
2. With the regulator turned off (adjusting knob turned fully counter-clockwise) and the regulator outlet needle valve closed (clockwise), open the cylinder valve slowly (counter clockwise), allowing the pressure to rise gradually in the regulator. When the high pressure gauge indicates maximum pressure, open the cylinder valve fully.
   CAUTION: Always close the cylinder valve when leaving the system unattended.
3. Adjust the system pressure by turning the regulator adjusting knob clockwise until the desired pressure is indicated on the low-pressure gauge.
4. Carefully check all system connections for leaks.
5. Adjust the gas flow rate to the system by turning the regulator outlet needle valve (counter clockwise to open).

Regulator Removal

1. Close the cylinder valve.
2. Vent or purge the process gas from the regulator and system. With the regulator outlet needle valve open (counter clockwise), turn the regulator adjusting knob clockwise to release any gas trapped in the regulator. If hazardous gas is present in the system, purge with dry, inert gas. Take appropriate measures to render the purged gas innocuous before venting the gas to the atmosphere.
3. Turn the regulator adjusting knob counter clockwise (off) as far as possible.
4. Disconnect the regulator (and purge assembly) and protect the inlet and outlet fittings from contamination or damage.
5. Replace the cylinder valve cap or plug.

Cylinder & Regulator Assemblies

Figure 5. Installation without regulator, but with hose-barb adapter, for noncorrosive, liquefied gases packaged in low pressure flat-bottom cylinders.

Figure 6. Use of a check valve on the outlet side of the regulator. This valve prevents cylinder suck back and back streaming of process gas, and protects the regulator from back pressure damage.

Figure 7. Use of a control valve, which meters the flow of gas packaged in the lecture bottles when pressure regulation is not required.

WARNING: Gas-control valves do not control pressure in a closed system. A relief valve should be used in such a system to prevent build-up of pressure, which could lead to an explosion, unless vented.

Figure 8. Optional gas-handling accessories. From left to right: tubing connectors (Swagelok® and hose-barb type), check valve, regulator, and T-purge assembly.

Data Sheet (MSDS)
information on the
be using.

2. Determine the app
to use the prod
ate the equ

3. Be a
t

y

Handling

Compressed gas cylinders should be handled only by those familiar with the hazards and who are trained in the proper handling techniques. Cylinders containing compressed gases are heavy and awkward to move. Improper handling of compressed gas cylinders can result in sprains, strains, falls, bruises, or broken bones. Other hazards such as fire, explosion, chemical burns, poisoning, and cold burns could occur if gases accidentally escape from the cylinder.

Proper Use of Compressed Gases

Take the following precautions to prevent injuries caused by the improper use of compressed gases.

NEVER

- Attempt to mix gases in a cylinder.
- Insert an object (e.g., wrench, screwdriver, etc.) into valve cap openings to remove a stuck cylinder cap. Doing so may damage or open the valve, causing a leak to occur. Use an adjustable strap-wrench to remove over-tight or rusted caps.
- Allow any part of a cylinder to be exposed to temperatures exceeding 125°F (52ºC).
- Permit cylinders to become part of an electrical circuit.
- Use oxygen as a substitute for compressed air.
- Strike an arc on a cylinder.
- Return product into a cylinder.
- Introduce another product into a cylinder.
- Use cylinder color as a primary means to identify the contents of a cylinder.
- Heat a cylinder to increase its pressure or withdrawal rate unless using an approved method. See Air Products' Safetygram-30, "Handling of Liquefied Compressed Gases."
- Discharge the contents from any gas cylinder directly toward any person.
- Refill any nonrefillable cylinder after use of the original contents.
- Force cylinder valve connections that do not fit.
- Reduce the residual pressure of a cylinder below the operating pressure of the system or 7 psig (0.5 bar), whichever is higher.
- Change service of equipment from the particular gas or group of gases for which they were intended.

ALWAYS

- Know and understand the gases and associated equipment you will be using. Refer to the supplier's MSDS to determine the proper PPE and any other special requirements for the gas being used.

Figure 3

The correct way to safely check a system

- Secure cylinders when in storage, transit, or use.
- Use a pressure-reducing regulator or separate control valve to safely discharge gas from a cylinder.
- Use regulators approved for the specific gas.
- Leak-test lines and equipment with an inert gas before using.
- Use regulators and pressure-relief devices when connecting cylinders to piping circuits with lower pressure service ratings.
- Use check valves to prevent reverse flow into the cylinder.
- Loosen the valve outlet seal slowly when preparing to connect a cylinder.
- Open cylinder valves slowly and carefully after the cylinder has been connected to the process.
- Stand clear of the regulator and valve outlet while opening the valve.
- Prevent sparks and flames from contacting