

- 2.3.1– Prevention: Keep away from heat, sparks, open flames and hot surfaces. No Smoking.
Use only outdoors or in a well-ventilated area.
Avoid breathing gas/spray.
- 2.3.2– Response: Leaking gas fire: Do not extinguish, unless leak can be stopped safely.
Eliminate all ignition sources if safe to do so.
Get medical advice/attention if you feel unwell.
If inhaled, remove the victim to fresh air and keep at rest in a position comfortable for breathing.
- 2.3.3 – Storage: Protect from sunlight.
Store in a well-ventilated place. Keep containers tightly closed.
Store in a location that is inaccessible to outsiders.
- 2.4. Precautionary Statements – Disposal:
Return used containers to the distributor as soon as possible.
- 2.5. National / Regional Information:
High-pressure gas as defined in Article 2 of the High Pressure Gas Safety Act and is a flammable gas.
Liquefied petroleum gas as defined in Article 2 of the Act on the Securing of Safety and the Optimization of Transactions of Liquefied Petroleum Gas and is a flammable gas.
Flammable gas as defined in item 5 of Appended Table 1 of the Order for Enforcement of Industrial Safety and Health Act.

3. Composition/Information on Ingredients

Classification of Chemical Substances and Mixtures: Mixture

Chemical name	Concentration or concentration range (Weight %)	MITI No.	CAS No.
Propane	0% to less than 10%	(2)-3	74-98-6
<i>n</i> -Butane Isobutane	90% to less than 100%	(2)-4	106-97-8 75-28-5
<i>n</i> -Pentane Isopentane	Less than 2.5% (Note 1)	(2)-5	109-66-0 78-78-4
1(α)-Butylene <i>cis</i> -2(β)-Butylene <i>trans</i> -2(β)-Butylene Isobutylene (γ -butylene)	Less than 1.9% (Note 1)	(2)-16	106-98-9 590-18-1 624-64-6 115-11-7

(Note 1) Concentration in Butane

4. First Aid Measures

- Inhalation: In case of massive inhalation, measures for oxygen deprivation should be taken.
If necessary, seek medical attention.
- Skin Contact: Treat for frostbite.

Eye Contact:	Rinse thoroughly with clean water.
Ingestion:	Same as in case of inhalation or skin contact.
Most Important Symptoms and Effects, both Acute and Delayed:	<p>Frostbite occurs when liquid gas adheres to the skin.</p> <p>Inhalation of high concentrations of gas causes loss of consciousness in a single breath. If this condition persists, it can be fatal.</p>
Protection of First-aiders:	<p>In areas where the product is leaking or gushing, wear protective equipment to prevent skin contact.</p> <p>Ventilate the area well where the product is leaking or gushing, as the oxygen concentration in the air may be low.</p> <p>Ventilate the area well when the concentration of leaked gas is about 1.8 to 9.5% of the air, because there is a risk of explosion in the presence of an ignition source.</p> <p>In the outdoors, use spray nozzles or other means to sprinkle water and prevent explosions.</p>
Special Precautions for Physicians:	No information available.

5. Firefighting Measures

Suitable Extinguishing Media: Carbon dioxide, ABC or BC type powder extinguisher is recommended in case of small fires.
Sprinkling and spraying water is recommended in case of large fires.

Unsuitable Extinguishing Media:

Straight Stream

Specific Hazards Arising from the Chemical:

Highly flammable/highly combustible gas
The product may ignite easily.
Heating may cause the container to explode.

Specific Extinguishing Methods :

Cut off the gas supply. Cool the surrounding area by spraying water with nozzles or other means to prevent the spread of fire.
Spray water from upwind to cool the container while extinguishing the surrounding fire.
In case of a perimeter fire, move the container to a safe location.
Leaked gas should be diffused by water spray or other means to prevent explosion.
If gas leakage can be prevented, extinguish with fire extinguishing agent.
If gas leakage cannot be prevented, do not extinguish the fire and allow fire to burn.
Evacuate all unrelated persons to a safe place.

Protective Equipment and Precautions for Firefighters:

Use air respirators and protective clothing when extinguishing fires.

6. Accidental Release Measures

Personal Precautions, Protective Equipment, and Emergency Procedures:

The product will explode if there is an ignition source within the concentration range of about 1.8% to 9.5% in the air, so stay away from it if safety cannot be confirmed.

Ventilate well to prevent asphyxiation hazards because the volume increases about 250 times, while the oxygen concentration in the air is reduced when vaporized.

When liquefied gas comes in direct contact with the body, the heat of vaporization causes frostbite. Wear dry leather gloves if necessary.

Wear antistatic clothing and shoes, leather gloves. Use air respirators and protective clothing as necessary.

Environmental Precautions: No information available.

Methods and Material for Containment and Cleaning Up:

Stop the leakage if it is not dangerous to do so.

If possible, rotate the leaking vessel so that gas, not liquid, is released to the air.

Sprinkle water to reduce evaporation and prevent vapor diffusion.

Ground all equipment when handling spills.

Measures to Prevent Secondary Accidents:

Remove ignition sources in the vicinity. Cut off gas supply.

Since the product is heavier than air in specific gravity, there is a risk of accumulation. Measures such as ventilation and diffusion should be taken.

7. Handling and Storage

7.1. Handling:

Technical Measures: Take measures to prevent containers from tipping over or falling.

Do not handle them roughly.

Always use a pressure regulator, not directly from the container, except in special cases of use.

Use soapy water or other foaming solution to check for leaks at joints, hoses, piping, and equipment.

Local Exhaust and General Ventilation:

Adequate air supply and exhaust shall be provided to prevent incomplete combustion.

Precautions for Safe Handling:

Take measures when using the product in areas where there is a risk of accumulation.

The product mixes with air or oxygen easily to form an explosive gas mixture.

Be very careful about leaks because of high hazard due to its low lower explosive limit (i.e. approximately 1.8% to 9.5%).

Since the product is highly flammable, any use of fire in the vicinity is strictly prohibited.

Containers with removable protective caps should be kept closed when not in use.

Do not use up the gas in the container to the end in order to preserve residual pressure.

Contact Avoidance: See "10. Stability and reactivity".

7.2. Storage

Conditions for Safe Storage: Containers should be placed in a dry area with good drainage and ventilation.

Keep containers out of direct sunlight and at temperatures 40°C (104°F) or lower.

Store in a location that is inaccessible to outsiders.

Post warning signs clearly indicating "flammable gas" or "LP Gas" when storing containers in a container yard.

Containers filled with toxic gases and oxygen should be kept in separate.

Container storage area is provided.

No fire or flammable or combustible materials shall be placed within a radius of 2-meters around the container storage area when a container storage area is provided, except when necessary barriers are provided.

Promptly return used containers to the distributor.

Safe Container Material: The container shall be a liquefied petroleum gas container as defined in the High Pressure Gas Safety Act.

8. Exposure Controls/Personal Protection

8.1. Exposure Guidelines:

Japan Society for Occupational Health:

(2024) *n*-Butane 500 ppm (Note 1)

Isobutane 500 ppm (Note 1)

n-Pentane 300 ppm (Note 1)

8.2. Appropriate Engineering Controls

Engineering Measures: Ensure to ventilate well when used indoors.

In areas where liquefied petroleum gas is likely to leak and accumulate, install gas leak alarms that will sound an alarm when the gas concentration in the air is less than about 0.5% (about 1/4 of the lower explosive limit).

8.3. Individual Protection Measures:

Respiratory Protection: Use an air respirator as necessary.

Hand Protection: Wear dry leather gloves as necessary.

Eye Protection: Wear protective eyewear as necessary.

Skin and Body Protection: Wear work clothes and helmets appropriate for the type of use.

9. Physical and Chemical Properties

Physical State: Gaseous under atmospheric pressure. In the pressure vessel, liquid.

Color: Colorless, transparent

Odor: Odorless.

Melting point: See the attached table.

Boiling point: See the attached table.

Flammability: Flammable gas

Lower and upper explosive (flammable) limits: See the attached table.

Flash point: See the attached table.

Auto ignition temperature: See the attached table.

Decomposition temperature: not available

pH: Not applicable (gaseous at atmospheric pressure)

Decomposition Temperature: No data available.

pH: Not applicable (gaseous at atmospheric pressure)

Kinematic Viscosity:	Not applicable (gaseous at atmospheric pressure)
Vapor pressure:	See the attached table.
Density:	See the attached table.
Relative density (gas):	See the attached table.
Particle Properties:	Not Applicable (gaseous at atmospheric pressure)

10. Stability and Reactivity

Reactivity and Chemical Stability:

Stable under normal conditions

Possibility of Hazardous Reactions:

Reacts violently with oxidizing substances

Propane: Explodes violently with chlorine dioxide

Butane: Nickel carbonyl + oxygen gas mixture causes explosion

Conditions to Avoid: Avoid all possible sources of ignition (spark or flame). Do not expose the container to heat.

Materials to Avoid: It is soluble in alcohol and ether and dissolves well in petroleum, animal and vegetable oils, and natural rubber.

Incompatible Materials: Strong oxidizing agents

Hazardous Decomposition Products:

Incomplete combustion in the form of harmful carbon monoxide occurs, if sufficient air is not supplied during combustion.

11. Toxicological Information

Acute Toxicity (Inhalation: Gas):

"Not Applicable".

Skin Corrosion/Irritation: "Not Applicable".

Serious Eye Damage/Eye irritation:

"Not Applicable".

Respiratory or Skin Sensitization:

"Not Applicable".

Germ-Cell Mutagenicity: "Not Applicable".

Carcinogenicity: "Not Applicable".

Reproductive Toxicity: "Not Applicable".

Specific Target Organ Toxicity (Single Exposure):

Isobutane falls under "Category 1 (circulatory system)" and the concentration of all components are calculated to be "Category 1".

Apart from 1-butylene, *cis*-2-butylene, *trans*-2-butylene, and isobutylene which are "Not Classifiable", propane, *n*-butane, isobutane, *n*-pentane, isopentane, ethane and ethylene fall under "Category 3 (narcotic effect)". When the concentration of all components is calculated, the product is classified as "Category 3 (narcotic effect)".

n-Pentane and isopentane fall under "Category 3 (irritating to the respiratory tract)", but when

the concentrations of all components are calculated, the product is classified as "Not Classified".

[Source data]

Excerpt from Workplace Safety Site Model SDS (based on JIS Z7253:2019)

2-Methylpropane (Isobutane)

- (1) In three of the four deaths from inhalation of butane gas (unknown quantity), *n*-butane, isobutane (this substance), or a mixture of *n*-butane, this substance, and propane were detected in the blood, brain, and lungs, with total hydrocarbon concentrations being greatest in the brain in all cases. The authors reported that, together with one other case of *n*-butane poisoning, the suspected cause of death in five cases was cardiac rhythm disturbances (DFGOT vol. 20 (2003)).
- (2) A 16-year-old boy suffered heart failure after inhaling butane gas. Abnormalities were observed on the electrocardiogram, but the mechanism of induction of heart failure was unknown. The authors reported that in addition to central inhibition, oxygen deprivation, ventricular flutter triggering cardiac arrest, or direct induction of cardiac arrest by butane were involved (DFGOT vol. 20 (2003)).
- (3) A 2-year-old girl developed ventricular tachycardia, tonic seizures, and hypokalemia after exposure to this substance and deodorants containing butane and propane. Tachycardia is thought to be caused by deodorant exposure and endogenous epinephrine (Patty (6th, 2012)).
- (4) After inhalation exposure of dogs (unanesthetized) to 50,000 ppm of this substance (4-hour equivalent: 7,906 ppm) for 6 minutes, epinephrine-induced arrhythmia due to cardiac sensitization occurred. In addition, there have been several reports of cardiac sensitizing responses to brief inhalation of this substance in experiments under anesthesia in mice and dogs pretreated with epinephrine (DFGOT vol. 20 (2003)).
- (5) The EC₅₀ for central inhibition in rats and the EC₅₀ for anesthetic effects in dogs due to inhalation exposure to this substance has been reported to be 200,000 ppm and 450,000 ppm, respectively (ACGIH (7th, 2017), DFGOT vol. 20 (2003)).
- (6) Based on the solubility of *n*-butane and this substance in olive oil and the partition coefficient between air and olive oil, the estimated concentrations for the onset of anesthetic effects in humans are 17,000 ppm for *n*-butane and 24,000 ppm for this substance (DFGOT vol. 20 (2003)).

Specific Target Organ Toxicity (Repeated Exposure):

n-Butane falls under "Category 1 (central nervous system)" and the concentration of all components is calculated to be "Category 1".

[Source data]

Excerpt from Workplace Safety Site Model SDS (based on JIS Z7253:2019)

n-butane

- (1) A 15-year-old girl who abused butane gas in a lighter replacement can for 4 weeks suffered serious brain damage and neurological complications

after hospitalization and treatment. MRI results showed disintegration of gray matter and atrophy of the brain (PATTY (6th, 2012)).

- (2) There are multiple reports of hallucinations, auditory hallucinations, and other neurological symptoms developing in young men and women who abused butane gas (PATTY (6th, 2012)).
- (3) Euphoria and hallucinations were observed in most of the 12 persons who repeatedly inhaled butane gas (DFGOT vol. 20 (2003)).

Aspiration Hazard: *n*-Pentane and isopentane fall under "Category 1".
However, the aspiration hazard regulates the hazards of accidental ingestion and does not cover gaseous gases, including liquefied petroleum gas.

12. Ecological Information

Hazardous to the Aquatic Environment, Short-Term (Acute):

"Not Applicable" in consideration of the concentration of all components, although *n*-pentane and isopentane falls under "Category 2".

Hazardous to the Aquatic Environment, Long-Term (Chronic):

"Not Applicable" in consideration of the concentration of all components, although isopentane falls under "Category2".

Hazardous to the Ozone Layer:

"Not applicable" because the product does not contain any controlled substances listed in Annexes A through E of the Montreal Protocol.

Ecotoxicity: No information available.

Persistence and Degradability: No information available.

Bioaccumulation: No information available.

Mobility in Soil: No information available.

13. Disposal Considerations

Information on the safe and environmentally preferred disposal method of chemicals, contaminated containers and packaging, or recycling: Return empty or unwanted containers to the supplier. Disposal will be entrusted to a waste disposal contractor licensed by the prefectural governor.

14. Transport Information

UN Number: UN1075

Proper Shipping Name: Petroleum Gases, Liquefied

Transport Hazard Class(es): 2.1

Packing group: —

Marine Pollutant: Not applicable

Maritime Regulation Information:

In accordance with IMO (International Maritime Organization) regulations.

Aviation Regulation Information:

In accordance with ICAO (International Civil Aviation Organization) / IATA (International Air Transport Association) regulations.

Specific safety measures and conditions for transport or means of transport:

A container should be secured and keep temperature below 40°C.

When transporting gas on a vehicle, a "High-Pressure Gas" warning sign must be displayed in a conspicuous place on the vehicle, and a fire extinguisher, disaster prevention tools, and a yellow card listing emergency contact information and response procedures must be carried. However, this does not apply to vehicles carrying only filled containers with an internal volume of 25L or less, and the total internal volume of the containers is 50L or less.

Information on Domestic Regulations:

Land Regulation Information: In accordance with the provisions of the High Pressure Gas Safety Act.

Maritime Regulation Information:

In accordance with the provisions of the Ship Safety Act.

Aviation Regulation Information:

In accordance with the provisions of the Civil Aeronautics Act.

15. Regulatory Information

Laws	Applicable Matters
Air Pollution Control Act	Volatile Organic Compounds Act, Article 2, Paragraph 4 (Notification from the Ministry of the Environment to prefectures): Volatile organic compounds
Act on the Assessment of Releases of Specified Chemical Substances in the Environment and the Promotion of Management Improvement	Not applicable
Industrial Safety and Health Act	Dangerous substances and hazardous substances for which the name, etc., must be labeled (Article 57 of the Act)
	Dangerous substances and hazardous substances for which the name, etc., must be notified (Article 57-2 of the Act)
	Substances whose potential for danger or harm, etc. must be assessed (Article 57-3 of the Act)
	Hazardous materials and flammable gases (Appended Table 1 No. 5 of the Order for Enforcement)
Poisonous and Deleterious Substances Control Act	Not applicable
High Pressure Gas Safety Act	High-pressure Gas (Article 2, Item 3 of the Act)
	Flammable Gas (General High Pressure Gas Safety Regulations, Article 2, Item 1)
	Container storage and filling containers, etc. (Liquefied Petroleum Gas Safety Regulations, Article 6, Paragraph 2, Item 7)

	Security Measures and Technical Standards Pertaining to Movement (Liquefied Petroleum Gas Safety Regulations, Articles 47, 48 and 49)
Act on the Securing of Safety and the Optimization of Transaction of Liquefied Petroleum Gas	Liquefied Petroleum Gas (Article 2 of the Act)
Ship Safety Act	Gases under pressure (Article 2 and Article 3 of the Regulations on the Carriage and Storage of Hazardous Materials by Ships, and Appendix 1 of the Hazardous Materials Notification)
Civil Aeronautics Act	Gases under pressure (Ordinance for Enforcement of the Civil Aeronautics Act, Article 194, Hazardous Materials Notification, Appendix 1)
Port Regulations Act	Gases under pressure (Ordinance for Enforcement of the act Article 12)

16. Other Information

References:

1. Training Textbook on MSDS Preparation Methods for Mixtures (Chemical Substances) in Compliance with GHS (Revised Edition), Japan Industrial Safety and Health Association
 2. Japan Industrial Safety and Health Association, Japan Advanced Information Center of Safety and Health, <http://www.jaish.gr.jp/>
 3. GHS Classification Manual, Version "Feb. 10, 2006 ed.", Liaison Conference of Ministries and Agencies concerned with GHS
 4. International Chemical Safety Card (ICSC) Japanese version, National Institute of Health Sciences (NIHS)
 5. Workplace Safety Site, Ministry of Health, Labour and Welfare, Japan.
<http://anzeninfo.mhlw.go.jp/index.html>
* This SDS reflects GHS classification year: through FY 2019.
 6. Globally Harmonized System of Classification and Labelling of Chemicals (GHS), Revision 6 (2015), United Nations (METI translation)
 7. JIS Z 7253: 2019 "Methods for communicating hazard information on chemicals based on the GHS - Labels, in-workplace markings and safety data sheets (SDS)", Japanese Standards Association
 8. JIS Z 7252: 2019 "Classification methods for chemical substances etc. based on the GHS", Japanese Standards Association
 9. GHS Preparation Guidelines for Labelling, display and SDS, Japan Chemical Industry Association, September 2023.
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(Appendix) Physical and chemical properties

Chemical name	Propane	<i>n</i> -Butane	Isobutane	<i>n</i> -Pentane	Isopentane	1(α)-Butylene	<i>cis</i> -2(β)-butylene	<i>trans</i> -2(β)-butylene	Isobutylene (γ -Butylene)
Melting point/Freezing point	-189.7°C (melting point)	-138°C	-160°C	-129.67°C (melting point)	-159.9°C (melting point)	-185.3°C	-138.9°C	-105.5°C	-140.4°C
Boiling point, initial distillation point and boiling range	-42°C (boiling point)	-0.5°C	-12°C	36.06°C	27.8°C	-6.47°C	3.7°C	0.8°C	-6.9°C
Flash point	-104°C	-60°C (Sealed)	-82.99°C	< -40°C(cc)	< -51°C (Sealed)	-80°C	-72°C	-73°C	< -10°C
Combustion range (Explosion range)	Lower limit 2.1 vol% Upper limit 9.5 vol%	Lower limit 1.8 vol% Upper limit 8.4 vol%	Lower limit 1.8 vol% Upper limit 8.4 vol%	Lower limit 1.4 vol% Upper limit 8.0 vol%	Lower limit 1.4 vol% Upper limit 7.6 vol%	Lower limit 1.6 vol% Upper limit 10.0 vol%.	Lower limit 1.7 vol% Upper limit 9.0 vol%	Lower limit 1.8 vol% Upper limit 9.7 vol%	Lower limit 1.8 vol% Upper limit 9.6 vol%
Vapour pressure	840 kPa (20°C)	213.7 kPa (21.1°C)	304 kPa (20°C)	53.3 kPa (18.5°C)	79 kPa (20°C)	265 kPa (20°C)	210.6 kPa	234.6 kPa	257 kPa (20°C)
Relative vapour density (air = 1)	1.6	2.1	2.01	2.5	2.5	1.93	1.9	1.9	1.94
Specific gravity of liquid (Density)	0.5853 (-45°C/4°C)	0.5788 (20°C/4°C)	0.6	0.62638 (20°C/4°C)	0.6	0.6255 (-6.47°C/4°C)	0.6	0.6	0.589 g/cm ³ (25°C, P > 1 atm)
Solubility	62.4 mg/L (25°C, water)	61 mg/L (20°C, water)	48.9 mg/L (Water)	360 mg/L (16°C, water)	48.0 mg/L (25°C, water)	500 mg/L (Water)	700 mg/L (25°C, water)	265 mg/L (25°C, water)	30 mg/100ml (20°C, water)
<i>n</i> -octanol/Water partition coefficient	log Pow = 2.35	log Pow = 2.89 (Measured value)	log Kow = 2.8	log Pow = 2.36	log Pow = 2.30 (Estimated value)	log Kow = 2.4	log Pow = 2.33	log Pow = 2.31	log Pow = 2.35
Auto-ignition temperature	450°C	287°C	460°C	260°C	420°C	385°C	324°C	324°C	465°C
Other Data (Molecular weight)	44.1 (ICSC)	58.1 (ICSC)	58.12	72.15	72.15	56.1	56.108	56.108	56.108
CAS No.	74-98-6	106-97-8	75-28-5	109-66-0	78-78-4	106-98-9	590-18-1	624-64-6	115-11-7

(Reference) CAS numbers also include the following classifications: LPG: 68476-85-7, mixture of butylene isomers: 25167-67-3, 2(β)-butylene: 107-01-7.

(Source: Workplace Safety Site, International Chemical Safety Card (ICSC))