

1. PRODUCT AND COMPANY IDENTIFICATION

PRODUCT NAME: Carbon Dioxide
CHEMICAL NAME: Carbon Dioxide
CHEMICAL FAMILY: Acid Anhydride
SYNONYMS: Carbonic Anhydride, Carbonic acid gas, Dry Ice
CHEMICAL FORMULA: CO₂
USE: Beverage carbonation, refrigerant, pH control, fire suppression, controlled atmospheres, pressurizing solvent medium, grain fumigation, supercritical extraction, medical respiratory therapy mixtures, chemical reactant.

NAME AND ADDRESS: **Refrigeration & Oxygen Co.**
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2. HAZARDS IDENTIFICATION

EMERGENCY OVERVIEW:

CAUTION! High pressure liquid and gas
 Can cause rapid suffocation.
 Can increase respiration and heart rate.
 Solid and liquid may cause frostbite.
 Avoid breathing the gas.
 Self-contained breathing apparatus may be required by rescue workers.

POTENTIAL HEALTH EFFECTS INFORMATION:

ROUTES OF EXPOSURE:

INHALATION: Carbon dioxide is an asphyxiant and a powerful cerebral vasodilator. Inhaling large quantities causes rapid circulatory insufficiency leading to coma and death. High concentrations of carbon dioxide can asphyxiate quickly without warning with no possibility of self-rescue regardless of the oxygen concentration. Concentrations of 10% or more can produce unconsciousness or death. Lower concentrations may cause headache, sweating, rapid breathing, increased heartbeat, shortness of breath, dizziness, mental depression, visual disturbances, and shaking. Repeated inhalation of low (3% to 5%) concentrations has no known irreversible effects.

EYE CONTACT: Contact with solid, liquid or cold vapor can cause freezing of tissue.

SKIN CONTACT: Contact with solid, liquid or cold vapor can cause frostbite. Frostbite effects are a change in the color of the skin to gray or white, possibly followed by blistering.

SKIN ADSORPTION: Not applicable

INGESTION: Ingestion of solid will cause internal frostbite effects.

CHRONIC EFFECTS: None established

MEDICAL CONDITIONS AGGRAVATED BY OVEREXPOSURE: None

OTHER EFFECTS OF OVEREXPOSURE: Damage to retinal ganglion cells and central nervous system may occur.

CARCINOGENICITY: Carbon dioxide is not listed by NTP, OSHA, or IARC.

POTENTIAL ENVIRONMENTAL EFFECTS: No adverse ecological effects are expected.

3. COMPOSITION/INFORMATION ON INGREDIENTS

INGREDIENT NAME: CARBON DIOXIDE

PERCENTAGE >99%

CAS NUMBER 124-38-9

4. FIRST AID MEASURES

FIRST AID PROCEDURES:

INHALATION: Persons suffering from overexposure should be removed to fresh air. If victim is not breathing, give artificial respiration. If breathing is difficult, give oxygen. Obtain prompt medical attention.

EYE CONTACT: Contact with solid, liquid or cold vapor can cause freezing of tissue. Gently flush eyes with lukewarm water. Obtain medical attention immediately.

SKIN CONTACT: Contact with solid, liquid or cold vapor can cause frostbite. Immediately warm affected area with lukewarm water not to exceed 105 of (41°C). Do not apply direct heat to affected area. Loosely apply dry, sterile, bulky dressings to protect area from infection and further injury. Get medical attention.

INGESTION OF SOLID: Drink lukewarm water. Get medical attention promptly.

NOTES TO PHYSICIAN: There is no specific antidote. Treatment of overexposure should be directed at the control of symptoms and the clinical condition.

5. FIREFIGHTING MEASURES

FLAMMABLE PROPERTIES: Carbon dioxide is nonflammable and does not support combustion.

EXTINGUISHING MEDIA: Carbon dioxide is an extinguishing agent for Class Band C fires, but should not be used on Class D fires. Use extinguishing media appropriate for the surrounding fire.

PROTECTION OF FIREFIGHTERS:

SPECIFIC HAZARDS ARISING FROM THE CHEMICAL: Upon exposure to intense heat or flame a cylinder or bulk container may vent rapidly and/or rupture violently. Most containers are designed to vent contents when exposed to elevated temperatures. Pressure in a container can build up due to heat and it may rupture if pressure relief devices should fail to function. See Section 10 for more information.

PROTECTIVE EQUIPMENT AND PRECAUTIONS FOR FIREFIGHTERS: Evacuate personnel from danger area. If possible, without risk, remove carbon dioxide cylinders from fire area or cool with water. Self contained breathing apparatus may be required for rescue workers.

SENSITIVITY TO STATIC DISCHARGE: Carbon dioxide has no sensitivity to static electricity. The manufacturing of solid dry ice will create high static charges. See Section 3 for more information.

SENSITIVITY TO MECHANICAL IMPACT: None, except as noted above

6. ACCIDENTAL RELEASE MEASURES

PERSONAL PRECAUTIONS: Use personal protection recommended in Section 8.

CYLINDERS: Evacuate all personnel from the affected area until the area is checked to ensure carbon dioxide levels below the exposure limits. Ventilate enclosed areas or remove cylinders to a well-ventilated open area. If leaking from cylinder or its valve, contact your supplier. The cylinder or valve may be very cold after a rapid release of product. Handle the cylinder carefully with leather gloves. Carbon dioxide solid may form and remain in the cylinder until it is warmed.

BULK CONTAINERS: Evacuate all personnel from the affected area until the area is checked to ensure carbon dioxide levels below the exposure limits. Ventilate enclosed areas. If leaking from a container valve, contact your supplier. Carbon dioxide solid may form and remain in the container until it is warmed. This must only be done by qualified personnel.

DRY ICE (SOLID): Evacuate all personnel from the affected area until the area is checked to ensure carbon dioxide levels below the exposure limits. Ventilate enclosed areas or remove the solid to a well-ventilated open area secure from contact by passers-by. Handle the solid only with cold-resistant gloves and clothing.

ENVIRONMENTAL PRECAUTIONS: Not applicable.

METHODS FOR CONTAINMENT: Shut off source of carbon dioxide, if possible without risk.

METHODS FOR CLEAN-UP: Not applicable.

OTHER INFORMATION: None.

7. HANDLING AND STORAGE

CYLINDERS: Use a suitable hand truck for cylinder movement. Never attempt to lift a cylinder by its valve protection cap. Never apply flame or localized heat directly to any part of the cylinder. High temperature may cause damage to cylinder and/or premature failure of the pressure relief device, which will result in venting of the cylinder contents. If user experiences any difficulty operating the cylinder valve, discontinue use and contact supplier. Never insert an object (e.g., wrench, screwdriver, pry bar, etc.) into valve cap openings. Doing so may damage the valve, causing a leak to occur. Use an adjustable strap wrench to remove over-tight or rusted caps. Never strike an arc on a compressed gas cylinder or make a cylinder a part of an electrical circuit.

LIQUID: Wear protective clothing, insulated gloves, and protective eye glasses or face shields when transferring liquid carbon dioxide. Use a suitable four-wheel hand truck for container movement. Check all hoses and transfer equipment before filling them with liquid. Replace any worn or cut hoses before use. Liquid carbon dioxide is extremely cold and under pressure. A leak will result in the formation of solid particles, which will be forcibly ejected from the system, possibly injuring the operator. A complete hose failure can result in a large carbon dioxide spill and violent movement of the hose and associated equipment, which may cause severe injury or death. Special care must be taken when depressurizing and disconnecting hoses. Releasing the contents of a liquid-filled line to atmospheric pressure may result in the formation of a solid dry ice plug in the line. This will prevent further removal of the liquid behind the plug, resulting in either an unexpected rapid release as it warms, or the catastrophic failure of the line as the liquid warms behind the plug. Sufficient vapor pressure must be applied and maintained behind the liquid before opening a discharge valve. This will prevent the depressurization of the liquid to the point of solid formation before it exits the line.

SOLID: Direct contact with solid carbon dioxide (dry ice) should be avoided. Wear appropriate clothing, safety shoes and insulated gloves. Do not ingest solid carbon dioxide. Wear protective eye glasses or shields when cutting dry ice.

STORAGE: Store and use with adequate ventilation. Compressed gas cylinders shall be separated from materials and conditions that present exposure hazards to or from each other. Storage containers and equipment should not be located in sub-surface or enclosed areas, unless engineered to maintain a concentration of carbon dioxide below the exposure limits in the event of a release. Relief valves should be vented to a well ventilated external location. Cylinders should be stored upright with their valve protection cap in place and firmly secured to prevent falling or being knocked over. Protect cylinders from physical damage; do not drag, roll, slide or drop. Do not allow storage area temperatures to exceed 125 °F (52 °C). Full and empty cylinders should be segregated. Use a first-in, first-out inventory system to prevent full containers from being stored for long periods of time. Solid carbon dioxide (dry ice) should be stored in insulated containers with loose fitting covers that allow the evolved gas to escape. Store in a well-ventilated area to prevent accumulation of carbon dioxide vapors above the exposure limits.

8. EXPOSURE CONTROLS/PERSONAL PROTECTION

OSHA PEL-TWA: 5000 ACGIH TLV-TWA: 5000
ACGIH TLV-STEL: 30,000 NIOSH IDLH: 40,000 ppm

ENGINEERING CONTROLS:

VENTILATION: Natural or mechanical to prevent accumulation in worker's breathing zone above exposure limits. (See Section 2.) Carbon dioxide levels should be monitored to assure levels below exposure limits regardless of oxygen levels. Remove vapor from the lowest possible level and exhaust to a well-ventilated outdoor area, Carbon dioxide accumulates in low-lying areas and areas with limited air movement.

PERSONAL PROTECTIVE EQUIPMENT:

EYE/FACE PROTECTION: Safety glasses are recommended when handling cylinders, vapor or liquid transfers, and solid carbon dioxide. Face shields are recommended for liquid transfer operations.

SKIN PROTECTION: Work gloves are recommended when handling cylinders. Leather and/or insulated gloves impervious to cold should be worn when handling liquid or solid carbon dioxide. Safety shoes with metatarsal protection are recommended when handling cylinders or dry ice blocks. Protective clothing as required to avoid skin contact.

RESPIRATORY PROTECTION:

General Use: None required

Emergency Use: Self-contained breathing apparatus (SCBA) or positive pressure air line and escape bottle with mask are to be used in oxygen-deficient atmospheres and areas with high carbon dioxide concentrations. Air purifying respirators will not provide protection.

9. PHYSICAL AND CHEMICAL PROPERTIES

APPEARANCE: Colorless gas, white solid

ODOR: Odorless gas. A slightly acid gas, it is felt by some persons to have a slightly pungent odor and biting taste.

ODOR THRESHOLD: Odorless

PHYSICAL STATE: Gaseous, liquid, or solid

pH: 3.7 @ 1 atm (for carbonic acid)

FREEZING POINT/MELTING POINT: Not applicable at 1 atm - see Sublimation

SUBLIMATION TEMPERATURE: -109.3 °F (-78.5 °C) @ 1 atm

BOILING POINT (1 atm): Not applicable at 1 atm - see Sublimation

TRIPLE POINT: -69.9 °F (-56.6 °C) at 60.4 psig (416 kPa)

FLASH POINT: Not applicable

EVAPORATION RATE (Butyl Acetate=1): Not applicable

FLAMMABILITY: Nonflammable

FLAMMABLE LIMITS IN AIR BY VOLUME:

LOWER: Not applicable UPPER: Not applicable

VAPOR PRESSURE at 70 °F (21.1 °C): 838 psig (5778 kPa)

GAS DENSITY at 70 °F (21.1 °C) and 1 atm: 0.114 lb/ft³ (1.833 kg/m³)

LIQUID DENSITY at 70 °F (21.1 °C) and 838 psig (5778 kPa): 47.35lb/ft³ (761.338 kg/m³)

SOLID DENSITY at -109.3 OF (-78.5 °C), 1 atm: 97.59lb/ft³ (1569 kg/m³)

SPECIFIC GRAVITY (Air=1): 1.522 @ 70 °F (21.1 °c) and 1 atm

SOLUBILITY IN WATER: 0.90 Vol/Vol at 68 °F (20°C)

COEFFICIENT OF WATER/OIL DISTRIBUTION: Not applicable

AUTOIGNITION: Nonflammable

DECOMPOSITION TEMPERATURE: 3,000 °F (1648.9 °C)

MOLECULAR WEIGHT: 44.01

EXPANSION RATIO at 70 °F (21.1 °C): 8.741 ft³/lb (solid to gas)

10. STABILITY AND REACTIVITY

CHEMICAL STABILITY: Stable **CONDITIONS TO AVOID:** None

INCOMPATIBLE MATERIALS: None. Carbon dioxide will react with alkaline materials to form carbonates and bicarbonates.

HAZARDOUS DECOMPOSITION PRODUCTS: Carbon dioxide gas in an electrical discharge yields carbon monoxide and oxygen. In the presence of moisture, carbon dioxide will form carbonic acid.

POSSIBILITY OF HAZARDOUS REACTIONS: Dusts of various metals (e.g., magnesium, zircon, titanium alloys), are readily ignited and explode in the presence of carbon dioxide. Mixtures of solid carbon dioxide with sodium and potassium alloys are impact sensitive and explode violently. In the presence of moisture, cesium oxide ignites on contact with carbon dioxide. Metal acetylides or hydrides will also ignite or explode.

11. TOXICOLOGICAL INFORMATION

Carbon dioxide is an asphyxiant. It initially stimulates respiration and then causes respiratory depression. High concentrations result in narcosis. Symptoms in humans are as follows:

EFFECT	CONCENTRATION
Slight increase in breathing rate.	1%
Breathing rate increases to 50% above normal level.	2%
Prolonged exposure can cause headache, tiredness.	

Breathing increases to twice normal rate and becomes labored. Weak narcotic effect. Impaired hearing, headache, increase in blood pressure and pulse rate.	3%
Breathing increases to approximately four times normal rate, symptoms of intoxication become evident and slight choking may be felt.	4% to 7%
Characteristic sharp odor noticeable. Very labored breathing, headache, visual impairment and ringing in the ears. Judgment may be impaired, followed within minutes by loss of consciousness.	7% to 15%
Unconsciousness occurs more rapidly above the 10% level.	Above 15%

Prolonged exposure to high concentrations may eventually result
in death from asphyxiation or severe acidosis.

ACUTE DOSE EFFECTS:

LD₅₀: None

LC₅₀: None

REPEATED DOSE EFFECTS: Damage to retinal ganglion cells and central nervous system may occur.

IRRITATION: None

SENSITIZATION: None

GENETIC EFFECTS: None

REPRODUCTIVE EFFECTS: None

DEVELOPMENTAL EFFECTS: None

TARGET ORGAN EFFECTS: Respiratory system,
cardiovascular system, eyes

MUTAGENICITY: None

TERATOGENICITY: None

SYNERGISTIC MATERIALS: None

12. ECOLOGICAL INFORMATION

ECOTOXICITY: No adverse ecological effects are expected. Carbon dioxide does not contain any Class I or Class II ozone depleting chemicals (40 CFR Part 82). Carbon dioxide is not listed as a marine pollutant by DOT (49 CFR Part 171).

13. DISPOSAL CONSIDERATIONS

WASTE DISPOSAL METHOD:

CYLINDERS: Do not attempt to dispose of residual or unused quantities. Return containers to the supplier. For emergency disposal, secure the cylinder and slowly discharge gas to the atmosphere in a well ventilated area or outdoors.

BULK CONTAINERS: Do not attempt to dispose of residual or unused quantities. Contact supplier for disposal. For emergency disposal, slowly discharge gas to the atmosphere in a well-ventilated area or outdoors.

DRY ICE (SOLID): Do not attempt to dispose of residual or unused quantities. Return containers to the supplier. Handle the solid only with cold-resistant gloves and clothing. For emergency disposal, allow solid carbon dioxide to sublime to a well-ventilated area that is away from general traffic and secure from accidental contact.

14. TRANSPORT INFORMATION

GAS:

BASIC SHIPPING DESCRIPTION:

PROPER SHIPPING NAME: Carbon Dioxide

HAZARD CLASS: 2.2 (Nonflammable gas)

IDENTIFICATION NUMBER: UN 1013

PIN: 1013

ADDITIONAL INFORMATION:

PRODUCT RQ: None

SHIPPING LABEL(s): Nonflammable gas

PLACARD (when required): Nonflammable gas

SPECIAL SHIPPING INFORMATION: Cylinders should be transported in a secure position, in a well ventilated vehicle. The transportation of compressed gas cylinders in automobiles or in closed-body vehicles can present serious safety hazards and should be discouraged.

REFRIGERATED LIQUID:

BASIC SHIPPING DESCRIPTION:

PROPER SHIPPING NAME: Carbon Dioxide, Refrigerated Liquid

HAZARD CLASS: 2.2 (Nonflammable gas)

IDENTIFICATION NUMBER: UN 2187

PIN: 2187

ADDITIONAL INFORMATION:

PRODUCT RQ: None

SHIPPING LABEL(s): Nonflammable Gas

PLACARD (when required): Nonflammable gas

SPECIAL SHIPPING INFORMATION: Cylinders should be transported in a secure position, in a well ventilated vehicle. The transportation of compressed gas cylinders in automobiles or in closed-body vehicles can present serious safety hazards and should be discouraged.

SOLID:

BASIC SHIPPING DESCRIPTION:

PROPER SHIPPING NAME: Carbon Dioxide, Solid or Dry Ice

HAZARD CLASS: 9

IDENTIFICATION NUMBER: UN1845

PIN: 1845

ADDITIONAL INFORMATION:

PRODUCT RQ: None PACKING GROUP: III

SHIPPING LABEL(s): No label required for highway shipment. If shipped by air or water, use a Class 9 label.

PLACARD: No placard required for domestic highway shipment.

SPECIAL SHIPPING INFORMATION: The transportation of solid carbon dioxide in automobiles or in closed-body vehicles can present serious safety hazards and should be discouraged.

15. REGULATORY INFORMATION & OTHER INFORMATION

SPECIAL PRECAUTIONS: Use piping and equipment adequately designed to withstand pressures to be encountered. Use a check valve or other protective apparatus in any line or piping from the cylinder to prevent reverse flow. Cross contamination of gases, liquids, or both can also create a

hazardous condition inside a cylinder, dewar, or vessel (e.g., flammable and oxidizing gases can create an explosive mixture), which may result in rupture. Discharge of liquid carbon dioxide lines to atmospheric pressure will result in formation of solid dry ice, which may cause blockage of the liquid line.

Static Electricity: Discharge of liquid carbon dioxide or formation of solid dry ice produces static electricity charges. This may lead to a discharge of the static electricity to any grounded object or person. Use of carbon dioxide snow or solid dry ice in combustible environments should be carefully evaluated. Carbon dioxide liquid (CO2 fire extinguishers) should not be used for inerting vessels containing flammable or explosive atmospheres.

MIXTURES: When two or more gases or liquefied gases are mixed, their hazardous properties may combine to create additional, unexpected hazards. Obtain and evaluate the safety information for each component before you produce the mixture. Consult an Industrial Hygienist or other trained person when you make your safety evaluation of the end product. Remember, gases and liquids have properties that can cause serious injury or death.

HAZARD RATINGS (NFPA RATING):

GAS:		LIQUID:	
HEALTH	= 1	HEALTH	= 3
FLAMMABILITY	= 0	FLAMMABILITY	= 0
INSTABILITY	= 0	INSTABILITY	= 0
SPECIAL	= SA	SPECIAL	= SA
SOLID:			
HEALTH	= 2		
FLAMMABILITY	= 0		
INSTABILITY	= 0		
SPECIAL	= SA		

STANDARD VALVE CONNECTION

THREADED:	CGA 320
PIN-INDEXED YOKE:	CGA 940 (Medical Use)
ULTRA HIGH INTEGRITY:	716

Use the proper connections; DO NOT USE ADAPTERS

The information and recommendations in this Material Safety Data Sheet relate only to the specific material mentioned herein and do not relate to use otherwise i.e., in combination with any other material or in any process.

The information and recommendations herein are taken from our extensive experiences and the data contained in recognized references and believed by us to be accurate. Refrigeration group of companies make no warranties either expressed or implied with respect there to and assume no liability in connection with the use of such information and recommendation.

