

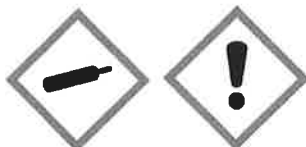
Safety Data Sheet

Revision Date : April 1, 2024
Prepared on : March 25, 1993

1. IDENTIFICATION

Chemical name : Liquefied carbon dioxide (liquefied carbon dioxide gas)
Company name of the supplier : RESONAC GAS PRODUCTS Corporation
Address : 1310, Omiya-cho, Saiwai-ku, Kawasaki, Kanagawa 212-0014 Japan
Department : Carbon Dioxide Department, Carbon Dioxide Division
Contact information : Tel; +81-44-223-9511 Fax; +81-44-520-8910
Emergency contact : Name;
: Address;
: Tel; Fax;
Recommended use : For industrial, food, agriculture, medical etc.
Restriction of use : Please obey applicable laws and regulations in the use of this product.
When you use it other than the recommended use, please ask our department in charge.
Reference number : 001

2. SUMMARY OF HAZARD/HARMS INFORMATION

GHS classification of chemical product
Physical and chemical hazards : High pressure gas Liquefied gas
Health hazards : Specific target organ toxicity (single exposure); Category 3 (narcotic effect)
Environmental Hazards : Classification not possible
GHS label elements
Pictogram or symbol : 
Attention signal word : Warning
Hazard harms information : Liquefied gas: May explode if heated.
: May cause frostbite or injury.
: May cause drowsiness or dizziness.
Precautionary statements [Safety measures] : Use only with outdoors or adequate ventilation.
: Avoid inhalation of gas/mist/steam/spray.
: Wear the tool for protection of mention in "8. EXPOSURE PREVENTION AND PROTECTIVE MEASURES"
[First-aid measures] : In case of inhalation: move the victim to fresh air and keep at rest in a position comfortable for breathing.
: If the victim feels unwell, contact a doctor.
: Dissolve the part which froze with lukewarm water.
: Do not rub the affected area.
[Storage] : Immediately consult a medical doctor for a diagnosis/treatment.
: Protect from sunlight. Store in a well-ventilated place where the temperature is 40°C or lower.
: Keep the cylinders sealed.
: Take measures such as locking and storing it.
[Disposal] : Do not dispose of contents/cylinders at your discretion. Contact the manufacture or the distributor.
Other hazards that are not related to GHS classification are not treated in GHS : Adverse effects to human health; inhalation of carbon dioxide with a high concentration may result in unconscious, coma, and death.
: Liquefied carbon dioxide changes to gas and carbon dioxide in snow state with low temperature if it is released to the air. Contacting with it may cause frostbite and getting in eyes may cause blindness.
: Effects on the environment; though carbon dioxide is one of the greenhouse effect gasses that are the cause of global warming, there are no effects on the environment under the normal state.

- : Physical and chemical hazard;
 - Liquefied carbon dioxide represents a hazard as high pressure gas and extremely low temperature substance.
 - No known chemical hazards.
- : Specific hazards;
 - In case of releasing liquefied carbon dioxide rapidly dry ice may be produced and static electricity may be generated by rust in the pipes, dusts, and moisture and it may cause fire if there is a flammable mixture.
 - Dry ice, such as dry ice snow made by releasing carbon dioxide in the atmosphere and dry ice manufactured industrially, sublimates to gas and expands to several hundred times its original volume. Therefore, there is a risk of explosion with bottles or plastic bottles containing dry ice.

3. COMPOSITION/INFORMATION ON INGREDIENTS

Chemical Substance/Mixture : Chemical substance
Chemical or generic name : Carbon dioxide (carbon dioxide gas) (CO₂)
(chemical formula)
Ingredients and content :

Chemical substance	CAS No.	Molecular weight	Reference number in gazette list in Japan		Concentration of ingredients ^{※)}
			JCSCL	ISHL	
Carbon dioxide	124-38-9	44.01	(1)-169		Not less than 99.5 vol%

※) Conversion formula to a percent by weight

Weight Concentration (wt. %)

$$= \frac{MnVn}{\sum MnVn} \times 100$$

Mn : Molecular weight of each component

Vn : Volume of each component (gas volume)

* The temperature and pressure of each component assume it the same condition.

* The volume of each component (gas volume) sets to 100% (all volume) in total.

4. FIRST-AID MEASURES

Inhalation

- : Move the victim to fresh air and keep at rest and warm, and contact a doctor.
- : Give humidified oxygen if breathing is weak.
- : Perform artificial respiration if breathing has stopped.

Skin contact

- : Special treatment is not necessary if exposed to carbon dioxide in atmospheric pressure.
- : In case of contact with liquefied carbon dioxide, it may cause frostbite. Do not rub the frostbitten area. There will be no sensation on the frostbitten area and the area will become yellow and waxy, and in case of warming up, it blisters with pain and tends to get purulent. Protect with gauze or the like and consult a doctor. Do not forcibly remove the clothes if they are not removable because of freezing. Cut off other areas of the clothes. Gradually warm the affected area with water. If the frostbitten area returns to normal temperature or even higher temperature, cool with cold water.

Eye contact

- : Wash with clean water and immediately seek medical attention.

Protection of first-aiders

- : Sufficiently ventilate the place where carbon dioxide is leaking or erupting because the oxygen concentration in the air may be low. Wear a positive-pressure air-supplied respirator as required.

5. FIRE-FIGHTING MEASURES

Suitable extinguishing media

- : Carbon dioxide (carbon dioxide gas) is non-flammable and an extinguishing agent. In case of a fire in the vicinity, suitable extinguishing media for the surrounding fire should be used though carbon dioxide is nonflammable.

Unsuitable extinguishing media

- : None

Specific hazards with regard to firefighting measures	<ul style="list-style-type: none"> : Carbon dioxide may spout from a cylinder exposed to a flame, because increased inner pressure makes the safety device activated. In case of large increase in inner pressure, may cause cylinder explosion. : Remove the cylinders to a safe place. If they are not movable, cool with water spray from the windward side as much as possible.
Specific means of extinction	<ul style="list-style-type: none"> : Quickly remove the cylinders to a safe place if they are movable. : Take measures such as spraying water on the cylinder, to prevent pressure rise therein. : In case of an unmovable cylinder such as cryogenic vessel, container, or tank, open the gas blow valve and liquid blow valve. In this instance, also take necessary measures not to inhale discharged high concentration carbon dioxide.
The special Protection of firefighters and Precautionary measures	<ul style="list-style-type: none"> : Wear respiratory apparatus as required. : Firefighting must be conducted from the windward as away as possible from the flame with protective equipment such as protective gloves and fireproof clothes.

6. LEAKAGE MEASURES

Personal precautions, protection, and emergency measures	<ul style="list-style-type: none"> : Immediately remove from the leakage area and surrounding. Prohibit persons other than the related ones from entering. Provide adequate ventilation and avoid inhalation of gas. : If large amount of leakage continues, encircle the leakage area with ropes and monitor the surrounding to prevent unauthorized individuals from entering. : Carbon dioxide is heavier than air and tends to remain in low area with a high concentration. Persons who get into the leakage area where the leaked part is possible to be repair must wear respiratory protective equipment, such as positive-pressure air-supplied respirator, because inhalation of gas with a high concentration may lead to suffocation.
Environmental precautions	<ul style="list-style-type: none"> : Measure and control oxygen concentration in the air.
Methods and machine parts for containment and cleaning up	<ul style="list-style-type: none"> : No environmental effects under the normal state. : Ventilate well and immediately spread into the atmosphere to be diluted.
Prevention of secondary hazards	<ul style="list-style-type: none"> : Enter places lower than the leaking area (basement, pit, etc.) is allowed only after measuring the concentration of carbon dioxide and confirming safety.

7. HANDLING AND STORAGE

Handling

Technical measures

Exposure control for handling personnel	<ul style="list-style-type: none"> : Check there is no leakage in the joints, hoses, piping, and equipment. At leakage inspection, using a foam liquid, such as soap water, is safe and reliable. : Close valves of cylinders when leaving workplace after interruption or completion of operation. Then, release gasses in the pressure regulator and loosen the pressure control handle.
Prevention of fire/explosion	<ul style="list-style-type: none"> : Do not place a cylinder where it may become part of an electrical circuit. In particular, do not cause damage by generating arc strike when welding arc. : If the cylinder valve gets frozen, warm with hot water of 40°C or lower. Do not directly heat with burner or the like.
Other precautions	<ul style="list-style-type: none"> : Check the name of gas by stamp on the cylinder, paint color (green for carbon dioxide), or labeling before use. If the content is different from what you need, return to the distributor instead of using it. : Check whether there is siphon tube or not depending on the type of use. Use the product without siphon tube (individual cylinder) if used in gas form. : Take measures to prevent the cylinders from falling down and tumbling. Do not handle them roughly. If a cylinder tumbles and gets damages with valve, it may be hazardous because the cylinder is shot off like a rocket due to splash of high-pressure gas.

- : Take off the removable protective cap before use. Ensure to attach when not using the cylinder.
- : Always use the pressure regulator and do not directly use from the cylinder when using as low pressure gas.
- : For attachment of the pressure regulator, use appropriate one for the screw after checking screw direction of the cylinder valve.
- : After attaching the pressure regulator in a proper manner, move the handle counterclockwise to loosen before opening the cylinder valve, and then open it slowly. During this operation, stand at the side of the pressure regulator and do not stand at the front side and back side of it.
- : Use prescribed handle to open/close the cylinder valve and open/close it slowly.
- : Do not hit by a hammer or the like on opening/closing the cylinder valve. If the cylinder valve cannot be opened/closed with hands, return to the distributor with display describing the condition.
- : Do not fill the gas into the cylinder except authorized personnel for filling.
- : Conduct repair of the cylinder, repainting, removing and exchanging of the cylinder valve or the safety device only at the inspection site.
- : Do not revise, diminish, and remove the stamp and the label of the cylinder.
- : The pressure of the cylinder after using must be retained 0.1 MPa or more. After using, ensure to close the cylinder valve and place the protective cap, and then immediately return the cylinder to the residual gas cylinder storage.
- : If the temperature of carbon dioxide in the cylinder gets higher, inner pressure of the cylinder rises, safety valve of rupture disk is activated, and then carbon dioxide blows out.
- : Operating temperature/pressure for safety valve of rupture disk
Two types of safety valve of carbon dioxide cylinder are available (except for medical use).
 - 1) Conventional type
 - Operating lower limit : 13.33 MPa (conversion temperature: 40.5 °C)
 - Operating upper limit : 15.68 MPa (conversion temperature: 46.2 °C)
 - 2) Revision standard type on December 1, 2007 (KHKS 0127 (2007) "Criteria Regarding Safety Valve for Cylinder of Liquefied Carbon Dioxide")
 - Operating lower limit : 16.66 MPa (conversion temperature: 48.6 °C)
 - Operating upper limit : 19.60 MPa (conversion temperature: 55.8 °C)

Safety valve under the new criteria is high pressure resistant type established in November 2007 and it has stamps on the cylinder valve and the tightening nut, and print on the rupture disk.

If the safety valve is activated and carbon dioxide is discharged into a room, open the door and window to prevent gas from being stayed in the room.
- : When loading and unloading of liquid gas container (hereinafter referred to as LGC), use truck with lifting apparatus, crane, or lift and pay special attention not to give shock to the LGC.
- : Always handle the LGC in standing state. Take measures to prevent the LGC from falling down and tumbling. Do not handle it roughly. Pushing the LGC down may cause damage to the inner tank leading to intrusion of carbon dioxide into the space between the inner tank and the outer tank, and then carbon dioxide may be evaporated rapidly and its pressure may destroy the outer tank.
- : For return and acceptance of the cylinder, previously appoint the personnel to manage cylinders, including to keep the return/acceptance record.
- : Immediately return the cylinders, whose expiration date specified under the contract passes, and the cylinders used to the distributor.
- : Handle the cylinders according to the High Pressure Gas Safety Law.

Local exhaust ventilation and total ventilation	: Carbon dioxide is heavier than the air and tends to retain in lower area. For handling of carbon dioxide, do not handle it in an enclosed area or poorly ventilated place because of the hazard that the oxygen concentration in the air may be lower.
	: Mount a releasing opening for the safety valve of the facility where carbon dioxide is used to a safe place in order to prevent carbon dioxide from being retained.
	: Operation inside the tank where carbon dioxide is used must be conducted with prohibition of spillage of carbon dioxide and adequate ventilation according to the Industrial Safety and Health Law.
Safe handling precautions	: It is dangerous because damages of the cylinder valve cause rapidly gas splash. Always attach a protection cap to the cylinder valve during transportation.
	: In case of releasing gas in order to remove dust attached to the inside of the gas outlet part of the cylinder valve, turn the gas outlet part to the direction where there is no person and conduct releasing by opening the gas outlet valve slightly for a short period.
	: Do not contact with gas blowing at high pressure because being blown by high pressure gas directly on the human body may cause damage, frostbite, oxygen deficiency, and poisoning. Pay attention not to spray on the human body.
	As well as low-pressure gas, care must be taken because spraying low-pressure gas on the human body and inhalation of gas may cause damage, oxygen deficiency, and poisoning.
	: Do not use the cylinders in ways other than what they are intended, e.g., using them as rollers.
	: Do not use carbon dioxide instead of compressed air or normal air.
Avoidance of contact	: If there is the possibility that gasses except carbon dioxide enter into the cylinders, notify the distributor of the details, such as cylinder symbol and number.
Hygiene measures	: Wash hands thoroughly after handling.
Storage	
Conditions for safe storage	
Appropriate technical measures	: Cylinders must be stored separated as filling cylinders and residual gas cylinders.
	: Fix the cylinders with a chain or railing in order to avoid shock by falling down and tumbling.
	: Always put protection caps on the cylinder valve except when gas is used.
Appropriate storage place and storage place to be avoided	: Exposure to direct sunlight must be avoided and the temperature must be always maintained at 40°C or lower.
	: Do not place anything which causes trouble around the reservoir in case of disaster.
	: Avoid exposure to corrosive atmosphere and continuous vibration.
	: Place in a well-drained, well-ventilated, and dry place.
Precautions	: Avoid sparks to keep away from flame and spark.
	: Do not store near electrical wiring and ground cables.
Safe packaging materials	: Use cylinders manufactured for high pressure gasses.

8. EXPOSURE PREVENTION AND PROTECTIVE MEASURES

Permissible concentration	: Japan Society for Occupational Health (2019)	: 5,000 ppm
	: NIOSH (The National Institute for Occupational Safety and Health)	IDLH : 40,000 ppm (escapable limit permissible concentration)
		IDLH (Immediately Dangerous to Life and Health); the value presented by NIOSH and OSHA as escapable limit concentration that does not cause unescapable states in thirty minutes or irreversible health problems mainly based on data of human. Use full respiratory protection if the value exceeds this concentration.
Measuring method	: Suction type detector tube, non-dispersive infrared analyzer	
Facility measures	: Install ventilating fans in indoor workplace and provide structure to prevent retention of carbon dioxide.	

- : Avoid the oxygen concentration in the air from being less than 18 vol%.
- : Measurement of oxygen/carbon dioxide concentration and safety check must be conducted in case of getting into the large facilities for internal inspection.

Protective equipment

- Respiratory protection** : Respirator, oxygen respirator, air-supplied respirator
- Hand protection** : Cold resistant gloves
- Eye and face protection** : Face shield, Protective glasses
- Skin and body protection** : Protective clothes

9. PHYSICAL AND CHEMICAL PROPERTIES

- Physical state** : Gas(0°C, 0.1013MPa)
Liquid(-20°C, 1.967MPa)
Solid(-80°C)
- Color** : colorless
- Odor** : Odorless, weak acid taste and irritating odor by interaction with moisture.
- Melting point** : -56.6 °C (triple point 0.518 MPa abs)
- /freezing point**
- Boiling point or initial boiling point and boiling range** : -78.5 °C (sublimating point)
- Flammability** : non-inflammability
- lower and upper explosion limit/flammability limit** : None (no flammability)
- Flash point** : None
- Natural ignition point** : No information
- Decomposition temperature** : About 2% are decomposed into carbon monoxide at 2,000°C
- pH** : 3.7 (25°C, 0.1013 MPa, saturated water) *HSDB (2008)
4.5 (normal temperature, 0.103 MPa, saturated water) *national regulatory documents of food additives, pharmacopoeia carbon dioxide
- Kinematic viscosity** : Not applicable
- Solubility** : 1.713 L CO₂/L Water (0°C, 0.1013 MPa)
1.194 L CO₂/L Water (10°C, 0.1013 MPa)
0.878 L CO₂/L Water (20°C, 0.1013 MPa)
- n-Octanol / water partition coefficient** : log Pow 0.83
- Vapor pressure** : 1.967 MPa abs (-20°C)
3.485 MPa abs (0°C)
5.733 MPa abs (20°C)
- Density and/or relative density** : Vapor density :1.977 kg/m³ (0°C, 0.1013 MPa)
Liquid density : 1.030 kg/L (-20°C, 1.967 MPa abs)
Solid density :1.566 kg/L (-80°C)
- Relative vapor density** : 1.53(0°C, 101.3kPa, Air=1)
- Particle properties** : Not applicable
- Other data**
- Critical temperature** : 31.06°C
- Critical pressure** : 7.3825 MPa abs

10. STABILITY AND REACTIVITY

- Reactivity** : Not reactive under the ordinary conditions.
- Chemical stability** : Inert gas and stable.
- Possibility of hazardous reactions** : None
- Conditions to avoid** : Corrode steels with acidity by coexisting with water.
Furthermore, corrosion progresses by coexisting with oxygen and under high pressure.
- Mixed hazardous substances** : None
- Hazardous decomposition products** : No decomposition under the normal (use, storage) conditions.

11. INFORMATION ON HARMS

Acute toxicity	: Causes the following effects to the human body depending on the concentration of atmospheric carbon dioxide. Carbon dioxide concentration
	0.04% ; Normal air
	0.5% ; Long term stability limit
	1.5% ; Can withstand for a long time without adverse effect on the workability and basic physiological function, but may induce effects on calcium and phosphorous metabolism.
	2.0% ; Deep breathing, with 30% increase in the amount of one respiration.
	3.0% ; Decrease in workability: changes in physiological function appear as changes in body weight, blood pressure, and heart rate
	4.0% ; Further deep breathing. Increased respiratory rates and slight suffocation. Considerable degree of discomfort.
	5.0% ; Breathing extremely difficult with severe gasping. Most people are in an almost unbearable situation, sometime feeling nauseous. Poisoning symptoms after 30 minutes of exposure.
	7 ~ 9% ; Tolerable limit: severe gasping, fall unconscious in about 15 minutes.
	10 ~ 11% ; Adjustability disabled: fall unconscious in about 10 minutes.
	15 ~ 20% ; Further severer symptoms, but not fatal in one hour.
	25 ~ 30% ; Decreased respiratory rate and blood pressure, comatose, loss of reflex action, and paralysis, leading to death in several hours.
Skin corrosion /irritation	: Non information
Serious eye damage /eye irritation	: Non information
Respiratory or skin sensitization	: Non information
Germ cell mutagenicity	: Non information
Carcinogenicity	: Non information
Reproductive toxicity	: Non information
Specific target organ toxicity (single exposure)	: Category 3 (narcotic effect)
Specific target organ toxicity (repeated exposure)	: Non information
Aspiration hazardousness	: Non information
Other information	: It also acts as a simple asphyxiating when I substitute it with air. Oxygen concentration
	18% ; Oxygen concentration security limit. Early stage of oxygen deficiency
	16~12% ; Increased pulse and respiratory rate, mind concentration needs an effort. Careful work is difficult. The symptoms such as headaches appear.
	10~6% ; Unconsciousness, central nervous system disorder, go into convulsions. It becomes the coma, and breathing stops, and, 6-8 minutes later, heart stops.
	6% or less ; Extreme hypoxic concentration. Loss of consciousness in an instant one breathing

12. INFORMATION ON ENVIRONMENTAL EFFECTS

Eco toxicity	: No information
Persistence and degradability	: No information
Bioaccumulation	: No information
Mobility in soil	: No information
Other adverse effects	: Carbon dioxide is one of major components in the air and an indispensable gas for animals and plants. At the same time, however, it is regarded as one of major materials causing global warming, thus various measures for reducing it are currently being examined both at home and abroad.

13. PRECAUTIONS FOR DISPOSAL CONSIDERATIONS

- : Ensure to close the cylinder valve and place the cylinder separately from the filling cylinders by attaching the notice that it is a used cylinder.
- : Return the used cylinders as they are to the manufacturer or the distributor.
- : Do not release residual gas in the cylinder without reason. Close the cylinder valve with pressure remained and return to the manufacturer or the distributor.
- : In case of disposing of carbon dioxide, discharge in small portions in the atmosphere with attention to ventilation.
- : Users are prohibited to dispose of the cylinders without permission.
When the owners dispose of, remove the cylinder valve and cut off the cylinder to make it scrapped.

14. PRECAUTIONS FOR TRANSPORTATION

International regulations

UN number	: 1013 (compression)
Product name (UN transportation name)	: Carbon dioxide gas
UN classification	: Class 2.2 (non-flammable, non-toxic high pressure gas)
Packing group	: Not applicable
Marine pollutant	: Not applicable
Liquid substance transported in bulk according to MARPOL73/78 II	: Not applicable

Japan regulations

High Pressure Gas Safety Law	: Article 2 of the law (liquefied gas)
Sea transportation Port Regulations Law	: Article 12 of the Enforcement Regulations Dangerous Goods (high pressure gas)
Ship Safety Law	: Appended Table 1 of the Public Notice of Dangerous Goods in Article 3 of the Regulations (high pressure gas)

Air transportation

Aviation Law	: Article 194 of the Enforcement Regulations
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Land transport

Road Traffic Law	: 13 of Article 19 of the Enforcement Order (restriction of traffic of a vehicle)
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Special safety measures regarding transport or transportation means	: Execute safe transportation according to the regulations under the High-pressure Gas Safety Law.
	: The temperature of the cylinders must be maintained at 40°C or lower during transportation. Cover with a sheet to prevent temperature rise especially during summertime.
	: Handle cautiously to prevent shock to the cylinders.
	: Take necessary measures to avoid tumbling of cylinders and damage to the valve during transportation.
	: In case of transportation on a vehicle, the yellow card, fire-extinguishing equipment, and material tools required for first aid measure must be carried.
	: Display a warning sign with a statement "high-pressure gas" at a visible location on the vehicle.
	: The pressure of the LGCs during transportation must be maintained under the normal operation pressure of the LGCs. Especially for long-term transportation or passing through a bad

road, park at a safe place on the way to check the state of pressure rise and the looseness of the valves as needed.

- : In principle, do not transport the LGCs filled with gas using manpower.
- : In case of transportation by vehicle on a public road and in a workplace, ensure that the LGCs do not extend out from the vehicle body lock the cylinders to avoid falling, and certainly fix with ropes or the like. Do not make sudden turns on corners.
- : When unloading the LGCs from the transport vehicle, gently unload on a buffer plate or the like.
- : When transporting the LGCs while lifting, do not directly put sling ropes round the valve of the cylinder and the pipe. Do not lift with magnet crane.

Number of Emergency Measures Guideline

: 120

15. APPLICABLE LAWS AND ORDINANCES IN JAPAN

Law on the Promotion of control of Discharge of Chemical Substances	: Not applicable
Labor Standards Law	: Restrictions on dangerous and injurious work (work related to production and use of compressed gas or liquefied gas), as well as restrictions on dangerous work by juveniles younger than 18 years old.
Industrial Safety and Health Law	: Ordinance on Prevention of Hypoxia, Ordinance on Health Standards in the Office Industrial safety and Health Regulation, 14 and 15 in Article 24 Indication of Hazards or Harms on Hazardous Chemical Substances
Poisonous and Deleterious Substances Control Law	: Not applicable
High Pressure Gas Safety Law	: Article 2 of the law (liquefied gas) Security Regulation for General High-Pressure Gas, Security Regulation for Cylinders
Port Regulations Law	: Article 12 of the Enforcement Regulations Dangerous Goods (high pressure gas)
Ship Safety Law	: Appended Table 1 of the Public Notice of Dangerous Goods in Article 3 of the Regulations (high pressure gas)
Aviation Law	: Article 194 of the Enforcement Regulations; Appended Table 1 of the Public Notice (high pressure gas)
Road Traffic Law	: 13 of Article 19 of the Enforcement Order (restriction of traffic of a vehicle)
Fire Service Law	: Distance in accordance with facilities for high pressure gas
Food Sanitation Law	: Food additives
Pharmaceuticals and Medical devices Law	: Pharmacopoeia Carbon Dioxide
Agricultural Chemical Regulation Law	: Fumigant
Law on Promotion of Global Warming Countermeasure	: Greenhouse effect gas

16. OTHER INFORMATION

Scope of application : This safety data sheet is applied only to liquefied carbon dioxide. Refer to other materials for liquefied carbon dioxide for medical use.

References

- 1) Japan Society For Occupational Health "Recommendations for Acceptable Concentrations" (2019)
- 2) Text for Handling of Liquefied Carbon Dioxide (edited by the Japan Industrial and Medical Gases Association: revised edition in June, 2015)
- 3) Quinn E.L and Jones C.L: CARBON DIOXIDE, Reinhold Publishing Corporation, 1936, USA(1936)

- 4) Recent electrostatic engineering: Senichi Masuda "Carbon dioxide" issued by The Pressure Gas Safety Institute of Japan
- 5) The Chemical Society of Japan Environment and safety promotion committee (disaster prevention guidance No. 120)
- 6) Edited by The Chemical Society of Japan: "Chemical Handbook" (third edition to fifth edition), Maruzen
- 7) The Japan Society of Mechanical Engineers: "Thermophysical Properties of Fluids" (August, 1983)
- 8) JIS Z 7252 : 2019 Classification of chemicals based on "Globally Harmonized System of Classification and Labelling of Chemicals(GHS)"
- 9) JIS Z 7253 : 2019 Hazard communication of chemicals based on GHS - Labelling and Safety Data Sheet(SDS)

Note:

- The values described in this safety data sheet, such as contents and physical and chemical properties are not guaranteed values.
- The precautions are premised on ordinary handling and it is the user's responsibility to take enough considerations in case of particular use.
- Hazard statement is not necessarily sufficient. Handle the product after confirming the materials and information except this safety data sheet.

Safety Data Sheet making department

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