


CENTRAL WELDING SUPPLY
 PACIFIC Xpress Cryogenics



Carbon Dioxide (CO₂) Safety Training

OCCUPATIONAL SAFETY (206) 423-1161 Contact our Safety Specialist to learn more about available safety presentations, training resources, and our comprehensive line of safety equipment and Personal Protection Equipment (PPE).

CENTRAL WELDING SUPPLY
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Carbon Dioxide (CO₂) Safety

Topics we'll cover...

- General properties and uses of CO₂
- Potential risks of exposure and symptoms
- Handling, storage, and equipment safety features
- Safety considerations and precautions
- What to do in the event of an emergency

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Carbon Dioxide (CO₂) Safety

Carbon Dioxide (CO₂)

- Inert gas, odorless, colorless, heavier than air
- Displaces oxygen
- Effective and preferred agent for Class "C" fires
- Effective agent for Class "B" fires
- Non-conductive, non-corrosive, leaves no residue

Earth's atmosphere

=

.03% CO₂

(300 ppm by volume)


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Carbon Dioxide (CO₂) Safety

Carbon Dioxide (CO₂)

- Boiling Point @ 1 atm (sublimes)
 -109.3°F (-78.5°C)
- Freezing Point @ 76 psia
 -69.9°F (-56.6°C)




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Carbon Dioxide (CO₂) Safety

Uses for Carbon Dioxide (CO₂)

- Liquid CO₂: Used widely in the food industry to freeze...
 - meats
 - poultry
 - vegetables
 - fruits




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Carbon Dioxide (CO₂) Safety

Uses for Carbon Dioxide (CO₂)

- Solid CO₂ (dry ice) used to...
 - cool meats prior to grinding
 - refrigerate meats during transit



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Carbon Dioxide (CO2) Safety

Uses for Carbon Dioxide (CO2)

- Gas CO2: Used for carbonation
 - soft drinks, wines, and beers
- Gas CO2: Used for water treatment
 - to neutralize alkaline water

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Carbon Dioxide (CO2) Safety

Uses for Carbon Dioxide (CO2)

- Industrial uses of CO2
 - Liquid CO2 is used to increase recovery from oil and gas wells
 - Used for production of chemicals, plastics, rubber, metals, and electronic components

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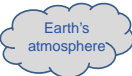
Carbon Dioxide (CO2) Safety

Toxicity

- CO2 does NOT support life and may immediately produce hazardous atmospheres.

NOTE: Release of CO2 displaces Oxygen in the air, presenting risk of asphyxiation.

NORMAL CO2 Levels:

 Earth's atmosphere = .03% CO2

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Carbon Dioxide (CO2) Safety

Exposure Reactions

- 1% Slight increase in breathing rate.
- 2% Breathing rate 50% above normal level. Prolonged exposure can cause headache, tiredness.
- 3% Labored breathing at 2 X normal rate. Weak narcotic effect. Impaired hearing, headache, increase in blood pressure and pulse rate.
- 4–5% Breathing at 4 X normal rate; evident symptoms of intoxication and slight choking

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Carbon Dioxide (CO2) Safety

Exposure Reactions

- 5–10% Characteristic sharp odor, very labored breathing, headache, visual impairment, and ringing in the ears; Judgment may be impaired, followed within minutes by loss of consciousness.
- 50–100% Unconsciousness occurs more rapidly above 10% level; Prolonged exposure to high concentrations may eventually result in death from asphyxiation.

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Carbon Dioxide (CO2) Safety

Carbon Dioxide (CO2) Bulk Storage

- Can be stored as a bulk liquid with capacities up to 50 tons and larger
- Liquid in the tank is maintained between 245 psig and 305 psig
- Vessels/piping must meet ASME and DOT specification codes
- Insulated by polyurethane foam with vapor barrier to protect from weather


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Carbon Dioxide (CO2) Safety

Carbon Dioxide (CO2) Bulk Storage

- Maintained below 305 psig by a refrigeration unit
- Maintained above 245 psig with a pressure buildup coil so that carbon dioxide can be stored for an indefinite period without venting




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Carbon Dioxide (CO2) Safety

Carbon Dioxide (CO2) Cylinder Storage

- Smaller liquid quantities are stored and shipped in cryogenic liquid cylinders
 - provide capacity of 384 pounds (3352 standard cubic feet)
- Cryogenic liquid cylinders
 - are vacuum-jacketed and can hold product for long periods without venting
 - Can either supply liquid or gas and liquid




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Carbon Dioxide (CO2) Safety

Carbon Dioxide (CO2) Cylinder Storage

- Shipped and stored as a liquefied compressed gas in hollow steel and aluminum cylinders
- Concave base allows cylinders to stand upright
- Tapered to a small opening on the top
- Tapered/open threaded to receive a cylinder valve or other suitable outlet connection
- Safety relief devices are part of the cylinder valve or the outlet connections




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Carbon Dioxide (CO2) Safety

Carbon Dioxide (CO2) Safety Features

- Threaded neckring is secured to tapered end of the cylinder to allow a protective cylinder cap to be installed
- Cylinders are manufactured according to ASME and DOT specification codes
- Cylinders in service are hydrostatically tested upon manufacture, and every five years thereafter at 5/3 times the service pressure.



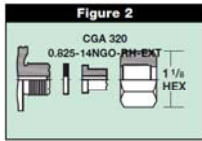
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Carbon Dioxide (CO2) Safety

CO2 Gas Cylinder Valves

- Specifications for CO2 gas cylinder valves are defined by the Compressed Gas Association (CGA), and the American National Standards Institute (ANSI)
- Bulk liquid storage tanks are protected against excessive pressures by reseatable relief devices and burst discs



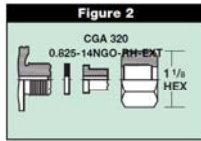
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Carbon Dioxide (CO2) Safety

CO2 Gas Cylinder Valves

- Gas cylinders are protected from rupture due to fire by a frangible disc sometimes backed by a fusible metal with a melting temperature of about 212°F (100°C).




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Carbon Dioxide (CO2) Safety

Gas Cylinder Identification



- Between necking and shoulder:
 - DOT specifications (3A, 3AA, etc.); followed by service pressure rating in pounds per square inch
 - Container serial number
 - Manufacturer's symbol and owner's symbol
 - Month and year of container manufacture
 - Month and year of subsequent 5-year retest of container.
 - Original inspector's identification stamp.
- Emergency phone number** and cylinder owner is disclosed on the label

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Carbon Dioxide (CO2) Safety

Cryogenic Liquid Cylinder Identification

- Identification stamped permanently on one of the following:
 - the shoulder, or
 - top head of the jacket
 - permanently attached plate
 - head protective ring

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Carbon Dioxide (CO2) Safety

Cryogenic Liquid Cylinder Identification


- Stamped permanently on the shoulder or top head of the jacket, on a permanently attached plate, or on the head protective ring.
 - DOT-4L followed by the service pressure rating in pounds per square inch.
 - Serial number and identifying symbol; location of the number to be just below or immediately following the DOT mark; location of the symbol to be just below or immediately following the number.
 - Month and year of the container manufacture.

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Carbon Dioxide (CO2) Safety

Cryogenic Liquid Cylinder Identification




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Carbon Dioxide (CO2) Safety

Workplace Safety

- An emergency response plan shall be developed and implemented wherever compressed gases are used, handled or stored.



HAVE A PLAN IN PLACE!

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Carbon Dioxide (CO2) Safety

Workplace Safety: Building

- Provide adequate ventilation.
- The atmosphere in areas in which carbon dioxide gas may be vented and collect should be tested with a portable or continuous monitoring carbon dioxide gas analyzer to insure ventilation is adequate.

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Carbon Dioxide (CO2) Safety

Personal Precautions

- Avoid breathing gas.
- Store and use with adequate ventilation.
- Do not get liquid in eyes, on skin or clothing.
- For liquid withdrawal, wear face shield and gloves.
- Use hand truck for large cylinder movement.
- Close gas cylinder valves after each use and when empty.


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Carbon Dioxide (CO2) Safety

General Gas Cylinder Safety

- **Do NOT** deface or remove identification labels applied by the gas manufacturer
- **Do NOT** accept a compressed gas cylinder for use that does not legibly identify its contents.
- **NEVER** rely on the cylinder color for identification.
- **Never smoke around compressed gas cylinders or bulk gas storage tanks.**



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Carbon Dioxide (CO2) Safety

Hazards Identification

- Inhalation: CO2 is an asphyxiate; concentrations of 10% or more can produce unconsciousness or death
- Eye Contact: Contact with liquid or cold vapor can cause freezing of tissue
- Skin Contact: Contact with liquid or cold vapor can cause frostbite


See Material Safety Data Sheet (MSDS) for Carbon Dioxide

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Carbon Dioxide (CO2) Safety

EMERGENCY RESPONSE: First Aid



- **Inhalation**
 - Victim may not be aware of asphyxiation; observe for increased respiration and headache symptoms
 - Remove victim to fresh air.
 - If victim is not breathing, give artificial respiration.
 - If breathing is difficult, give Oxygen.
 - Keep victim warm and rested
 - Call 911


DO NOT ENTER EFFECTED AREA FOR RESCUE WITHOUT SELF-CONTAINED BREATHING APPARATUS (SCBA)!

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Carbon Dioxide (CO2) Safety

EMERGENCY RESPONSE: First Aid



- **Skin or Eye Contact**
 - Immediately flush eyes thoroughly with water for at least 15 minutes
 - In case of frostbite, spray with water for at least 15 minutes
 - Apply a sterile dressing
 - Call for medical assistance



ALWAYS USE TEPID – NOT WARM – WATER WHEN FLUSHING EFFECTED AREA!


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Carbon Dioxide (CO2) Safety

EMERGENCY RESPONSE: Accidental Release

- **Personal precautions**
 - Evacuate area. Use **protective clothing** and wear **self-contained** breathing apparatus entering area unless atmosphere is proved to be safe. Ensure adequate air ventilation.
- **Environmental precautions**
 - Try to stop release. Prevent from entering sewers, basements and workpits, or any place where its accumulation can be dangerous.
- **Clean up methods**
 - Ventilate area.



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Carbon Dioxide (CO2) Safety

EMERGENCY RESPONSE: Exposure to Fire

- **Fire fighting measures**
 - Exposure to fire may cause containers to rupture/explode. (Contents are non flammable.)
 - If possible, stop flow of product and move container away or cool with water from a protected position.
 - In confined space, use self-contained breathing apparatus (SCBA).

Insure adequate ventilation. Protect eyes, face and skin from potential liquid splashes.

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Carbon Dioxide (CO2) Safety

EMERGENCY RESPONSE: Checklist

- ✓ Evacuate area in case of spill or spontaneous venting of gas
- ✓ Put on Self Contained Breathing Apparatus (SCBA) and skin protection **BEFORE** entering an affected area to provide rescue
- ✓ Call 911
- ✓ Ventilate affected area

REMEMBER: CO2 IS HEAVIER THAN AIR. EVACUATE ALL LOW LYING AREAS, WHERE CO2 MAY ACCUMULATE!

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Carbon Dioxide (CO2) Safety

EMERGENCY CONTACTS

- **Central Welding Supply - 1 800 697-0128**
For questions or concerns about potential leaks (non life threatening)
- **Chemtrec – 1 800 424-9300**
For emergency situations; Chemtrec will dispatch the appropriate local authorities
- **Call 911**
Medical emergencies, ie. unable to resuscitate exposed victim


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Carbon Dioxide (CO2) Safety

BE PREPARED!

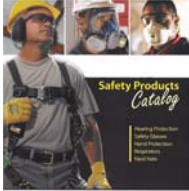
- **Have a plan**
- **Education employees regarding**
 - potential risks and hazards
 - emergency response
- **Have necessary safety equipment on-hand**
 - self-contained respirator
 - protective clothing for skin



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SAFETY RESOURCES



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 www.centraisafety.com

CALL TO REQUEST OUR SAFETY CATALOG!

Our Safety Specialist can be helpful in assessing the hazards in your workplace and recommend compliant solutions.

Call to schedule a walk-through or to learn more about the products and services available through our Occupational Safety Division.

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 (206) 423-1161

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