

Product name	CAS No.	UN No.	EU No.
Isobutane	75-28-5	1969	200-857-2

1. Product and company identification

- a) Product name Isobutane
- b) Recommended use of the chemical and restrictions on use
- Recommended use of the chemical Solvent, refrigerant, petrochemical raw material, fuel, consumer use
 - Restrictions on use No Data Available
- c) Manufacturer / Supplier Information
- Name SK GAS
 - Address ECO Hub, SK Chemicals Complex, 332, Pangyo-ro, Bundang-gu, Seongnam-si, Gyeonggi-do, Korea
 - Emergency phone number 82-2-6200-8162

2. Hazards identification

- a) Hazard-Risk Classification
- Flammable gases : 1
 Gases under pressure : liquefied gas or Refrigerated liquefied gas
 Specific target organ toxicity (single exposure) : 3 (narcosis)
 Skin Corrosion / irritation : 2

b) Label elements including precautionary

- Symbol



- Signal word

Danger

- Hazard-risk statement

H220 Extremely flammable gas
 H280 Contains gas under pressure; may explode if heated
 H281 Contains refrigerated gas; may cause cryogenic burns or injury.
 H336 May cause drowsiness or dizziness

- Precautionary statement

Prevention

P210 Keep away from heat/sparks/open flames/hot surfaces. - No smoking
 P261 Avoid breathing dust/fumes/gas/mist/vapours/spray.
 P264 Wash handling area Thoroughly after handling
 P271 Use only outdoors or in a well-ventilated area.
 P280 Wear protective gloves/protective clothing/eye protection
 P282 Wear cold insulating gloves/face shield/eye protection.

Response

P302+P352 If on skin: wash with plenty of soap and water
 P304+P340 IF INHALED: Remove person to fresh air and keep comfortable for breathing.
 P312 Call a medical center(doctor) if you feel unwell.
 P315 Get immediate medical advice/attention.
 P321 Take a specific treatment
 P332+P313 If skin irritation occurs: Get medical advice/attention
 P336 Thaw frosted parts with lukewarm water. Do not rub affected areas.
 P362+P364 Take off contaminated clothing and wash it before reuse.
 P377 Leaking gas fire: Do not extinguish, unless leak can be stopped safely
 P381 Eliminate all ignition sources if safe to do so

Storage

P403 Store in a well-ventilated place
 P403+P233 Store in a well ventilated place. Keep container tightly closed.

Storage (Continued) P405 Store locked up.
P410+P403 Protect from sunlight. Store in a well-ventilated place.

Disposal P501 Dispose of contents or container in accordance with local/regional/national/international regulation.

c) Other Hazard Risk (NFPA)

- Propane
Health 1 (slightly hazardous)
Flammability 4 (flash points below 22.7 °C)
Reactivity 0 (stable)

- n-Butane
Health 1
Flammability 4
Reactivity 0

- iso-Butane
Health 1
Flammability 4
Reactivity 0
Reactivity 0

- iso-Pentane
Health 1
Flammability 4
Reactivity 0

3. composition / information in ingredients

Chemical name	Other name	CAS 번호	Content (mol%)
Propane	Propane	74-98-6	0 ~ 5 %
Butane	Butane mixture	68513-65-5	95 ~ 100 %
1,3-Butadiene	1,3-Butadiene	106-99-0	< 0.1%
Total			100 %

4. First aid measure

a) Eye contact Seek medical attention immediately.

b) Skin contact
If frostbite has occurred, seek medical attention immediately; Do NOT rub the affected areas
In order to prevent further tissue damage, do NOT attempt to remove frozen clothing and cool the frostbite part as long as possible with cold water.
Before to remove frozen clothing, thaw it
If frostbite has NOT occurred, immediately wash contaminated skin with soap and water
If skin trouble occurred, get medical attention and advice.

c) Inhalation Seek medical attention immediately.
Keep the affected person warm and at rest.
If a person breathes large amounts of this chemical, move the exposed person to
If breathing is difficult, give oxygen.
If breathing has stopped, perform mouth-to-mouth resuscitation.

d) Ingestion Seek medical attention immediately.

e) Notes for physician Keep a doctor to recognize chemical substance and take care of patients.

5. Fire-fighting measures

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| a) Suitable (and unsuitable) extinguishing | <p>CO₂, dry chemical, water spray or fog for surrounding area.</p> <p>Use dry sand or earth for the smothering extinguishment</p> |
| b) Specific hazards arising from the chemical | <p>Extreme flammable gas</p> <p>A leakage of material may present a fire / explosion risk.</p> <p>There is a risk of steam explosion in indoor, outdoor and sewer.</p> <p>It will ignite easily by heat, spark and flame.</p> <p>Vapors may ignite and explode.</p> <p>Shut off source of propane, if possible, dilute leakage of water.</p> <p>Easily ignited by heat, sparks and flames.</p> <p>Steam can move back to the ignition source and flash back</p> <p>Vapor may cause dizziness or asphyxiant without awareness</p> <p>Some constituents may be irritating when inhaled at high concentrations.</p> <p>Cylinders exposed to fire may release flammable gas.</p> <p>Note that some part can leave flammable residue after evaporation</p> |
| c) Special protective equipment and precautions for fire-fighters | <p>Keep away from contact with clothing and other combustible materials to avoid</p> <p>Avoid friction or rough handling because of fire hazard.</p> <p>Allow gas to burn if flow cannot be shut off.</p> <p>Eliminate sources of ignition.</p> <p>Evacuate area and fight fire from a safe distance</p> <p>Leaking gas fire : do not stop extinguish unless leak can be stopped safely.</p> <p>Move container from fire area if it is not dangerous.</p> <p>Be careful that broken cylinders may fly over.</p> <p>Isolate the hazard area and deny entry to unnecessary and unprotected personnel.</p> <p>Do not touch the exposure source or safety device directly, as it may freeze in the event of a tank fire.</p> <p>In case of a tank fire, use fire extinguisher at enough distance or use unmanned fire fighting equipment.</p> <p>After fire has extinguished, flush with plenty of water for a long time to cool</p> <p>In case of a tank fire, immediately leave the fire area if there is treble sound or discoloration of the tank.</p> <p>In case of a tank fire, get out of the area If the tank is in flames</p> <p>Evacuate in accordance of accident situation. (Evacuation radius : 0.8 km, The spread range varies depending on the location of the accident and the fire fighting way to be taken.)</p> |

6. Accidental release measures

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| a) Personal precautions, protective equipment and emergency procedures | <p>Use non-sparking equipment when cleaning up flammable spill.</p> <p>In closed spaces, wear a self-contained breathing apparatus and ventilate.</p> <p>Isolate the hazard area and deny entry to unnecessary and unprotected personnel.</p> <p>Avoid inhalation and skin contact, contaminated clothing should be changed.</p> <p>Contain spilled liquid with sand or earth. do NOT use combustible materials.</p> <p>Dust can be a fire or explosion hazard.</p> <p>Immediately wipe the spill, follow precautions for protective equipment.</p> <p>If possible, turn the leak valve of container to be released as gas rather than liquid.</p> <p>Ventilate the contaminated area.</p> <p>Do not touch the leak source directly.</p> <p>Using water spray to reduce the vapor or vapor clouds of gas and do not allow water to come into contact with spilled material.</p> <p>Always ground all equipment when handling material</p> |
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| b) Environmental precautions and protective procedures | <p>Keep out of drains, sewers, ditches and waterways.</p> <p>Use appropriate container to avoid environmental contamination.</p> <p>Cover with absorbent or contain, Collect and dispose.</p> |
| c) Methods and materials for containment | <p>If possible, release in vapor by turning over leaking container.</p> <p>Clean the contaminated zone using cleanser and water.</p> <p>Use water spray/fog for prevent spread.</p> |

7. Handling and storage

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| a) Precautions for safe handling | <p>To avoid sudden release of pressure, loosen closure cautiously before opening.</p> <p>Avoid inhalation, skin and eyes.</p> <p>Use only clean, dry utensils in handling.</p> <p>Minimize dust generation and accumulation.</p> <p>Do not smoke or use matches or lighters during use and until vapors are gone.</p> <p>To dissipate static electricity during transfer, ground drum and connect to receiving container with bonding strap.</p> <p>Avoid prolonged or repeated skin contact.</p> <p>Wash thoroughly after handling.</p> <p>Avoid breathing gas or vapor.</p> |
| b) Conditions for safe storage
(including any incompatibilities) | <p>Keep away from heat, spark and flame – No Smoking.</p> <p>Avoid direct sunlight and store in a well-ventilated place.</p> <p>The empty cylinder should be completely drained, properly blocked and immediately returned to the cylinder regulator. Place it properly.</p> <p>Stored containers should be periodically checked for general conditions and leakage.</p> <p>Keep container tightly closed.</p> <p>Store in a cool, well-ventilated area.</p> |

8. Exposure controls and personal protection

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| a) Control parameter and Biological Exposure Indices | |
| Domestic regulation | |
| Propane | TWA - 1,000ppm 1,800mg/m ³ |
| n-Butane | TWA - 800ppm 1,900mg/m ³ |
| iso-Butane | TWA - 800ppm 1,900mg/m ³ |
| iso-Pentane | No Data Available |
| ACGIH TLV-TWA (Threshold Limit Value - Time Weighted Average) | |
| Propane | TWA 1,000 ppm 8hours (3/2012) |
| n-Butane | TWA 1,000 ppm 8hours (3/2012) |
| iso-Butane | TWA 1,000 ppm 8hours (3/2012) |
| iso-Pentane | TWA 600 ppm 8hours (3/2012) |
| Biological Exposure Indices (BEI) | |
| Propane | No Data Available |
| n-Butane | No Data Available |
| iso-Butane | No Data Available |
| iso-Pentane | No Data Available |

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| b) Appropriate engineering controls | Adequate ventilation should be provided so that exposure limits are not exceeded. |
| | In case of risk explosion, use explosion-proof ventilation equipment. |
| c) Personal protective equipment | |
| - Respiratory protection | Use NIOSH approved positive-pressure, supplied air respirator with escape bottle. |
| - Eye protection | Where there is a possibility of liquid contact, wear splash-proof safety goggles and faceshield. |
| - Hands protection | Use cold-impervious, insulating gloves where contact with liquid may occur. |
| - Body protection | Where contact with liquid may occur, wear apron and faceshield. |

9. Physical and chemical properties

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| a) Appearance | |
| - Color | Colorless |
| - Physical state | Gas, liquid at low temperature, high pressure |
| b) Odor | Odorless (before injecting an odorizer), Characteristic odor (after injecting an odorizer) |
| c) Odor threshold | The odor of gas shall be detected when the gas/air compound ratio reaches 1/1000. (after injecting an odorizer) |
| d) pH | Not applicable |
| e) Melting /freezing point | about -165 ~ -150°C |
| - Propane | -187.68°C |
| - n-Butane | -138.29°C |
| - iso-Butane | -159.61°C |
| - iso-Pentane | -159.9°C |
| f) Initial boiling point and boiling range | about -15 ~ -5°C |
| - Propane | -42.11°C |
| - n-Butane | -0.49°C |
| - iso-Butane | -11.75°C |
| - iso-Pentane | 27.85°C |
| g) Flash point | about -90 ~ -70°C |
| - Propane | -104°C |
| - n-Butane | -60°C |
| - iso-Butane | -83°C |
| - iso-Pentane | -51°C |
| h) Evaporation rate | No Data Available |
| i) Flammability (liquid, gas) | Flammable gas |
| j) Upper / lower flammability | about 8.4 % / 1.8 % |
| - Propane | 9.5% / 2.1% |
| - n-Butane | 8.4% / 1.8% |
| - iso-Butane | 8.4% / 1.8% |
| - iso-Pentane | 7.6 % / 1.4 % |

k) Vapor pressure	about 3.0 Bar (at 21°C)
- Propane	8.587 Bar (at 21°C)
- n-Butane	2.148 Bar (at 21°C)
- iso-Butane	3.126 Bar (at 21°C)
- iso-Pentane	0.795 Bar (at 21°C)
l) Solubility	about 50mg/L (at 25°C)
- Propane	62.5mg/L (at 25°C)
- n-Butane	61mg/100mL (at 20°C)
- iso-Butane	48.9mg/L (at 25°C)
- iso-Pentane	48 mg/L (at 25°C)
m) Vapor density	about 2 (air=1)
- Propane	1.55
- n-Butane	2.07
- iso-Butane	2.01
- iso-Pentane	2.5
n) Specific gravity	about 0.57 (at 15°C)
- Propane	0.58088 kg/L (at boiling point, 1.013bar)
- n-Butane	0.60126 kg/L (at boiling point, 1.013bar)
- iso-Butane	0.59382 kg/L (at boiling point, 1.013bar)
- iso-Pentane	0.616 kg/L (at boiling point, 1.013bar)
o) Partition coefficient (n-octanol / water)	about 2.8 (log Kow)
- Propane	2.36
- n-Butane	2.89
- iso-Butane	2.76
- iso-Pentane	2.3
p) Autoignition temperature	About 420°C (The Lowest temperature of all substance)
- Propane	470°C
- n-Butane	430°C
- iso-Butane	460°C
- iso-Pentane	420°C
q) Decomposition temperature	No Data Available
r) Viscosity	No Data Available
s) Molecular weight	About 58.4
- Propane	44.0965
- n-Butane	58.1234
- iso-Butane	58.1234
- iso-Pentane	72.1503

10. Stability and reactivity

a) Chemical stability and possibility of hazardous reactions	<p>Extreme Flammable gas.</p> <p>A leakage of material may present a fire / explosion risk.</p> <p>There is a risk of steam explosion in indoor, outdoor and sewer.</p> <p>It will ignite easily by heat, spark and flame.</p> <p>Vapors may ignite and explode.</p> <p>Vapor can move to the ignition source and flash back.</p> <p>Vapors may cause dizziness or asphyxiant without awareness</p> <p>Cylinders exposed to fire may release flammable gas.</p>
b) Conditions to avoid	Keep away from strong oxidizers, ignition sources and heat – no smoking.
c) Incompatible materials	No Data Available
d) Hazardous decomposition products	Carbon monoxide, carbon dioxide and non-combusted hydrocarbons(smoke).

11. Toxicological information

a) Information on the likely routes on	
- Propane	<p>nausea, vomiting, irregular heart rate, headaches, drowsiness, dizziness, disorientation, emotional lability, inebriation, adjustment (feature) loss, asphyxiant, convulsion, loss of consciousness, lethargy, shortness of breath, central nervous system (CNS) depression.</p> <p>Ingestion of a hazardous amount is unlikely to occur.</p> <p>may cause freeze burns and frostbite.</p>
- n-Butane	<p>It can cause stimulus, nausea, vomiting, shortness of breath, irregular heart rate, headaches, drowsiness, fatigue, dizziness, disorientation, emotional lability, inebriation, adjustment (feature) loss, asphyxiant, convulsion, loss of consciousness, lethargy.</p>
- iso-Butane	<p>It can cause stimulus, nausea, vomiting, headaches, drowsiness, fatigue, dizziness, emotional lability, adjustment (feature) loss, asphyxiant, convulsion, loss of consciousness, lethargy.</p> <p>may cause freeze burns and frostbite</p>
- iso-Pentane	<p>It can cause stimulus, nausea, vomiting, stomach ache, shortness of breath, headaches, drowsiness, dizziness, adjustment (feature) loss, asphyxiant.</p> <p>Ingestion of a hazardous amount is unlikely to occur.</p>
b) Health hazards information	
- Acute toxic	
Oral	No Data Available
Dermal	
Propane	No Data Available
n-Butane	No Data Available
iso-Butane	No Data Available
iso-Pentane	LD50 > 2,000mg/kg Rat
Inhalation	
Propane	LC50 800,000 ppm 15 min Rat
n-Butane	LC50 800,000 ppm 15 min Rat
iso-Butane	LC50 658,000mg/m ³ 4 hr Rat
iso-Pentane	LC50 280,000mg/m ³ 4 hr Rat

- Skin corrosive / irritant	
Propane	No Data Available (EU Directive 67/548) rabbit /irritating (IUCLID)
n-Butane	No Data Available
iso-Butane	No Data Available
iso-Pentane	Non-stimulated (rabbit)
- Serious eye damage / eye irritation	
Propane	No Data Available (EU Directive 67/548/EEC) Rabbit/ not irritating (IUCLID)
n-Butane	Non-stimulated (rabbit)
iso-Butane	Non-stimulated (rabbit)
iso-Pentane	High-concentrated vapor can stimulate eye.
- Respiratory sensitization	No Data Available
- Skin sensitization	
Propane	No Data Available
n-Butane	No Data Available
iso-Butane	No Data Available
iso-Pentane	Negative (from the result of Maximization test using a guinea pig)
- Carcinogenicity	Not applicable
The occupational safety and health act (domestic)	No Data Available
Labor Ministry Notice	Not Listed
Propane	Not Listed
n-Butane	Not Listed
iso-Butane	Not Listed
iso-Pentane	Not Listed
IARC	Not Listed
OSHA	Not Listed
ACGIH	No Data Available
NTP	Not Listed
- EU CLP	
Propane	No Data Available
n-Butane	No Data Available
iso-Butane	No Data Available
iso-Pentane	No Data Available
- Germ cell mutagenicity	
Propane	No Data Available
n-Butane	Back mutation test using microorganism – negative
iso-Butane	Back mutation test using microorganism – negative
iso-Pentane	Mammal bone marrow micronucleus test – negative

- Reproductive toxicity
 - Propane No Data Available
 - n-Butane No Data Available
 - iso-Butane No Data Available
 - iso-Pentane First generation reproductive toxicity test result : No reproductive toxicity was observed in mother and next generation slight effects
- Specific target organ toxicity (single exposure)
 - Propane Not applicable(EU Directive 67/548/EEC)
 - n-Butane No Data Available
 - iso-Butane In high concentration, causing narcosis and depressing-central nervous system.
 - iso-Pentane Narcotization was reported for inhalation exposure : Rat
- Specific target organ toxicity (repeated exposure)
 - Propane No Data Available
 - n-Butane No Data Available
 - iso-Butane No Data Available
 - iso-Pentane No Data Available
- Aspiration hazard No Data Available

12. Ecological information

a) Aquatic and terrestrial ecotoxicity

- fish
 - Propane LC50 > 100 mg/L 96 hr ((Species : Fish TLm))
 - n-Butane No Data Available
 - iso-Butane No Data Available
 - iso-Pentane No Data Available
- Crustacean
 - Propane LC50 52.157 mg/L 48 hr
 - n-Butane No Data Available
 - iso-Butane No Data Available
 - iso-Pentane EC50 2.3 mg/L 48 hr
- Algae
 - Propane LC50 32.252 mg/l 96 hr
 - n-Butane No Data Available
 - iso-Butane No Data Available
 - iso-Pentane No Data Available

b) Persistence and degradability

- Persistence
 - Propane log Kow 2.36
 - n-Butane log Kow 2.89
 - iso-Butane log Kow 2.76
 - iso-Pentane log Kow 2.30
- Degradability No Data Available

- c) Bioaccumulative potential
- Accumulative
 - Propane BCF 13
 - n-Butane No Data Available
 - iso-Butane BCF 1.57~1.97
 - iso-Pentane No Data Available
 - Biodegradability
 - Propane 65.7% 35day
 - n-Butane 65.7% 35day (aerobic, microbes, well-decomposed)
 - iso-Butane 65.7% 36day (aerobic, microbes, well-decomposed)
 - iso-Pentane No Data Available
- d) Mobility in soil No Data Available
- e) Other adverse effects No Data Available (the components ratio of pentanes is less than 2.5 %)

13. Disposal considerations

- a) Disposal method All disposal practices must be in compliance with all laws and regulations with elimination of the risk of explosion.
- b) Disposal precaution Beware of fire and explosion hazards due to residual gas in the container like cylinder or tank
Disposal should be in accordance with applicable regional, national and local laws and regulations.

14. Transport information

- a) UN number
- Propane 1969
 - n-Butane 1978
 - iso-Butane 1011
 - iso-Pentane 1969
 - 1265
- b) UN proper shipping name BUTANE
- c) Transport hazard class(es) 2.1
- d) Packing group, if applicable No Data Available
- e) Environmental hazards No Data Available
- f) Special precaution for user
- emergency procedures in a fire F-D
 - emergency procedures with the gas S-U

15. Regulatory information

- a) Regulations by the occupational safety and health act (Korea domestic act)
- Propane Not applicable
 - n-Butane Substance with exposure limits
 - iso-Butane Not applicable
 - iso-Pentane Not applicable

b) Act on registration, evaluation, etc of chemicals (domestic)

Propane	Not Listed
n-Butane	Not Listed
iso-Butane	Not Listed
iso-Pentane	Not Listed

c) Chemicals control act (domestic)

Propane	Not Listed
n-Butane	Not Listed
iso-Butane	Not Listed
iso-Pentane	Not Listed

d) Regulation by the act on the safety control of hazardous substances (domestic)

Not applicable

e) Regulation by wastes control act (domestic)

Propane	Designated waste material
n-Butane	Designated waste material
iso-Butane	Designated waste material
iso-Pentane	No Data Available

f) The other regulation by domestic and foreign act

- Domestic regulation

Persistent organic pollutants control act	Not applicable
High-pressure gas safety control act	Flamable, Liquefied gas
Safety control and business of liquefied petroleum gas act	Liquefied petroleum gas

- Foreign regulation

OSHA regulation	Not regulated
CERCLA103 (40CFR302.4)	Not regulated
EPCRA (section 302)	Not regulated
EPCRA (section 304)	Not regulated
EPCRA (section 313)	Not regulated
Rotterdam Convention	Not regulated
Stockholm Convention	Not regulated
Montreal protocol	Not regulated
EU REACH (classification result)	F+; R12
Propane	F+; R12
n-Butane	F+; R12
iso-Butane	F+; R12
iso-Pentane	F+; R12 Xn; R65, R66, R67 N; R51/53 Aspiration hazard; Tox. 1 - May be fatal if swallowed and enters airways.
EU REACH (risk statement)	R12
Propane	R12
n-Butane	R12, R67
iso-Butane	R12
iso-Pentane	R12, R51/53, R65, R66, R67

EU REACH(safety statement)	S2, S9, S16
Propane	S2, S9, S16
n-Butane	S2, S9, S16
iso-Butane	S2, S9, S16
iso-Pentane	S2, S9, S16, S33, S61, S62

16. Other information

a) Information source and references

ECB-ESIS(European chemical Substances Information System)(<http://ecb.jrc.it/esis>)
 ECOTOX Database, EPA(<http://cfpub.epa.gov/ecotox>)
 IUCLID Chemical Data Sheet, EC-ECB
 International Chemical Safety Cards(ICSC)(<http://www.nihs.go.jp/ICSC>)
 TOXNET, U.S. National Library of Medicine(<http://toxnet.nlm.nih.gov>)
 The Chemical Database, The Department of Chemistry at the University of Akron(<http://ull.chemistry.uakron.edu/erd>)
 Transport of Dangerous Goods - UN
 Chemical Information System, National Environmental Science Institute(<http://ncis.nier.go.kr>)
 Korea Occupational Safety and Health Agency MSDS Database
 Corporate Solution From Thomson Micromedex(<http://csi.micromedex.com>)
 Industrial poisoning handbook, Shin Kwang Publishing Co.
 Dangerous Material Information Management System, National Emergency Management Agency
 (<http://hazmat.nema.go.kr>)
 UN RTDG
 ICSC
 PATTY(4th, 1994)
 ACGIH (7th, 2001)
 Airliquide (<http://encyclopedia.airliquide.com>)
 Airgas (<http://www.airgas.com>)
 Wikipedia (<http://en.wikipedia.org>)

b) First Date Created 2020-01-22

c) Number of revisions and date of last revision

Number of revisions	Rev 1
Date of last revision	2020-02-21

d) The other information

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