

Safety Data Sheet (SDS)

Propane (R290 / HC-290)

CAS No.: 74-98-6 UN No.: 1978 Date of issue: Aug 29, 2026 Version: 1.0

1 Identification

1.1 Product identifier

Chemical name	Propane
Common names / synonyms	R290, HC-290, Dimethylmethane, LPG component
CAS number	74-98-6
UN number	1978 (Propane, flammable gas)
Dangerous goods code	Class 2.1 Flammable gas
Molecular formula	C ₃ H ₈
Molecular weight	44.10 g/mol
Recommended use	Refrigerant (residential/commercial refrigeration), fuel, aerosol propellant, chemical feedstock, welding/cutting gas

1.2 Details of the supplier of the safety data sheet

Supplier name	Hangzhou Wula Chemical Co., Ltd.
Address	No. 7 Longtan Road, Yuhang District, Hangzhou, Zhejiang Province, China
Postal code	311100
Telephone	+86-571-87024025
Fax	+86-571-87024025
E-mail	safety@wulachem.cn

1.3 Emergency telephone number

National Chemical Emergency Hotline (China): +86-532-83889090 (24 hours)

2 Hazards identification

2.1 GHS classification

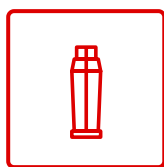
Hazard classification:

- Flammable gas (Physical hazard) — Category 1A (extremely flammable)
- Compressed gas (Physical hazard) — Liquefied gas
- Specific target organ toxicity - single exposure (Health hazard, narcotic effect) — Category 3
- Aspiration hazard (Health hazard) — Category 1
- Hazardous to the aquatic environment - Acute (Environmental hazard) — Category 1

2.2 GHS label elements



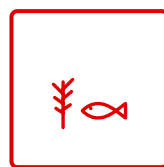
GHS02 Flammable



GHS04 Gas cylinder



GHS08 Health hazard



GHS09 Environment

Signal word: **DANGER**

Hazard statements:

- H220** Extremely flammable gas.
- H280** Contains gas under pressure; may explode if heated.
- H304** May be fatal if swallowed and enters airways.
- H336** May cause drowsiness or dizziness.
- H400** Very toxic to aquatic life.

Precautionary statements:

- P101** If medical advice is needed, have product container or label at hand.
- P102** Keep out of reach of children.
- P210** Keep away from heat, hot surfaces, sparks, open flames and other ignition sources. No smoking.
- P271** Use only outdoors or in a well-ventilated area.
- P304+P340** IF INHALED: Remove victim to fresh air and keep at rest in a position comfortable for breathing.
- P311** Call a POISON CENTER or doctor/physician.
- P370+P379** In case of fire: Stop leak if safe to do so.

- P377** Leaking gas fire: Do not extinguish, unless leak can be stopped safely.
- P381** In case of leakage, eliminate all ignition sources.
- P391** Collect spillage.
- P403** Store in a well-ventilated place.
- P410+P403** Protect from sunlight. Store in a well-ventilated place.
- P405** Store locked up.
- P501** Dispose of contents/container in accordance with local regulations.

2.3 Other hazards

Extremely flammable gas warning:

- This is an A3 flammability class refrigerant (ASHRAE safety group) with a wide explosive range (2.1%~9.5%). Even a small leak can form an explosive gas mixture.
- Vapor is heavier than air (vapor density ~1.52 times air) and can spread long distances along the ground; ignition can flash back to the source.
- Refrigerant-grade propane is typically not odorized; leaks cannot be detected by smell. Combustible gas detectors are mandatory.
- High concentrations can cause asphyxiation and central nervous system depression (dizziness, drowsiness, loss of consciousness).
- Liquid contact with skin or eyes can cause severe frostbite.
- Cylinders heated by fire may undergo BLEVE (Boiling Liquid Expanding Vapor Explosion).

3 Composition/information on ingredients

3.1 Substance/mixture

This product is a pure substance.

3.2 Composition information

Component name	CAS No.	Concentration (by mass)
Propane	74-98-6	≥99.5% (refrigerant grade)

3.3 Impurity information

Impurity	Specification limit
Moisture	≤10 ppm

Acidity (as HCl)	≤ 1 ppm
Evaporation residue	≤ 100 ppm
Non-condensable gas (25°C, vol%)	$\leq 1.5\%$
Sulfides	≤ 1 ppm
Other hydrocarbons (ethane, butane, etc.)	$\leq 0.5\%$

Note: Refrigerant-grade propane differs from fuel-grade LPG. Refrigerant grade has higher purity, is not odorized, and is specifically intended for refrigeration systems.

4 First aid measures

4.1 Description of necessary first aid measures

General advice: Remove victim from contaminated area immediately. Keep warm and at rest. Show this SDS to attending physician. Note: Ensure no explosion hazard before entering the leak area.

Inhalation:

- Move victim to fresh air immediately. Keep airway clear.
- Administer oxygen if breathing is difficult.
- If not breathing, give artificial respiration (preferably with bag-valve-mask; avoid mouth-to-mouth).
- If no pulse, start cardiopulmonary resuscitation (CPR) immediately.
- Keep victim warm and at rest. Monitor condition closely.
- Seek medical attention immediately.

Skin contact (frostbite):

- Immediately flush affected area with large amounts of lukewarm water (37–40°C) to promote rewarming.
- Do NOT use hot water (>40°C) or direct heat (e.g., electric heaters).
- Do NOT rub or massage frostbitten area; this may worsen tissue damage.
- Carefully remove frozen clothing. If clothing sticks to skin, do NOT pull it off; cut around it.
- Cover with sterile dressing.
- Seek medical attention immediately.

Eye contact:

- Immediately hold eyelids open and rinse thoroughly with plenty of water or normal saline for at least 15 minutes.
- Ensure complete irrigation of all eye surfaces by lifting upper and lower lids.
- Remove contact lenses if present and easily removable.
- Seek medical attention immediately, preferably from an ophthalmologist.

Ingestion:

This substance is a gas at ambient temperature; ingestion is highly unlikely. If liquid propane is accidentally swallowed (extremely rare), do NOT induce vomiting; seek medical attention immediately. Liquid propane ingestion poses risk of aspiration pneumonitis and internal frostbite.

4.2 Most important symptoms and effects, both acute and delayed

- Acute inhalation: dizziness, drowsiness, headache, nausea, ataxia, loss of consciousness, cardiac arrhythmia; high concentrations may cause asphyxiation.
- Skin contact (liquid): frostbite (pale, hard skin, pain, blistering).
- Eye contact (liquid): severe frostbite, corneal damage, visual impairment.
- Aspiration hazard: liquid propane entering the respiratory tract can cause chemical pneumonitis and pulmonary edema, potentially fatal.

4.3 Indication of any immediate medical attention and special treatment needed

Notes for physicians:

- Symptomatic and supportive therapy. Maintain airway; administer oxygen if needed.
- Monitor cardiac function; high-concentration exposure may cause arrhythmias.
- Treat frostbite with standard protocols: lukewarm water (37–40°C) rewarming. Do NOT use dry heat or massage.
- If aspiration pneumonitis is suspected, perform chest imaging and blood gas analysis.
- If liquid propane is ingested, do NOT perform gastric lavage or induce vomiting to prevent further airway damage.

5

Firefighting measures

Extremely flammable gas! This is an A3 flammability class refrigerant with a wide explosive range (2.1%~9.5%), extremely low flash point (-104°C), and auto-ignition temperature of 470°C. Any ignition source (open flame, static electricity, electrical spark, hot surface) can ignite or cause an explosion.

5.1 Extinguishing media

Suitable extinguishing media: Dry chemical powder, carbon dioxide, water fog (for cooling containers). For large gas fires, the preferred approach is to shut off the gas source and then extinguish.

Unsuitable extinguishing media: Direct water jets (may spread the flame and expand the hazard area; direct spray onto liquid propane tanks may cause splashing).

5.2 Special hazards arising from the substance or mixture

- Extremely flammable; forms explosive mixtures with air (explosive range 2.1%~9.5%).

- Vapor is heavier than air and can travel along the ground to remote ignition sources, causing flash-back.
- Cylinders or tanks exposed to heat may undergo BLEVE (Boiling Liquid Expanding Vapor Explosion), producing shock waves and flying fragments.
- Incomplete combustion produces carbon monoxide (CO), a toxic gas.
- Burning in confined spaces may cause vapor explosion.

5.3 Hazardous combustion products

Carbon dioxide (CO₂), water (H₂O), carbon monoxide (CO, from incomplete combustion)

5.4 Advice for firefighters

- Firefighters must wear positive-pressure self-contained breathing apparatus (SCBA) and full protective fire-resistant clothing.
- **For leaking gas fire: Do NOT extinguish the flame unless the leak can be safely stopped.** Continued burning prevents gas accumulation and potential larger-scale vapor cloud explosion. The flame will self-extinguish when the leak is stopped.
- If possible, move containers from fire area to a safe location.
- Cool containers with water spray from a safe distance until fire is extinguished.
- Immediately evacuate if containers show discoloration or if pressure relief devices begin to vent.
- Isolate the area; keep unauthorized personnel out.
- Apply large quantities of water from a distance to cool fire-exposed containers. Personnel must stay upwind.

6 Accidental release measures

Extremely flammable! Primary principle for leak response: Immediately eliminate ALL ignition sources (open flames, static electricity, electrical sparks, mechanical sparks). Evacuate downwind personnel. Prohibit use of spark-producing tools and equipment. Use only explosion-proof electrical equipment.

6.1 Personal precautions, protective equipment and emergency procedures

- Evacuate personnel from the leak area to upwind locations immediately. Establish a perimeter and restrict access.
- Immediately eliminate all ignition sources: cut power, prohibit open flames, no smoking, prohibit use of non-explosion-proof electrical equipment.
- Emergency responders should wear SCBA, anti-static work clothing, cryogenic gloves, and eye protection.
- Enter from upwind direction.

- Stop leak if it can be done safely. If the valve cannot be closed, retreat to a safe distance and await professional assistance.
- Do not touch or walk through spilled material.
- Use only non-sparking tools.

6.2 Environmental precautions

- Prevent gas from entering sewers, basements, cable trenches, or confined spaces (highly likely to accumulate and cause explosion).
- Ventilate the area to accelerate dispersion.
- Avoid release to waterways and soil.
- Vapor is heavier than air and accumulates in low-lying areas. Monitor combustible gas concentration (LEL).

6.3 Methods and materials for containment and cleaning up

- **Small leak:** Increase ventilation to accelerate gas dispersion. Use combustible gas detectors to monitor concentration, ensuring it is below the lower explosive limit (LEL = 2.1%).
- **Large leak:**
 - Immediately establish a security perimeter and evacuate downwind personnel.
 - Close source valve if safe to do so.
 - Use dedicated gas recovery equipment or flare system for safe disposal.
 - If recovery is not possible, ignite and burn the gas at a safe location (under professional guidance only) to prevent accumulation and explosion.
 - Use water fog/mist to dilute vapor, but do NOT direct water spray at the leak point.
- **Cylinder leak:** Move cylinder to a well-ventilated safe area and vent slowly. If valve cannot be closed, monitor from a safe distance and contact supplier for professional handling.

6.4 Reference

See Section 8 (Exposure controls/personal protection) and Section 13 (Disposal considerations).

Critical hazard: Propane vapor is approximately 1.52 times heavier than air and will accumulate in low-lying and confined areas, forming explosive gas mixtures. Always check combustible gas concentration (<10% LEL) and oxygen levels ($\geq 19.5\%$) and use a buddy system before entering confined spaces or low-lying areas. All open flames and static discharge are strictly prohibited.

7 Handling and storage

7.1 Precautions for safe handling

Explosion-proof safety requirements: This is an A3 extremely flammable gas. All operating areas must meet explosion-proof requirements. All electrical equipment, lighting, and ventilation must be explosion-proof type (Ex rating per GB 3836). Operators must wear anti-static work clothing and anti-static footwear.

- Handle in closed systems with adequate natural ventilation or local exhaust.
- Personnel must be specially trained and strictly follow operating procedures. Certified personnel only.
- Prevent gas leakage into workplace atmosphere.
- **All equipment, piping, and cylinders must be reliably grounded** to prevent static accumulation. Grounding resistance must meet anti-static requirements.
- Prohibit use of spark-producing mechanical equipment and tools (use non-sparking copper alloy tools).
- No smoking, eating, or drinking in work areas.
- Handle cylinders carefully; do not drop, slide, roll, or bump cylinders.
- Wear insulated gloves and eye/face protection when handling liquid to prevent frostbite.
- Equip area with combustible gas detection/alarm system and leak emergency response equipment.
- Periodically inspect cylinders, valves, and piping for leaks using leak detection solution or combustible gas detectors.
- Strictly control filling quantity during cylinder filling operations to prevent overfilling.

7.2 Conditions for safe storage, including any incompatibilities

- Store in a cool, dry, well-ventilated flammable gas warehouse. The warehouse must comply with GB 50016 (fire protection design code) for Class A warehouse requirements.
- Storage temperature should not exceed 30°C. Keep away from fire, heat sources, and direct sunlight.
- Store separately from oxidizers, halogens, strong acids, and strong bases. Do not co-store with incompatible materials.
- Storage area should be equipped with leak emergency response equipment and combustible gas detectors.
- Cylinders must be stored upright with valve caps and safety rings in place, properly secured to prevent falling.
- Use explosion-proof lighting and ventilation systems. Switches and receptacles must be located outside the warehouse or be of explosion-proof type.
- Prohibit use of equipment and tools that can generate sparks.
- Filling coefficient must not exceed 0.42 kg/L (propane).
- Post clear safety warning signs: "No Smoking" and "Flammable Gas."
- Storage areas must be kept at a safe distance from residential areas, schools, hospitals, and other populated areas.
- Implement two-person receiving/issuing and two-person custody system.

7.3 Specific end uses

When used as a refrigerant, only trained and certified technicians may handle the product. Refrigeration system design, installation, and maintenance must comply with relevant safety standards (e.g., GB 9237). R290 refrigeration systems should minimize charge quantity, use sealed designs, and be equipped with combustible gas detection. Do not use for direct food contact, medical inhalation, or other unapproved applications.

8 Exposure controls/personal protection

8.1 Control parameters

China OEL (Occupational Exposure Limit)	No established legal limit. Managed as a simple asphyxiant. Maintain oxygen content $\geq 19.5\%$ in air.
ACGIH TLV-TWA (USA)	1000 ppm (approx. 1800 mg/m ³), 8-hour time-weighted average (simple asphyxiant)
NIOSH REL-TWA (USA)	1000 ppm (1800 mg/m ³)
OSHA PEL-TWA (USA)	1000 ppm, 8-hour time-weighted average
Biological limit value	Not established

Note: The primary hazards of propane are flammability and simple asphyxiation (displacement of oxygen at high concentrations), not chemical toxicity. Workplace oxygen content must be maintained above 19.5%.

8.2 Exposure monitoring methods

Gas chromatography with flame ionization detection (GC-FID) or mass spectrometry (GC-MS); combustible gas detectors (LEL monitoring, catalytic combustion or infrared type).

8.3 Appropriate engineering controls

- Enclosed process design with general ventilation or local exhaust.
- Provide safety shower and eyewash station.
- Install combustible gas detection alarms (audible and visual) in areas where leaks may occur. Alarm set point $\leq 20\%$ LEL.
- All electrical equipment, lighting, and ventilation must be explosion-proof (complying with GB 3836).
- All metal equipment, piping, and cylinders must be reliably grounded. Grounding resistance $< 10\Omega$.
- Workplace floors must be made of non-sparking materials.

8.4 Individual protection measures

Respiratory protection:

- Normal conditions (below exposure limit and normal oxygen): no special protection required.
- Elevated concentrations or reduced oxygen: positive-pressure SCBA or positive-pressure supplied-air respirator is recommended.

- High concentration or emergency rescue/evacuation: positive-pressure SCBA must be worn.
- **Do NOT use filter-type respirators** (due to asphyxiation risk at high concentrations; filter respirators do not supply oxygen).

Eye/face protection:

- General handling: safety goggles.
- When handling liquid or potential liquid exposure: chemical safety goggles or face shield must be worn to prevent frostbite.

Skin protection:

- Hand protection: cryogenic-insulated gloves (e.g., dry ice gloves, leather cold gloves) for liquid contact.
- Body protection: anti-static work clothing and anti-static footwear (clothing must comply with GB 12014 anti-static standard).
- Other: no smoking in work areas; use a buddy system when entering tanks or confined spaces, with rescue equipment available.

8.5 Hygiene measures

- Remove work clothing and wash skin thoroughly after work.
- Maintain good personal hygiene.
- Ensure eyewash and emergency shower are available in the workplace.

9 Physical and chemical properties

9.1 Basic physical and chemical properties

Appearance and odor	Colorless gas with a slight natural gas odor; gaseous at ambient temperature and pressure; colorless transparent liquid under pressure
Odor threshold	~16,000 ppm (1.6%), near the lower explosive limit. Refrigerant-grade propane is not odorized; odor is unreliable for detection.
pH	Not applicable (gas)
Melting point / Freezing point	-187.7 °C (-305.9 °F)
Boiling point / Boiling range (101.3 kPa)	-42.1 °C (-43.8 °F)
Flash point	-104 °C (-155.2 °F) (closed cup)
Evaporation rate	Fast (liquid evaporates rapidly)
Flammability (gas)	Extremely flammable (Category 1A)

Explosive limits (upper/lower)	Upper 9.5% / Lower 2.1% (vol% in air)
Vapor pressure (25°C)	940 kPa (saturated vapor pressure)
Vapor density (air = 1)	1.52 (heavier than air)
Relative density (liquid, 25°C)	0.493 g/cm ³
Solubility	Slightly soluble in water (~65 mg/L at 25°C); soluble in ethanol, ether, and other organic solvents
Octanol/water partition coefficient (log P)	2.36
Auto-ignition temperature	470 °C (878 °F)
Decomposition temperature	Stable at ambient temperature and pressure; does not decompose
Viscosity (gas, 25°C)	~8.2 µPa·s
Surface tension (liquid, 25°C)	~7.0 mN/m
Gas specific heat (25°C, constant pressure)	1.67 kJ/(kg·°C)

9.2 Thermodynamic properties

Critical temperature	96.7 °C (205.9 °F)
Critical pressure	4250 kPa (4.25 MPa / 616.3 psia)
Critical density	0.220 g/cm ³
Heat of vaporization (at boiling point)	425 kJ/kg
Liquid specific heat (25°C)	2.72 kJ/(kg·°C)
Henry's Law constant (25°C)	1.4×10^{-1} mol/(m ³ ·Pa)

9.3 Other safety data

ASHRAE safety group	A3 (low toxicity, high flammability)
Ozone Depletion Potential (ODP)	0 (does not deplete ozone layer; natural refrigerant)

Global Warming Potential (GWP, 100-yr)	~3 (very low greenhouse effect; natural refrigerant)
Heat of combustion (lower heating value)	46.3 MJ/kg
Minimum ignition energy	~0.25 mJ (static discharge can ignite)

10 Stability and reactivity

10.1 Reactivity

Chemically stable under normal temperature and pressure conditions. May react violently with strong oxidizing agents under specific conditions.

10.2 Chemical stability

Stable under normal conditions of temperature and pressure. Avoid high temperatures, open flames, and strong oxidizers.

10.3 Possibility of hazardous reactions

- May react violently with strong oxidizing agents (e.g., liquid oxygen, chlorine, hydrogen peroxide), with explosion risk.
- May undergo vigorous substitution or addition reactions with halogens (fluorine, chlorine, bromine) under light or high-temperature conditions.
- Incomplete combustion at high temperatures produces carbon monoxide.

10.4 Conditions to avoid

High temperature, open flame, sparks, static discharge, direct heat sources, cylinder overpressure. Avoid forming explosive gas-air mixtures.

10.5 Incompatible materials

Strong oxidizing agents (liquid oxygen, chlorine, hydrogen peroxide, potassium permanganate, etc.), halogens (fluorine, chlorine, bromine), strong acids, strong bases

10.6 Hazardous decomposition products

Carbon monoxide (CO) from incomplete combustion. Does not decompose under normal storage conditions.

10.7 Hazardous polymerization

Will not occur.

11 Toxicological information

11.1 Information on toxicological effects

Acute toxicity:

Rat inhalation LC ₅₀ (4 hr)	> 100,000 ppm (100,000 ppm, ~4 vol%; practically non-toxic; main hazards are asphyxiation and flammability)
Mouse inhalation LC ₅₀ (2 hr)	> 100,000 ppm
Rabbit dermal LD ₅₀	Not available (gaseous substance)

Note: Propane has extremely low acute toxicity. The rat 4-hour inhalation LC₅₀ exceeds 100,000 ppm, classifying it as practically non-toxic. The primary health hazards are flammability/explosion and simple asphyxiation.

11.2 Skin irritation/corrosion

Gaseous state: no skin irritation. Liquid contact can cause frostbite (physical cryogenic injury), but is not a chemical corrosive. GHS classification: no skin corrosion/irritation classification (physical frostbite only).

11.3 Eye irritation/corrosion

Gaseous state: no eye irritation. Liquid contact can cause severe frostbite and corneal damage. GHS classification: no eye irritation classification (physical frostbite only).

11.4 Respiratory or skin sensitization

No sensitization reported. Available animal test data and human epidemiology data show no sensitization effect.

11.5 Germ cell mutagenicity

In vitro tests (Ames test, etc.) show no mutagenic effect. Propane is a simple alkane and does not exhibit genotoxicity.

11.6 Carcinogenicity

Insufficient evidence for carcinogenicity.

- IARC (International Agency for Research on Cancer): Not listed
- ACGIH (American Conference of Governmental Industrial Hygienists): Category A4 (Not classifiable as a human carcinogen)
- EPA (U.S. Environmental Protection Agency): Not listed

11.7 Reproductive toxicity

Available data show no reproductive or developmental toxicity. Animal studies have not shown teratogenic effects.

11.8 STOT-single exposure

- Narcotic effect (Category 3): Inhalation of high concentrations (> 10,000 ppm) may cause central nervous system depression, manifested as dizziness, drowsiness, headache, and impaired consciousness.

- Cardiac effects: Very high-concentration exposure may cause cardiac arrhythmia, especially under stress.
- Asphyxiation: At high concentrations, displaces oxygen in air, causing hypoxia (symptoms appear when $O_2 < 19.5\%$; may be fatal when $O_2 < 6\%$).

11.9 STOT-repeated exposure

Repeated low-concentration exposure shows no significant target organ toxicity. Long-term occupational exposure (below TLV) has not shown clear organ damage.

11.10 Aspiration hazard

Liquid propane entering the respiratory tract (e.g., aspiration following ingestion of liquid propane) can cause chemical pneumonitis and pulmonary edema, potentially fatal. GHS classification: Aspiration hazard Category 1. In gaseous form, aspiration pneumonia is not expected.

12 Ecological information

12.1 Ecotoxicity

Fish acute toxicity (LC ₅₀ , 96 hr)	Toxic to fish (GHS classification: Aquatic Acute 1)
Daphnia acute toxicity (EC ₅₀ , 48 hr)	Detailed data not available
Algae growth inhibition (EC ₅₀ , 72 hr)	Detailed data not available
Bacterial toxicity	Not available

Note: Propane has very low water solubility, limiting actual aquatic exposure risk. The GHS aquatic toxicity classification is based on analog data.

12.2 Persistence and degradability

- Atmospheric degradation: Primarily degraded by reaction with hydroxyl radicals ($\cdot OH$); atmospheric lifetime ~12 days.
- Biodegradability: Biodegradable under aerobic conditions.
- Hydrolysis: Not readily hydrolyzed at ambient temperature.
- Photodegradation: Can be photochemically degraded in the atmosphere.

12.3 Bioaccumulative potential

log P = 2.36. Low bioaccumulation potential (below the bioconcentration threshold of log P = 4.5).

12.4 Mobility in soil

Highly volatile in gaseous form. Very low water solubility. Volatilizes readily to atmosphere when released to soil; does not persist in soil.

12.5 Results of PBT and vPvB assessment

Does not meet PBT (persistent, bioaccumulative, and toxic) / vPvB (very persistent and very bioaccumulative) criteria.

12.6 Other adverse effects

- **Ozone Depletion Potential (ODP):** 0 (does not deplete the ozone layer; natural refrigerant)
- **Global Warming Potential (GWP, 100-year time horizon):** ~3 (relative to CO₂ = 1, extremely low greenhouse effect)
- R290 is a natural organic working fluid (hydrocarbon). Environmentally friendly with ODP=0 and very low GWP (~3), it is an eco-friendly alternative to freon-type refrigerants.
- Large releases to water may be harmful to aquatic life, but rapid volatilization limits actual aquatic exposure risk.
- Not a controlled substance under the Montreal Protocol; not a controlled greenhouse gas under the Kyoto Protocol (GWP is very low).

13 Disposal considerations

13.1 Waste treatment methods

Product/residues:

- Recovery and recycling (purification and reuse) is the preferred approach.
- Small amounts of unrecoverable residual liquid may be slowly vented to the atmosphere at a safe location (away from people, buildings, and ignition sources).
- Large quantities should be disposed of through a licensed hazardous waste treatment facility.
- High-temperature incineration with a safe combustion system is an acceptable method.
- **Do NOT discharge liquid propane to sewers, waterways, or soil.**
- When venting, ensure no ignition sources are present and the area is well-ventilated.

Contaminated packaging:

- Empty cylinders must be returned to supplier or a qualified facility for disposal. Do not discard or cut empty cylinders.
- Empty cylinders with residual pressure and liquid are managed as hazardous waste.
- Never apply open flame heating, cutting, or welding to cylinders containing residual liquid.

13.2 Special precautions for disposal

- Refer to national and local regulations before disposal (e.g., Solid Waste Pollution Prevention and Control Law, Hazardous Waste Storage Pollution Control Standards, etc.).

- Personnel should wear appropriate personal protective equipment (see Section 8).
- Ensure good ventilation to prevent flammable gas accumulation.
- Disposal must be performed by a qualified and licensed facility.
- Disposal records should be maintained.

14 Transport information

14.1 UN number

1978 (Propane, flammable gas)

14.2 UN proper shipping name

PROPANE

14.3 Transport hazard class(es)

Class 2.1 Flammable gas

14.4 Packing group

Not applicable (Class 2 gases are not assigned a packing group)

14.5 Packing mark / Hazard label

- Primary hazard label: Flammable gas (red, Class 2.1)
- Subsidiary hazard label: None

14.6 Methods and materials for containment and packaging

- Seamless or welded steel cylinders. Cylinders must comply with applicable national standards (e.g., GB 5099, GB 5100).
- Common package sizes: 10 kg, 20 kg, 50 kg cylinders; 400 kg, 800 kg, 1000 kg tanks.
- Filling coefficient must not exceed 0.42 kg/L (propane).
- Cylinder valve outlet thread direction: left-hand thread for flammable gases.

14.7 Special requirements for different modes of transport

Road transport:

- Vehicles must have hazardous cargo transport license and be equipped with spark arrestors.
- Cylinders must have valve caps and safety rings in place.
- Cylinders generally laid flat with valves pointing in same direction; do not stack crosswise. Height must not exceed vehicle guardrail.
- Transport during early morning/evening in summer to avoid direct sunlight.
- Follow designated routes; do not stop in residential or densely populated areas.
- Vehicles must carry fire extinguishers and combustible gas detectors.

Rail transport:

- Prohibit hump shunting (no free-roll classification).
- Transport in boxcars; cylinders upright or laid flat and secured.
- Prohibit co-loading with oxidizers or self-igniting materials.

Marine transport (IMDG Code):

- UN 1978, Class 2.1
- Marine pollutant: No
- Stowage category: D (on deck only)
- Must be stowed away from heat sources and fire

Air transport (ICAO/IATA DGR):

- UN 1978, Class 2.1
- Flammable gas
- Passenger aircraft: Prohibited (unless meeting excepted quantity provisions)
- Cargo aircraft: Must comply with IATA DGR packaging requirements (subject to aviation authority approval)

14.8 Special precautions for user

- Do not co-transport with oxidizers, halogens, strong acids, strong bases, or food/feed products.
- Vehicles must be equipped with appropriate fire extinguishing equipment and leak emergency response gear.
- Transport personnel must be specially trained and certified.
- Protect from sunlight, rain, and high temperature during transit.
- When stopping en route, stay away from fire, heat sources, and high-temperature areas.
- Exhaust pipes of vehicles carrying this product must be fitted with spark arrestors.
- Load and unload carefully to prevent damage to cylinders and fittings. No dropping or impact.
- Cylinders must be securely fastened during transport to prevent rolling and collision.

15 Regulatory information**15.1 Safety, health and environmental regulations/legislation specific for the substance or mixture****China regulations:**

- Regulation on the Safety Management of Hazardous Chemicals (State Council Decree No. 591)
- Catalog of Hazardous Chemicals (2015 edition): Listed (Class 2.1 flammable gas)
- GB 30000 series: Rules for classification and labelling of chemicals (GHS)
- GB/T 16483-2008: Content and order of sections in safety data sheet
- GBZ 2.1-2019: Occupational exposure limits for hazardous agents in the workplace

- TSG 23-2021: Safety Technical Regulation for Gas Cylinders
- GB 50016: Code for Fire Protection Design of Buildings (Class A warehouse)
- GB 50058: Design Code for Electrical Installations in Explosive Atmospheres
- GB 9237: Refrigerating Systems and Heat Pumps - Safety and Environmental Requirements
- Production Safety Law of the People's Republic of China
- Fire Protection Law of the People's Republic of China (Class A flammable gas)
- Solid Waste Pollution Prevention and Control Law

International regulations:

- **UN GHS (Globally Harmonized System of Classification and Labelling of Chemicals):** 8th revised edition
- **Montreal Protocol:** Not a controlled ozone-depleting substance (ODP = 0, natural refrigerant)
- **Kyoto Protocol / Paris Agreement:** Very low GWP (~3); not a priority controlled greenhouse gas
- **EU REACH Regulation (EC 1907/2006):** Registered substance
- **EU CLP Regulation (EC 1272/2008):** Classification, labelling and packaging regulation
- **EU F-Gas Regulation (EC 517/2014):** Not a fluorinated greenhouse gas; not subject to this regulation
- **US EPA SNAP Program:** Approved for refrigeration applications
- **US OSHA HCS 2012:** Hazard Communication Standard
- **US DOT 49 CFR:** Hazardous Materials Transportation Regulations
- **ADR/RID:** European Agreement concerning the International Carriage of Dangerous Goods by Road/Rail
- **IMDG Code:** International Maritime Dangerous Goods Code
- **IATA DGR:** International Air Transport Association Dangerous Goods Regulations
- **ASHRAE Standard 34:** Designation and Safety Classification of Refrigerants (Group A3)

15.2 Chemical safety assessment

Chemical Safety Assessment has not been carried out for this substance in the context of this SDS. Users should conduct their own assessment based on specific use conditions.

16 Other information

16.1 References

- NIOSH Pocket Guide to Chemical Hazards
- International Chemical Safety Card (ICSC) No. 0332
- NOAA CAMEO Chemicals Database
- PubChem Compound Database (CID 6334)
- ASHRAE Standard 34-2019 (Designation and Safety Classification of Refrigerants)

- ASHRAE Handbook - Refrigeration Systems and Applications
- GB/T 16483-2008 (Content and order of sections in safety data sheet for chemical products)
- GB 30000 series (Rules for classification and labelling of chemicals)
- United Nations GHS (Globally Harmonized System of Classification and Labelling of Chemicals), 8th revised edition
- GB 9237 (Refrigerating Systems and Heat Pumps - Safety and Environmental Requirements)

16.2 Abbreviations

Abbreviation	Full term
SDS / MSDS	Safety Data Sheet / Material Safety Data Sheet
GHS	Globally Harmonized System of Classification and Labelling of Chemicals
CAS	Chemical Abstracts Service (registry number)
UN	United Nations (dangerous goods number)
ODP	Ozone Depletion Potential
GWP	Global Warming Potential
LC ₅₀	Lethal Concentration, 50%
LD ₅₀	Lethal Dose, 50%
TLV-TWA	Threshold Limit Value - Time-Weighted Average
PEL	Permissible Exposure Limit
SCBA	Self-Contained Breathing Apparatus
PBT	Persistent, Bioaccumulative, and Toxic
LEL	Lower Explosive Limit
UEL	Upper Explosive Limit
BLEVE	Boiling Liquid Expanding Vapor Explosion
HC	Hydrocarbon
STOT	Specific Target Organ Toxicity
IARC	International Agency for Research on Cancer

ACGIH	American Conference of Governmental Industrial Hygienists
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16.3 Disclaimer

This Safety Data Sheet (SDS) has been prepared in accordance with the UN GHS standard and applicable regulatory requirements. The information contained herein is based on publicly available chemical databases, technical literature, and national standards, and is believed to be accurate and complete as of the date of issuance. However, no warranty, express or implied, is made as to the absolute accuracy, completeness, or reliability of the information. R290 is an A3 extremely flammable refrigerant. Explosion-proof safety regulations must be strictly followed during use, storage, and transport. Users should verify the applicability of the information for their specific use conditions and refer to the official SDS provided by the manufacturer/supplier for compliance purposes. The information in this document may be updated as new research findings and regulatory changes become available; periodic review of the latest version is recommended.