UC Riverside TANGO Training: Compressed Gas Cylinder and Cryogenics Safety

September 2021
Introduction: Airgas are Partners in Safety

• Airgas is committed to safety
• Airgas is committed to providing:
  – The right products designed for safety
  – The right locations that practice safety
  – The right technical expertise to provide safety
• Working together with your total commitment to safety, we can minimize the risk of accident or injury.
Take Home Messages

Compressed Gases and Regulators:
• PPE: protect your eyes and skin
• Secure the cylinder properly; 1/3 down from the top, 1/3 up from the floor
• Always install the cylinder cap when cylinder is not in use
• Move cylinders only with carts, caps installed, and restraints
• If it gets away from you… Let it fall
• Only install regulators on properly secured cylinders
• Never use Teflon tape on CGA fittings. CO₂ has a gasket
• Open valve slowly and check for leaks

Cryogenics:
• PPE: Cryo gloves, aprons, and face shields with LN2 Closed toed shoes. Be dry!
• “Loose Top” Containers
• Transfill in a well ventilated area only, and with a buddy.
Safe Handling of Compressed Gas and Cryogenic Liquids

• Introduction
  Hazards of Handling Compressed and Cryogenic Gases

• Safe Handling Practices
  Regulator Installation and Operation

• Liquid Cylinder Operation

• Airgas Support
Introduction: UCI and Airgas are Partners in Safety

A commitment to safety is a commitment to your continued well being!
Introduction: Chemical and Physical Hazards of Compressed Gases

Compressed gases can present unique chemical and physical hazards. Gases you handle may be:

- Explosive
- Corrosive
- Flammable or combustible
- Poisonous
- Inert (Anoxic atmosphere)

...or any combination of these hazards
Introduction: Chemical and Physical Hazards of Compressed Gases

Pressure – Compressed gas cylinders 2200+psi

Temperature – Cylinders rated under 125 degrees F

Flammable gases: H₂, Acetylene, CO – Open flames and sources of possible electrical charge can influence ignition

Material Compatibility: Piping, Seats, CGA’s – Piping systems design with failsafe pressure relief, gas-compatible materials

Cryogenics: Cold, Expansion – expansion ratio 1:700+
Introduction: Chemical and Physical Hazards of Compressed Gases

Cylinder Placards for hazardous gases

- Flammable Gas
- Non-Flammable Gas, Corrosive
- Poison Gas, Poison
- Oxidizer
Introduction: Chemical and Physical Hazards of Compressed Gases

• Refer to the specific MSDS document for additional hazard information regarding any and all the gases you use.

• MSDS documents are available from your EH&S representative, and are also free to download or printout from the Airgas website at: www.airgas.com

• Just click the link on the main web page!
Safe Gas Handling Practices

Cylinder Movement Methodology

Rules:

• Always with cart, strapped or chained
  • Never without cap
  • Always remove the regulator
  • If it gets away from you…
    • **Let it fall!**
Safe Gas Handling Practices

• Gas cylinders must be secured at all times to prevent tipping.

• Cylinders may be attached to a bench top, individually to the wall, placed in a holding cage, or have a non-tip base attached.

• Two chains per cylinder are used to secure them.
Safe Gas Handling Practices

Always use safety glasses or face shield when connecting and disconnecting compressed gas regulators and lines.
Safe Gas Handling Practices: Regulator Installation

• Before removing the cylinder cap, move the cylinder to the work site:
  – Secure cylinder to floor, wall or bench with appropriate chain or stand to prevent toppling.
  – Remove cylinder cap
  – Be sure cylinder valve is tightly closed
  – Remove cylinder valve plug, if any
  – Inspect the cylinder valve threads for damage or contamination
Regulator Mounting

VS.
Safe Gas Handling Practices: Regulator Installation

Outlet pressure gauge

Inlet pressure gauge

Rotablator® Hose Quick Connect

CGA 580 Nut (Cylinder Connection)

CGA 580 Nipple

CGA 346 Nipple

1/4” MNPT

CGA 346 Nut

CGA 346 Nut
Safe Gas Handling Practices: Regulator Installation

- Keep cylinder between you and the regulator.
- Slowly open cylinder valve. Watch the high pressure gauge as it climbs to full pressure.
- Observe all connections for leaks.
- A soap solution may be applied to the connections to indicate leaks by bubbling.
- An alternative leak check method is to close the cylinder valve for five minutes and watch for a drop in pressure.
Safe Handling Of Liquid Cylinders

- Transporting the cylinder
  - Hand truck
  - Handling ring/supports
    ➔ Crane
    ➔ Yoke
Safe Handling Of Liquid Cylinders

➢ Improper techniques
  • Never roll cylinder horizontally
  • Do not use handling ring to roll

➢ In the event of a tip over
  • Get help (three or more people)
  • Raise cylinder
  • Open vent valve (outdoors)

➢ Appropriate equipment
  • Face shield
  • Dry gloves
Safe Handling Of Liquid Cylinders

➢ Never-Nevers

• Tamper with the settings
• Tamper with the Pressure Relief Valve (PRV)
• Defeat anti-tamper devices
• Plug safety reliefs or burst discs
• Use a high pressure cylinder for low pressure liquid use.
• Lay the cylinder on its side
Safe Handling of Cryogenic Liquids

• All cryogenic liquids produce large volumes of gas when they vaporize. For example, one volume of liquid nitrogen at atmospheric pressure vaporizes to 694 volumes of nitrogen gas at 70°F.

• Never allow any unprotected parts of your body to touch uninsulated pipes or vessels containing cryogenic liquids; the extremely cold material may stick fast and tear the flesh when you attempt to withdraw it.
Safe Gas Handling Practices: Cryogenic Liquids

• General

- A cryogenic liquid is considered to be a liquid with a normal boiling point of below -150°C
- Cryogenic liquids and their cold “boil-off” vapor can rapidly freeze human tissue
- Liquid expanding into vapor can quickly displace the breathable atmosphere
Liquid Cryogenic Gas Hazards

- Extremely cold
  - Liquid Nitrogen -320°F (-190°C)
  - Do not allow objects cooled to cryogenic temperatures touch your bare skin
  - Objects will stick to skin and cause frostbite

- Produces large amount of gas: volume expansion
  - 1:700 ratio liquid to gas (typical)
    - Asphyxia hazard
    - Overpressure hazard in unvented volumes
Liquid Nitrogen/Argon/Helium Hazards

- Colorless
- Odorless
- Tasteless
- Avoid confinement areas to displace oxygen below 19.5% (Oxygen deficient)
- These inert gases produce an Oxygen deficient atmosphere
- Safely move to fresh air
  - CPR/mouth to mouth
  - Frozen Tissue
    - Luke warm water
    - Remove clothes
    - Do not rub frozen skin
Liquid Nitrogen Hazards

- Protective clothing can reduce the hazards of handling liquid nitrogen
  - Dry leather gloves or cryo gloves
  - Loose fitting clothing and cryo apron
  - Boots or closed toe shoes
  - Face shield and safety glasses
  - Trousers outside of closed toe footwear
- Special container required
  - Stainless steel or aluminum
  - Insulated
- Do not seal the containers tightly
- Transfer liquid nitrogen with care
- Use resin (plastic) or wooden dipsticks…no tubes
Safe Gas Handling Practices: Cryogenic Liquids

• Never allow Liquid Nitrogen to be trapped between any type of closure device. Extreme pressure will develop and the containment device or pipe will fail or explode violently.
Always wear cryogenic gloves and apron, a face shield and long sleeve shirts and pants when dispensing cryogenic liquids.
Liquid Cylinder Valve Manifold

- **Liquid Use Valve** – Liquid product is withdrawn from the cylinder through this valve.
- **Contents Gauge** – This is a float type liquid level gauge used to indicate the approximate amount of product in the cylinder.
- **Vent Valve** – Vents the pressure while filling
- **Relief Device** – Relieves excess pressure in the cylinder - venting from this valve is normal.
- **Delivery Pressure Gauge** - Displays the internal container pressure (not the volume)
- **Gas Use Valve** – controls the withdrawal of gas phase product.
Airgas: Here to Help

Safety Supplies

- A leading U.S. supplier with $440 M+ in annual sales
- 30,000+ product offering includes:
  - Personal Protective Equipment (PPE), Hard hats, safety glasses, gloves
  - First Aid & Emergency Response
  - Bandages, eyewash stations
- 250+ experienced safety professionals
- All the leading brands and our Radnor® brand
Airgas: Here to Help
...Known Locally Nationwide

1,500+ Locations
350 HP fill plants, 13 acetylene plants,
67 spec gas labs ISO9001 and ISO/IEC
17025 accredited, 16 ASUs,
6 national distribution centers,
900+ retail stores

22,000 +Associates
1,500 sales people
(30% specialists)
4,500+ drivers

10 M+ Cylinders
15,000 Bulk tanks
6,200+ Vehicles

1,500 sales people
(30% specialists)
4,500+ drivers

10 M+ Cylinders
15,000 Bulk tanks
6,200+ Vehicles
Take Home Messages

Compressed Gases and Regulators:
- PPE: protect your eyes and skin
- Secure the cylinder properly 1/3 down from the top, 1/3 up from the floor
- Always install the cylinder cap
- Move cylinders only with carts, caps installed, and restraints
- If it gets away from you… Let it fall
- Only install regulators on properly secured cylinders
- Never use Teflon tape on CGA fittings. CO₂ has a gasket
- Open valve slowly and check for leaks

Cryogenics:
- PPE: Cryo gloves, aprons, and face shields with LN2 Closed toed shoes. Be dry!
- “Loose Top” Containers
- Transfill in a well ventilated area only with a buddy.
Thank you!

Tony Pham       818 259 7483
Todd Price      619 787 1425