

Safety Data Sheet (SDS)

R410A Refrigerant Mixture (HFC-410A, R32/R125 = 50/50)

CAS No.: No single CAS (mixture); R32: 75-10-5; R125: 354-33-6 UN No.: 3162 Date of issue: Aug 29, 2026

Version: 1.0

1 Identification

1.1 Product identifier

Chemical name	R410A Refrigerant Mixture (Difluoromethane/Pentafluoroethane near-azeotropic mixture)
Common names / synonyms	R410A, HFC-410A, HFC410A, SUVA 410A, Genetron 410A, AZ-20
CAS number	No single CAS number (mixture); R32: 75-10-5; R125: 354-33-6
UN number	3162 (Liquefied gas, n.o.s.)
Dangerous goods code	Class 2.2 Non-flammable, non-toxic gas
Molecular formula	CH ₂ F ₂ (R32) + CHF ₂ CF ₃ (R125)
Molecular weight	72.59 g/mol (mixture average)
Recommended use	Refrigerant for residential and commercial air conditioning, heat pump systems; HFC replacement for R22

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)

Supplier Emergency Contact: +86-571-87024025

2 Hazards identification

2.1 GHS classification

Hazard classification:

- Compressed gas (Physical hazard) — Liquefied gas
- Specific target organ toxicity - single exposure (Health hazard, narcotic effect) — Category 3

Note: Frostbite from liquid contact is a physical low-temperature injury. GHS does not have a specific "frostbite" category.

2.2 GHS label elements



GHS04 Gas cylinder



GHS07 Exclamation mark

Signal word: **WARNING**

Hazard statements:

H280 Contains gas under pressure; may explode if heated.

H336 May cause drowsiness or dizziness.

Precautionary statements:

P102 Read and understand all safety precautions before handling.

P271 Use only outdoors or in a well-ventilated area.

P280 Wear protective gloves/protective clothing/eye protection/face protection.

P304+P340 IF INHALED: Remove person to fresh air and keep comfortable for breathing.

P312 Call a POISON CENTER/doctor if you feel unwell.

P403 Store in a well-ventilated place.

P410+P403 Protect from sunlight. Store in a well-ventilated place.

P405 Store locked up.

2.3 Other hazards

- Vapor is heavier than air and may spread long distances along the ground, creating an oxygen-deficient environment in low-lying areas.
- Non-flammable, but decomposes at high temperatures (>300°C) producing toxic and corrosive gases (hydrogen fluoride, carbon monoxide, carbonyl fluoride, etc.).
- Cylinders may rupture or burst when heated due to increased internal pressure. R410A operating pressure is significantly higher than R22 and other traditional refrigerants.
- R410A is not an ozone-depleting substance (ODP = 0) but is a high-GWP greenhouse gas (GWP = 2088).

3 Composition/information on ingredients

3.1 Substance/mixture

This product is a mixture (near-azeotropic mixture).

3.2 Composition information

Component name	CAS No.	Concentration (by mass)	Molecular formula
Difluoromethane (R32 / HFC-32)	75-10-5	50%	CH ₂ F ₂
Pentafluoroethane (R125 / HFC-125)	354-33-6	50%	CHF ₂ CF ₃

3.3 Impurity information

Impurity	Specification limit
Acidity (as HCl)	≤1 ppm
Moisture	≤10 ppm
Evaporation residue	≤100 ppm
Non-condensable gas (25°C, vol%)	≤1.5%
Chloride	Pass

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.

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 or pocket 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:

Not applicable. This substance is a gas at ambient temperature; ingestion exposure is not expected.

4.2 Most important symptoms and effects, both acute and delayed

- Acute inhalation: dizziness, drowsiness, headache, nausea, ataxia, loss of consciousness, cardiac arrhythmia.
- Skin contact (liquid): frostbite (pale, hard skin, pain, blistering).
- Eye contact (liquid): severe frostbite, corneal damage, visual impairment.
- Thermal decomposition products: HF can cause respiratory irritation and pulmonary edema.

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.
- Avoid catecholamine drugs (e.g., epinephrine/adrenaline) — they may increase myocardial sensitivity to fluorocarbons and precipitate ventricular fibrillation.
- Treat frostbite with standard protocols: lukewarm water (37–40°C) rewarming. Do NOT use dry heat or massage.
- If thermal decomposition products (HF) are suspected, monitor for delayed pulmonary edema; consider corticosteroids and bronchodilators.

5 Firefighting measures

5.1 Extinguishing media

Suitable extinguishing media: This substance is non-flammable. Use extinguishing agent appropriate for surrounding fire. Carbon dioxide, dry chemical, water fog, and foam are acceptable.

Unsuitable extinguishing media: No specific contraindications.

5.2 Special hazards arising from the substance or mixture

- Non-flammable. No flash point. No explosive limits.
- Thermal decomposition at high temperatures (>300°C) produces toxic and corrosive gases: hydrogen fluoride, carbon monoxide, carbonyl fluoride, etc.
- Cylinders may rupture or burst when heated due to increased internal pressure. R410A pressure-temperature curve is steeper than traditional refrigerants, posing higher overpressure risk.
- May react with alkali metals, alkaline earth metals, and aluminum powder under certain conditions.

5.3 Hazardous combustion products

Hydrogen fluoride (HF), carbon monoxide (CO), carbonyl fluoride (COF₂), and other fluorinated compounds.

5.4 Advice for firefighters

- Firefighters must wear positive-pressure self-contained breathing apparatus (SCBA) and full protective fire-resistant clothing.
- 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.
- Avoid direct water spray on leaking liquefied gas, as this will accelerate evaporation and dispersion.

6 Accidental release measures

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.
- Emergency responders should wear SCBA, standard work clothing, cryogenic gloves, and eye protection.
- Enter from upwind direction.
- Stop leak if it can be done safely.
- Do not touch or walk through spilled material.
- Maintain emergency contact personnel for external support.

6.2 Environmental precautions

- Prevent gas from entering sewers, basements, or confined spaces.
- Ventilate the area to accelerate dispersion.
- Minimize releases to control greenhouse gas emissions; recover whenever possible.
- Avoid release to atmosphere, waterways, or soil.

6.3 Methods and materials for containment and cleaning up

- **Small leak:** Increase ventilation to accelerate gas dispersion. Monitor oxygen levels to prevent asphyxiation.
- **Large leak:**
 - Close source valve if safe to do so.
 - Recover using dedicated gas recovery equipment.
 - If recovery is not possible, use water fog/mist to dilute and dissolve gas (prevent water pollution).
 - If cylinder valve cannot be closed, immerse cylinder in alkaline water solution for absorption.
- **Cylinder leak:** Move cylinder to a well-ventilated safe area and vent slowly. If valve cannot be closed, contact supplier for professional handling.

6.4 Reference

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

Critical hazard: R410A vapor density is approximately 2.5 times that of air and will accumulate in low-lying and confined areas, creating an oxygen-deficient atmosphere. Always check oxygen levels (must be $\geq 19.5\%$) and use a buddy system before entering confined spaces or low-lying areas. R410A systems operate at higher pressures; leaks may spray forcefully — take extra precautions.

7

Handling and storage

7.1 Precautions for safe handling

- 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.
- Avoid contact with reactive metals and strong oxidizing agents.
- Handle cylinders carefully; do not drop, slide, roll, or bump cylinders. Use proper lifting equipment.
- Equip area with leak emergency response equipment.
- No smoking, eating, or drinking in work areas.
- Wear insulated gloves and eye/face protection when handling liquid to prevent frostbite.
- Use explosion-proof ventilation systems and equipment.
- Periodically inspect cylinders, valves, and piping for leaks.
- R410A operating pressure is approximately 50% higher than R22; use only R410A-rated equipment and tools (dedicated pressure gauges, charging hoses, etc.). Never mix with R22 equipment.

7.2 Conditions for safe storage, including any incompatibilities

- Store in a cool, dry, well-ventilated non-flammable gas warehouse.
- Storage temperature should not exceed 45°C. Keep away from fire, heat sources, and direct sunlight.
- Store separately from oxidizers and reactive metals. Do not co-store with incompatible materials.
- Storage area should be equipped with leak emergency response equipment.
- 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.
- Prohibit use of equipment and tools that can generate sparks.
- Filling coefficient must not exceed 1.1 kg/L.
- Post clear safety warning signs in storage areas.
- Implement two-person receiving/issuing and two-person custody system.

7.3 Specific end uses

For industrial use only. Personnel must be professionally trained. R410A is primarily used in air conditioning and heat pump systems as an R22 replacement. Systems and components for R410A must be designed for higher operating pressures. 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. Recommended reference: ACGIH TLV 1000 ppm (TWA, 8 hr)
ACGIH TLV-TWA (USA)	1000 ppm (R32 component), 8-hour time-weighted average

OSHA PEL-TWA (USA)	1000 ppm, 8-hour time-weighted average
Biological limit value	Not established

Note: Per GBZ 2.1-2019 (Occupational exposure limits for hazardous agents in the workplace — Part 1: Chemical agents), this substance is not currently listed in the Chinese OEL table. International standards are recommended as reference.

8.2 Exposure monitoring methods

Gas chromatography with flame ionization detection (GC-FID) or mass spectrometry (GC-MS); infrared spectroscopy; halide detector tubes.

8.3 Appropriate engineering controls

- Enclosed process design with general ventilation or local exhaust.
- Provide safety shower and eyewash station.
- Install gas detection alarms in areas where large leaks may occur.
- Use explosion-proof electrical equipment.

8.4 Individual protection measures

Respiratory protection:

- Normal conditions (below exposure limit): no special protection required.
- Elevated concentrations: half-face respirator with organic vapor/acid gas cartridge is recommended.
- High concentration or emergency rescue/evacuation: positive-pressure self-contained breathing apparatus (SCBA) must be worn.

Eye/face protection:

- General handling: no special protection required.
- When handling liquid or potential liquid exposure: chemical safety goggles or face shield must be worn to prevent frostbite.

Skin protection:

- Hand protection: general work gloves for normal handling; cryogenic-insulated gloves (e.g., dry ice gloves, leather cold gloves) for liquid contact.
- Body protection: standard work uniform; cold-resistant clothing for liquid contact.
- Other: no smoking in work areas; avoid high-concentration inhalation; use a buddy system when entering tanks, confined spaces, or other high-concentration areas.

8.5 Hygiene measures

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



9.1 Basic physical and chemical properties

Appearance and odor	Colorless gas with a faint ethereal odor; gaseous at ambient temperature and pressure; colorless transparent liquid under pressure
Odor threshold	Not available (faint ether-like odor)
pH	Not applicable (gas)
Melting point / Freezing point	-136 °C (mixture, approximate)
Boiling point / Boiling range (101.3 kPa)	-51.6 °C (-60.9 °F) (near-azeotropic mixture)
Flash point	None (non-flammable gas)
Evaporation rate	Not available
Flammability (gas)	Non-flammable
Explosive limits (upper/lower)	Not applicable (non-flammable gas)
Vapor pressure (25°C)	1660 kPa (saturated vapor pressure)
Vapor density (air = 1)	~2.5 (heavier than air)
Relative density (liquid, 25°C)	1.063 g/cm ³
Solubility	Slightly soluble in water; soluble in ethanol, ether, and other organic solvents
Octanol/water partition coefficient (log P)	~0.65 (mixture, approximate)
Auto-ignition temperature	Not applicable (non-flammable)
Decomposition temperature	>300 °C onset of thermal decomposition
Viscosity (gas, 25°C)	~12.5 µPa·s
Surface tension (liquid, 25°C)	~6.0 mN/m
Refractive index (gas, 25°C)	1.0006

9.2 Thermodynamic properties

Critical temperature	72.5 °C (162.5 °F) (mixture, approximate)
Critical pressure	4720 kPa (4.72 MPa / 684.8 psia)
Critical density	0.519 g/cm ³
Heat of vaporization (at boiling point)	224 kJ/kg
Liquid specific heat (25°C)	1.94 kJ/(kg·°C)
Henry's Law constant (25°C)	1.0×10^{-3} mol/(m ³ ·Pa)

9.3 Other safety data

ASHRAE safety group	A1 (low toxicity, non-flammable)
Ozone Depletion Potential (ODP)	0 (does not deplete ozone layer; see Section 12.6)
Global Warming Potential (GWP, 100-yr)	2088 (greenhouse gas; see Section 12.6)
Temperature glide	~0.1°C (near-azeotropic; minimal composition shift during evaporation/condensation)

10 Stability and reactivity

10.1 Reactivity

Chemically stable under normal temperature and pressure conditions; not readily reactive.

10.2 Chemical stability

Stable under normal conditions of temperature and pressure. R410A is a near-azeotropic mixture with minimal composition change during evaporation and condensation.

10.3 Possibility of hazardous reactions

- Thermal decomposition at high temperatures (>300°C) produces toxic hydrogen fluoride, carbon monoxide, and carbonyl fluoride.
- May react with alkali metals, alkaline earth metals, and aluminum powder under high temperature or specific conditions.
- May undergo oxidation-reduction reactions with strong oxidizing agents.

10.4 Conditions to avoid

High temperature, open flame, direct heat sources, cylinder overpressure

10.5 Incompatible materials

Reactive metals (sodium, potassium, calcium, aluminum powder, magnesium powder, etc.), strong oxidizing agents

10.6 Hazardous decomposition products

Hydrogen fluoride (HF), carbon monoxide (CO), carbonyl fluoride (COF₂), and other fluorinated compounds

10.7 Hazardous polymerization

Will not occur.

11 Toxicological information

11.1 Information on toxicological effects

Acute toxicity:

Rat inhalation LC ₅₀ (4 hr)	> 500,000 ppm (mixture, highest concentration tested)
R32 component: Rat inhalation LC ₅₀ (4 hr)	> 1,000,000 ppm
R125 component: Rat inhalation LC ₅₀ (4 hr)	> 800,000 ppm
Rabbit dermal LD ₅₀	Not available (gaseous substance)

11.2 Skin irritation/corrosion

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

11.3 Eye irritation/corrosion

Liquid contact can cause severe frostbite and corneal damage.

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

Both components: in vitro and in vivo tests (Ames test, chromosome aberration test, mouse micronucleus test, etc.) show no mutagenic effect.

11.6 Carcinogenicity

Insufficient evidence for carcinogenicity for both components.

- IARC (International Agency for Research on Cancer): Neither component is listed
- ACGIH (American Conference of Governmental Industrial Hygienists): Both components Category A4 (Not classifiable as a human carcinogen)
- EPA (U.S. Environmental Protection Agency): Both components Group D (Not classifiable as to human carcinogenicity)

11.7 Reproductive toxicity

Animal studies for both components show no significant reproductive or developmental toxicity at high concentrations. No human reproductive toxicity data available.

11.8 STOT-single exposure

- Narcotic effect (Category 3): Inhalation of high concentrations may cause central nervous system depression, manifested as dizziness, drowsiness, headache, and impaired consciousness.
- Cardiac effects: High-concentration exposure may cause cardiac arrhythmia, especially under stress or exercise (catecholamine sensitization).

11.9 STOT-repeated exposure

Both components: repeated low-concentration exposure shows no significant target organ toxicity. Long-term animal inhalation studies (high concentrations) have not shown clear organ damage.

11.10 Aspiration hazard

Not expected to cause aspiration pneumonia in gaseous form. However, high-concentration inhalation can cause CNS depression and cardiac sensitization. Thermal decomposition products (HF) can cause severe respiratory injury and delayed pulmonary edema.

12 Ecological information

12.1 Ecotoxicity

Fish acute toxicity (LC ₅₀ , 96 hr)	> 100 mg/L (low toxicity to fish)
Daphnia acute toxicity (EC ₅₀ , 48 hr)	> 100 mg/L
Algae growth inhibition (EC ₅₀ , 72 hr)	> 100 mg/L
Bacterial toxicity	Not available

12.2 Persistence and degradability

- R32 atmospheric degradation: Primarily degraded by reaction with hydroxyl radicals; atmospheric lifetime ~5.6 years.
- R125 atmospheric degradation: Primarily degraded by reaction with hydroxyl radicals; atmospheric lifetime ~28.4 years.
- Biodegradability: Poorly biodegradable (not readily degraded by microorganisms).
- Hydrolysis: Not readily hydrolyzed at ambient temperature.
- Photodegradation: Can be photochemically degraded in the atmosphere.

12.3 Bioaccumulative potential

$\log P \approx 0.65$. Low bioaccumulation potential (below the bioconcentration threshold of $\log P = 4.5$).

12.4 Mobility in soil

Highly volatile in gaseous form. Low water solubility. High mobility. Volatilizes readily to atmosphere when released to 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; HFC-class non-ODS substance)
- **Global Warming Potential (GWP, 100-year time horizon):** 2088 (relative to $\text{CO}_2 = 1$)
- Large releases contribute to global warming; emissions should be controlled with priority on recovery and reuse.
- Not a controlled substance under the Montreal Protocol, but is a greenhouse gas listed under the Kyoto Protocol and Paris Agreement.
- EU F-Gas Regulation and the Kigali Amendment impose phasedown of HFC substances.

13 Disposal considerations

13.1 Waste treatment methods

Product/residues:

- Do NOT release directly to atmosphere (greenhouse gas).
- Recovery and recycling (purification and reuse) is the preferred approach.
- If recovery is not feasible, dispose of through a licensed hazardous waste treatment facility.
- High-temperature incineration with alkaline scrubber for fluoride removal is an acceptable method.
- Do not discharge to sewers, waterways, or soil.

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 are managed as hazardous waste.

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 asphyxiation.
- Disposal must be performed by a qualified and licensed facility.
- Disposal records should be maintained.

14 Transport information

14.1 UN number

3162 (Liquefied gas, n.o.s.; R410A Refrigerant Mixture)

14.2 UN proper shipping name

LIQUEFIED GAS, N.O.S. (R410A Refrigerant Mixture)

14.3 Transport hazard class(es)

Class 2.2 Non-flammable, non-toxic 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: Non-flammable non-toxic gas (green, Class 2.2)
- Subsidiary hazard label: None

14.6 Methods and materials for containment and packaging

- Seamless steel cylinders. Cylinders must comply with applicable national standards (e.g., GB 5099). R410A cylinders must be rated for higher working pressure.
- Common package sizes: 11.3 kg, 22.7 kg, 50 kg, 100 kg cylinders; recovery cylinders.
- Filling coefficient must not exceed 1.1 kg/L.
- Cylinder valve outlet thread direction: right-hand thread for non-flammable non-toxic gases. R410A uses a dedicated valve connection (different from R22 to prevent cross-use).

14.7 Special requirements for different modes of transport

Road transport:

- Vehicles must have hazardous cargo transport license.

- 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.

Rail transport:

- Prohibit hump shunting (no free-roll classification).
- Transport in boxcars; cylinders upright or laid flat and secured.

Marine transport (IMDG Code):

- UN 3162, Class 2.2
- Marine pollutant: No
- Stowage category: A (on deck or under deck)

Air transport (ICAO/IATA DGR):

- UN 3162, Class 2.2
- Non-flammable non-toxic gas
- Acceptable on passenger and cargo aircraft (subject to quantity limits)

14.8 Special precautions for user

- Do not co-transport with oxidizers, reactive metals, 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.

15 Regulatory information

15.1 Safety, health and environmental regulations/legislation specific for the substance or mixture

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)
- **Montreal Protocol Kigali Amendment:** HFC substances listed for phasedown
- **Kyoto Protocol / Paris Agreement:** Listed as greenhouse gas (HFC class)

- **EU REACH Regulation (EC 1907/2006):** Components registered as substances
- **EU CLP Regulation (EC 1272/2008):** Classification, labelling and packaging regulation
- **EU F-Gas Regulation (EC 517/2014):** Fluorinated greenhouse gas controls, HFC phasedown
- **US EPA SNAP Program:** Approved for various refrigeration applications
- **US AIM Act:** HFC phasedown
- **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

15.2 Chemical safety assessment

Chemical Safety Assessment has not been carried out for this mixture 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
- NOAA CAMEO Chemicals Database
- PubChem Compound Database (R32: CID 7757; R125: CID 6448)
- ASHRAE Handbook - Refrigeration Systems and Applications
- ANSI/ASHRAE Standard 34: Designation and Safety Classification of Refrigerants
- 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

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
HFC	Hydrofluorocarbon
n.o.s.	Not Otherwise Specified
IARC	International Agency for Research on Cancer
ACGIH	American Conference of Governmental Industrial Hygienists
STOT	Specific Target Organ Toxicity

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. 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.