

## Safety Data Sheet

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## 1. Chemical Product and Company Identification

Product name : Carbon dioxide (liquefied carbon dioxide)  
 SDS serial number : NTG-CO2-02 Rev.5  
 Supplier/Manufacture : Nippon Tansan Gas Co., Ltd.  
 Address : 4956-2 Ienaka, Tsuga-machi, Tochigi-shi, Tochigi, Japan  
 Division : Technical Department, Product & Technology Division  
 Phone : 0282-27-5205  
 Fax : 0282-27-8226  
 Emergency calls : 0282-27-5205



## 2. Hazards Identification

GHS classification

Physical and chemical

hazards : High pressure gas - Liquefied gas

GHS label elements

Pictogram :



Attention signal word : Warning

Hazards information : Contains gas under pressure ; may explode if heated

Storage precaution : Protect from sunlight.  
 : Store in a well-ventilated place.

Other hazards which  
do not result in GHS

classification : Harmful effects on human health ;  
 Inhalation of high concentrations of carbon dioxide may cause hypoxia  
 or anoxia.

Specific hazards/harms information ;

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.

## 3. Composition and Information on Ingredients

Single or compound

material : Single

Chemical name : Carbon dioxide

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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

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## 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.</li> <li>· Get medical attention.</li> <li>· If breathing is weak, give 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 eyes with clear water. Get medical attention.</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>

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## 5. Fire Fighting Measures

Extinguishing media	:	<ul style="list-style-type: none"> <li>· Use appropriate extinguishing media for surrounding fire.</li> </ul>
Extinguishing media that should not be used	:	<ul style="list-style-type: none"> <li>· None</li> </ul>
Specific hazards	:	<p>In case of fire, take the following actions to prevent pressure increase of gas cylinder</p> <p>(this is necessary even though the substance is nonflammable):</p> <ul style="list-style-type: none"> <li>· Move the cylinders from fire area if it can be done without risk. If it is not possible to move cylinders, from a safe position, cool cylinders with water spray.</li> </ul>

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## Protective measures

- extinguishing a fire : · Use fireproof gloves, respirator, and other protective equipments as needed. Extinguish with taking appropriate distance.

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

- Warning : · 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.
- Personnel precaution : · Ensure sufficient ventilation.
- Discharge : · Ventilate the room and let in fresh air.

## 7. Handling and Storage

- Handling : Protection for carbon dioxide users

Suffocation

- Use in a well-ventilated area

Handling of cylinders

- Do not use cylinders roughly.
- Do not use near fire.
- Use only exclusive equipment, and don't release gas directly.
- Do not refill gas.
- Do not modify or erase marks on cylinders.
- Do not use gas cylinders in electric circuits. Be careful not to cause arc strike particularly.
- Do not touch dry ice with the bare hands.
- Do not touch discharging gas directly.

## Storage

- Storage conditions : Storage conditions

- Keep cylinder away from fire and spark sources.
- Do not store cylinders near electric lines or ground wire.
- Keep cylinders in dry and low-humidity environment.
- Keep cylinders away from corrosive atmosphere.
- Keep cylinders away from direct sunlight at temperature of 0 to 40°C.
- Take appropriate measures to prevent stored cylinders falling down.
- Control oxygen concentration in storage area at 18 vol% or more.

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## 8. Exposure Control and Personal Protection

## Acceptable

- concentration :
- Japan Society for Occupational Health: (2014 version) 5,000 ppm (TWA)
  - ACGIH: 5,000 ppm (TLV-TWA) (2014 version)  
30,000 ppm (TLV-STEL) (2014 version)
  - NIOSH: 5,000 ppm (TWA)  
30,000 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 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.

Personal protection : Ensure sufficient ventilation.

Use gloves and/or goggles to protect hands, eyes, and/or body as needed.

## 9. Physical and Chemical Properties

Appearance : · Gas : Colorless and odorless. Reaction with water leads to exhibition of weak acidity and a pungent odor.

· Liquid : Colorless and transparent

· Solid : Semitransparent, milky white

Smell : Odorless

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pH	: 3.7 (25°C, 0.1013MPa, saturated water)
Melting point/ freezing point	: -56.6°C (triple point, 0.518MPa abs)
Boiling point, initial boiling point and boiling range	: -78.5°C (sublimation point)
Flash point	: None (noncombustible)
Combustion and explosion range	
Upper limit	: None (noncombustible)
Lower limit	: None (noncombustible)
Vapor pressure	: 1.967MPa (abs) (-20°C) 3.485MPa (abs) (0°C) 5.733MPa (abs) (20°C)
Vapor density	: 1.977kg/m <sup>3</sup> (0°C, 0.1013MPa abs)
Liquid density	: 1.013kg/L (-20°C, 1.967MPa abs)
Solid density	: 1.566kg/L (-80°C)
Solubility in water	: 1.713 CO <sub>2</sub> /H <sub>2</sub> O (0°C, 0.1013MPa) 1.194 CO <sub>2</sub> /H <sub>2</sub> O (10°C, 0.1013MPa) 0.878 CO <sub>2</sub> /H <sub>2</sub> O (20°C, 0.1013MPa)
n- octanol /water partition coefficient	: log Pow 0.83
Other data	:
Critical temperature	: 31.1°C
Critical pressure	: 7.382MPa abs, 75.28kg/cm <sup>2</sup>

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## 10. Stability and Reactivity

Stability	: Stable
Reactivity	: No special reactivity

## Possibility of hazardous

reactions	: None
Conditions to avoid	: ·Carbon dioxide in the presence of water shows acidity and corrodes steel materials. ·Corrosion increases further with the presence of oxygen or under high pressure.

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Incompatible materials : None  
 Hazardous decomposition  
 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. Fatal within few hours.

Local physical effects on skin,

eyes, etc. : · None

Sensitization : · None

Chronic or

long-term toxicity : · None

## 12. Ecological Information

Global warming potential (GWP) : 1

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\* Global Warming Potential (GWP)

Index detailing effects on global warming

Ecotoxicity : No known effects

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13. Disposal ConsiderationDisposal of carbon dioxide

- Ensure sufficient ventilation and gradually release in open air.
- It is dangerous to release gas quickly because it may produce dry ice, causing frostbite.

Disposal of cylinders

- If gas remains in cylinders, pierce the cylinder cap with appropriate application to release gas and dispose of cylinders as incombustible.
- Do not dispose unused cylinders without all gas has been released.
- For empty cylinders, check if the cap of cylinders are open and dispose them as incombustible waste.

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14. Transport Information

## International regulations

UN number : IMDG UN2037 / IATA UN1013

UN Proper Shipping Name : Carbon Dioxide

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

Marine pollutant : None

## Transport in bulk according

to MARPOL : None

- Special safety measure :
- Cylinder temperatures during transfer must be kept at 40°C or below.
  - Handle the cylinder with care to avoid impact.
  - Display warning labels stating "High Pressure Gas" on the vehicle in easily viewable places.

## Emergency Response Guide

Number : 120

\*Follow local laws and regulations, in use outside Japan.

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15. Regulatory Information

## Legal information

(on Japan)

High-Pressure Gas Safety Act : Production, sales, storage, transportation, consumption, disposal

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- Fire Service Law : Distances related to high pressure gas facilities
- Labor Standards Law : Work limit to hazardous/harmful work (duties of producing or using compressed gas or liquefied gas). Work limit for young people 18 years of age to work on hazardous/harmful duties.

## Industrial Safety and Health

Act : Production, storage, consumption

Act on Confirmation, etc. of  
Release Amounts of Specific  
Chemical Substances in the  
Environment and Promotion  
of Improvements to the

Management Thereof : N/A

Poisonous and Deleterious

Substances Control Law : N/A

Laws relating to the

Prevention of Global Warming : Greenhouse effect gases

Act on Port Regulations : Transportation

Aviation Law : Transportation

Road Act : Transportation

Food Sanitation Law : Food additives

Pharmaceutical Affairs Law : Carbon dioxide in the Japanese Pharmacopoeia

\*Follow local laws and regulations, in use outside Japan.

## 16. Other Information

- Scope : • This Safety Data Sheet applies to liquefied carbon dioxide.  
• On article 2 of the High Pressure Gas Safety Law (Japan) , Carbon dioxide is specified as a "High Pressure Gas" .
- Data sheet : • This Safety Data Sheet (SDS) is prepared based on the latest information and data. It may be subject to change when new information and/or data are obtained.
- The SDS states precautions assuming that the product is used under normal conditions. The user must operate with appropriate safety measure for unusual use.
- While the SDS has been prepared as comprehensively as possible, we cannot guarantee its applicability or effectiveness under all possible conditions or applications.



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Rev.4 : October 31, 2014

Rev.5 : April 14, 2016

- Bibliography :
- 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)
  - Data Book on Safe Handling of Gas jointly edited by Nippon Sanso Co., Ltd. and Matheson Gas Products, published by Maruzen (1988)
  - Profiles of 100 Hazardous and Harmful Substances, edited by Kikuo Oikawa, published by Maruzen Co., Ltd. (1987)
  - 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 database