

## Material Safety Data Sheet

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### 1. Chemical Product and Company Identification

Product name: Carbon dioxide (liquefied carbon dioxide)  
 MSDS serial number: NTG-CO2-02  
 Supplier/Manufacture: Nippon Tansan Gas Co., Ltd.  
 Address: 3-12-15 Aoi, Adachi-ku, Tokyo, Japan  
 Division: Design Development Section, Technology Department  
 Phone: 03-3849-1571  
 Fax: 03-3880-6829  
 Emergency calls: 0282-27-5205

### 2. Composition and Information on Ingredients

Single or compound

Material: Single  
 Chemical name: Carbon dioxide  
 Content (vol%): 99.5 or more  
 Chemical formula: CO<sub>2</sub>  
 Serial numbers of corresponding official daily gazettes: Law on the Examination and Regulation of Manufacture, etc., of Chemical Substances: 1-169 (Japan)  
 CAS number: 124-38-9  
 Hazardous or toxic components: Carbon dioxide

### 3. Hazards Identification

Highest-level danger or toxicity:



Compressed gas (Contents under high pressure)

- Health:
- Inhalation of high-purity of carbon dioxide may cause adverse effects on the human body.
  - If liquefied carbon dioxide is released into the atmosphere, it turns into a low-temperature gas and snow-like dry ice, exposure to which may cause frostbite, and if such cold gas or dry ice enters the eyes, it may cause blindness.
  - Note that the gas is asphyxiating even at low toxicity.

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Environmental impact:	· Carbon dioxide is said to be a major cause of global warming, and measures to reduce it are being considered domestically and internationally.
Physical or chemical danger:	· Carbon dioxide is filled in containers for supply to customers. Because it is under high pressure ,it is hazardous.

### 4. First Aid Measures

Inhalation:	<ul style="list-style-type: none"> <li>· Immediately move the victim to fresh air. Loosen clothing and keep warm with a blanket or similar. If the victim is unconscious, loosen clothing, clear the respiratory tract, and conduct artificial respiration. Seek immediate care by a physician.</li> <li>· If breathing is weak, give pure oxygen.</li> <li>· If not breathing, give artificial respiration.</li> </ul>
Skin contact:	<ul style="list-style-type: none"> <li>· If the person is lightly frostbitten, rub the affected area to warm it. If frostbite is serious, do not rub, but warm the affected area with tepid water, and wrap in gauze or similar. Seek immediate care by a physician.</li> </ul>
Eye contact:	<ul style="list-style-type: none"> <li>· If the victim has been exposed to a gas flow, wash the part with clear water. Seek immediate care by a physician.</li> </ul>
Protective measures before starting first aid:	<ul style="list-style-type: none"> <li>· Ensure sufficient ventilation, and provide respirators and other equipment as needed.</li> </ul>

### 5. Fire Fighting Measures

Extinguishing media:	<ul style="list-style-type: none"> <li>· Use spray powder extinguisher and/or water. Use appropriate extinguishing media for surrounding fire.</li> </ul>
Specific hazard or toxicity:	<p>For nearby fire, do as follows to prevent internal pressure from rising; this is necessary even though the substance is nonflammable:</p> <ul style="list-style-type: none"> <li>· Move containers from fire area if it can be done without risk. If it is not possible to move containers, turn water on them from windward.</li> <li>· Keep away from leakage because of the risk of suffocation.</li> </ul>
Protective measures extinguishing a fire:	<ul style="list-style-type: none"> <li>· Using fireproof gloves, respirator, and other protective equipments, fight fires from windward and keep appropriate distance.</li> </ul>

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### 6. In Case of Leakage (Accidental release measures)

- Respiration:
  - Promptly evacuate personnel near leakage, keep others away, and ensure sufficient ventilation.
  - Stay windward and dispose.
- Protectors:
  - If oxygen concentration is low, do not enter the area without protection.
- Environmental Affects:
  - Carbon dioxide is about 1.5 times heavier than air and tends to remain in low places, resulting in high concentration.
  - High concentration may cause suffocation.
- Discharge:
  - Ventilate the room and let in fresh air.
  - Work in teams of two or more and wear protective equipment such as respirators, protective gloves, and other proper guards.

### 7. Handling and Storage

- Handling: Protection for carbon dioxide users
- Suffocation
- Use in a place where ventilation is good.
- Handling of containers
- Do not use containers roughly.
  - Do not use near fire.
  - Before using confirm the name of the gas by checking the mark or the other items on the containers.
  - Feed gas via a pressure regulator ,not directly.
  - Use only specialized pressure regulators.
  - Before connecting a pressure regulator ,check the screw type.
  - Before using a gas container, check the pressure regulator, hose, pipes, joints ,etc.,for leakage.
  - Do not refill gas.
  - Do not modify or erase marks or other items on containers. Do not peel off labels on containers.
  - Do not use gas containers in electric circuits. Be careful not to cause arc strike particularly.
  - Do not touch dry ice with the bare hands because it has an extremely low temperature.
  - Avoid compressed gas discharge. Direct high-pressure gas may cause injury to the body.
  - Do not use gas containers for other purposes.

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## Storage

Storage conditions:

Storage conditions

- Keep container away from fire and spark sources.
- Do not store containers near electric lines or grounding.
- Store containers at a dry place that is well drained and ventilated.
- Keep containers away from corrosive atmosphere.
- Keep containers away from direct sunlight at an ambient temperature of 0 to 40°C.
- Do not expose containers to rough handling or falling.
- Control oxygen concentration in storage area at 18 vol% or more.

Safe container

material:

- Use only container for compressed gas.

**8. Exposure Control and Personal Protection**Acceptable  
concentration:

- Japan Society for Occupational Health: (2000 version) 5,000 ppm (TWA)
- ACGIH: 5,000 ppm (TLV-TWA) (1999 version)  
300,000 ppm (TLV-STEL) (1999 version)
- NIOSH: 5,000 ppm (TWA)  
300,000 ppm (STEL)
- OSHA: 5,000 ppm (TWA)

Note: ACGIH :American Conference of Governmental Industrial Hygienists

NIOSH: National Institute for Occupational Safety and Health

OSHA : Occupational Safety and Health Administration

TLV : Threshold Limit Value

TWA: Time Weighted Average Concentration

STEL: Short Term Exposure Limit

TLV-TWA: time-weighted average

Expressed as the time-weighted average concentration (TWA) during regular working time of 8 hours a day, 40 hours a week, and the health of most personnel is not adversely affected even when repeatedly exposed to such conditions.

TLV-STEL: short-term exposure limit

Indicates the limit of concentration that does not cause:

- 1) Intolerable stimulus,
- 2) Chronic or irreversible damage to the living body, or
- 3) Increased risk of occurrence of injury, accidents, loss of self-control, or significantly lowered work efficiency caused by

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anesthetic action even after continuous short-term (15-minute) exposure to that environment provided that the day's average exposure does not exceed the TLV-TWA.

Measures for facilities:	Before using containers in enclosed place, install a ventilator or similar.
Protectors for Protectors for respiration:	· Air respirator, oxygen inhaler, gas mask
Protectors for hands:	· Not needed
Protectors for eyes:	When handling low-temperature containers, wear leather gloves.
Protectors for skin and body:	· To protect eyes, wear goggles.
	· Not needed

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**9. Physical and Chemical Properties**

Appearance	
Physical state:	Liquid
Color:	Colorless
Odor:	Odorless
Explosiveness:	Nonflammable
Molecular weight:	44.01 g/mol
Specific gravity:	1.5 (air = 1) 0.93(water = 1)
Temperature for change in physical state	
Triple point:	-56.6°C at 0.518 MPa
Critical temperature:	31.1°C
Critical pressure:	7.382 MPa
Boiling point: (Sublimation)	-78.5°C
Solubility:	0.878 CO <sub>2</sub> /H <sub>2</sub> O (at 20°C, 1 atm.)

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## 10. Stability and Reactivity

Stability:	Stable
Reactivity:	No special reactivity
Hazardous or harmful degradation products:	None

## 11. Toxicological Information

Acute toxicity: Inhalation

- The gas is low in inhalation toxicity but causes symptoms of oxygen deficiency if concentration is high.

0.04%	Normal air
0.5% (TLV)	Limit of long-term safety
1.5%	Tolerable for an extended time without affecting operability and basic physiology, but calcium and phosphorus metabolism may be affected in some cases.
2%	Respiration becomes deeper.
3%	Operability drops. Physiological changes appear in variations in blood pressure, heartbeat, and other factors.
4%	Respiration becomes much deeper. Higher breathing, slight gasping. Considerable degree of discomfort.
5%	Extreme difficulty in breathing; serious gasping intolerable for most people; some feeling of nausea. Toxicosis occurs after 30 minute's exposure.
7 to 9%	Limit of tolerance, resulting in violent gasping. In about 15 minutes, the subject loses consciousness.
10 to 11%	Disabled regulation; unconsciousness in about 10 minutes.
15 to 20%	Much more serious symptoms are seen, but not lethal within an hour.
25 to 30%	Respiration weakens, blood pressure drops, resulting in coma, lost reflexes, and paralysis. Death occurs in some hours.

Local physical effects on skin, eyes, etc.:

- None

Sensitization:

- None

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Chronic or  
 long-term toxicity: · None

### 12. Ecological Information

Global warming  
 potential (GWP): 1  
 \* Global Warming Potential (GWP)  
 Index detailing effects on global warming

### 13. Disposal Consideration

#### Disposal of carbon dioxide

- Gradually release in open air, because it may cause simple suffocation, even though the toxicity is low.
- Too quick gas release is dangerous because it may produce dry ice, causing frostbite.

#### Disposal of containers

- If gas remains in containers, drive into the container cap with appropriate application to release gas and dispose of containers as incombustible.
- Do not dispose of containers without first checking that all gas has been released
- For empty containers, check that containers are open and dispose of as incombustible waste.

### 14. Transport Information

International  
 regulations

UN number: IMDG UN2037 / IATA UN1013

UN classification: Class 2.2 (Compressed gas, Non-flammable gas, Non-toxic gas)

### 15. Regulatory Information

Legal information  
 (on Japan)

High Pressure Gas

Safety Law: Production, sales, storage, transportation, consumption, disposal

Industrial Safety  
 and Health Law:

Production, storage, consumption

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Food Sanitation Law:	Production, sales
Law for Safety of Containers:	Transportation
Port Regulation Law:	Transportation
Civil Aeronautics Law:	Transportation
Road Trucking Vehicle Law:	Transportation
Road Traffic Law:	Transportation

**16. Other Information**

Scope:	<ul style="list-style-type: none"> <li>· This Material Safety Data Sheet applies to liquefied carbon dioxide.</li> <li>· Article 2 of the High Pressure Gas Safety Law (Japan) , Carbon dioxide is specified as a “High Pressure Gas” .</li> </ul>
Data sheet:	<ul style="list-style-type: none"> <li>· This Material Safety Data Sheet (MSDS) is prepared based on the latest materials and data. It may be subject to change when new material and/or data are obtained.</li> </ul> <p>The MSDS states precautions assuming that the product is used under normal conditions. Uses under special conditions should take these conditions into account to ensure safety. While the MSDS has been prepared as comprehensively as possible ,we cannot guarantee its applicability or effectiveness under all possible conditions or applications.</p>
History of revision:	<p>Prepared on: September 25, 2007</p> <p>Revised on: March 1, 2010</p>
Bibliography:	<ul style="list-style-type: none"> <li>· Semiconductor Process Gas Safety Data Book, revised and enlarged edition, jointly edited by Special Gas Industrial Association and SEMI Standard Facilities and Safety sectional meeting, published by SEMI Japan (1993)</li> <li>· Data Book on Safe Handling of Gas jointly edited by Nippon Sanso Co., Ltd. and Matheson Gas Products, published by Maruzen (1988)</li> <li>· Profiles of 100 Hazardous and Harmful Substances, edited by Kikuo Oikawa, published by Maruzen Co., Ltd. (1987)</li> </ul>



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- Special Materials Gas Safety Data Book, Ver. 2000, written and edited by Special Gas Industry Sectional Meeting of Japan Industrial Gases Association (1999)
- 14,906 chemical products PDF by The Chemical Daily Co., Ltd. (2006)
- Search System of Legal Regulation on Chemicals by Japan chemical data base

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