Safety data sheet

Printing date 23.09.2025 **Version number 1** **Revision: 23.09.2025**

* SECTION 1: Identification of the substance/mixture and of the company/undertaking

1.1 1 Product identifier

Trade name: R-448A
Article number: R448A
1.2 Relevant identified uses of the substance or mixture and uses advised against:
Sector of Use SU8 Manufacture of bulk, large scale chemicals (including petroleum products)

1.3 Details of the supplier of the safety data sheet
Manufacturer/Supplier:
FRIOFLOR GROUP Co.,Limited:

Phone:+86-15088239500 Fax:+86-570-8076952

Further information obtainable from:
manager@frioflor.com
1.4 Emergency telephone number:
+86-15088239500

* SECTION 2: Hazard identification

2.1 Classification of the substance or mixture
Classification according to Regulation (EC) No 1272/2008



Press. Gas (Comp.) H280 Contains gas under pressure; may explode if heated.

2.2 2 Label elements
Labelling according to Regulation (EC) No 1272/2008:
The product is classified and labelled according to the CLP regulation. Signal word: Warning
Precautionary statements:
P410+P403 Protect from sunlight. Store in a well-ventilated place.

* SECTION 3: Composition/information on ingredients

Information on ingredients:

CAS: 75-10-5 Difluoromethane **26%**
Flam. Gas 1B, H221
Press. Gas (Liq.), H280

CAS: 354-33-6 Pentafluoroethane **26%**
Press. Gas (Liq.), H280

CAS: 811-97-2 1,1,1,2-Tetrafluoroethane **21%**
Press. Gas (Liq.), H280

CAS: 754-12-1 2,3,3,3-tetrafluoro-1-Propene **20%**
Flam. Gas 1B, H221
Press. Gas (Liq.), H280

CAS: 29118-24-9 trans-1,3,3,3-tetrafluoroprop-1-ene **7%**
Press. Gas (Liq.), H280
Additional information: For the wording of the listed hazard phrases refer to section 16.

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SECTION 4: First aid measures

4.1 Description of first aid measures
General information: Seek immediate medical advice.
After inhalation:
Supplyfresh air. If required, provide artificial respiration. Keep patient warm. Consult a doctor if symptoms persist. In case of unconsciousness place patient stably in side position for transportation.
In case of emergency to rescue the victims; be sure to wear supplied-air respirator (SAR) or self-contained breathing apapratus (SCBA).
If the patient does not breathe or hardly breathes, unbutton clothes, secure the airway for breathing and perform artificial respiration.
At high levels, cardiac arrhythmia may occur.
After skin contact:
Rinse with warm water.
Remove contaminated clothes immediately.
In cases of frost bites, rinse with plenty of water. Do not remove clothing.
Immediately rinse with warm water and soap.
Consult a doctor in case of complaints.
After eye contact:
Rinse opened eye for several minutes under running water.
Consult an ophthalmologist in case of complaints.
After swallowing: Not applicable.
Information for doctor:
Catecholamines such as adrenaline, and other compounds having similar effects, should be reserved for emergencies and then used only with special caution.
The examining physician should advise workers taking medications containing catecholamines that they may be at increased risk and should avoid excessive exposure.
4.2 Most important symptoms and effects, both acute and chronic:
Frost bites
High concentrations cause asphyxiation. May cause an abnormal heart rhythm and prove suddenly fatal.
4.3 Indication of any immediate medical attention and special treatment needed:
No further relevant information available.

SECTION 5: Firefighting measures

5.1 1 Extinguishing media
Suitable extinguishing agents: Use fire extinguishing methods suitable for surrounding conditions.
5.2 Special hazards arising from the substance or mixture:
In case of fire, the following can be released:
Hydrogenfluoride (HF)
Formation of toxic gases is possible during heating or in case of fire.
Receptacle may explode when heated.
5.3 Advice for firefighters:
Move receptacle to a safe place immediately if possible. If not, spray water on the receptacles and surrounding equipment to cool.
If receptacle catches fire: cool them with plenty of water.
If possible, close valves of receptacles to shut off the gas supply.
Protective equipment:
Wear fully protective suit.
Wear self-contained breathing apparatus and protective suit.
Do not inhale explosion gases or combustion gases.

SECTION 6: Accidental release measures

6.1 Personal precautions, protective equipment and emergency procedures:
Wear appropriate protective devices (See Section 8 Exposure Controls/Personal Protection). Avoid contact with eyes and skin.
Do not inhale the product.
Ensure adequate ventilation before entering the area.

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Stay on the windward side.
Keep out unauthorized persons.

6.2 Environmental precautions:
Suppress gases/fumes/haze with water spray.
Do not allow to enter sewers/surface or ground water.
Must not be emitted into the environment.

6.3 Methods and material for containment and cleaning up:
Stop leakage if possible.
Ensure adequate ventilation.

6.4 Reference to other sections:
See Section 7for information on safe handling.
See Section 8for information on personal protection equipment.
See Section 13for disposal information.

* SECTION 7: Handling and storage

7.1 Precautions for safe handling:
Waste air is to be released into the atmosphere only via suitable separators.
Do not inhale the gas.
Ensure good ventilation/exhaustion at the workplace.
Handle with care. Avoid jolting, friction and impact.
Stay on the windward side when working outdoors.
Be careful of leakage when attaching/detaching receptacles.
Inhaling large quantities may cause cardiac arrhythmia or asphyxiation or both.
Keep away from naked flame or metal heated over 300 - 400 ℃ to prevent thermal decomposition that may form toxic gases.
Do not handle until all safety precautions have been read and understood.
For heating receptacle, use hot compresses or lukewarm water below 40 ℃.
Do not use heaters.
Information about fire - and explosion protection:
The product is not flammable.
Keep ignition sources away - Do not smoke.
Keep respiratory protective device available.

7.2 Conditions for safe storage, including any incompatibilities:
Storage
Requirements to be met by storerooms and receptacles:
Store material at:
Store material at 5 ℃to 25 ℃.
Store in a cool and dry location.
Keep containers tightly sealed.
Information about storage in one common storage facility:
No further information available.
See section 10for information on incompatible materials.
Further information about storage conditions:
Keep at temperature not exceeding 40 °C.
Protect from heat and direct sunlight.
Store containers in a well ventilated area.
Store locked up.

7.3 Specific end use(s): No further relevant information available.

SECTION 8: Exposure controls/personalprotection

8.1 Control parameters No further information available.
Ingredients with limit values that require monitoring at the work place:
The product does not contain any relevant quantities of materials with critical values that have to be monitored at the workplace.
Additional information: The lists valid during the making were used as basis.

8.2 2 Exposure controls
Appropriate engineering controls No further data; see item 7.

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Individual protection measures, such as personal protective equipment General protective and hygienic measures:
Wash hands before breaks and at the end of work.
Do not eat or drink while working.
Keep away from tobacco products.
Respiratory protection: Use respiratory protective device with organic gas cartridge. Hand protection

Protective gloves

To avoid skin problems reduce the wearing of gloves to the required minimum.
Material of gloves:
The selection of the suitable gloves does not only depend on the material, but also on further marks of quality and varies from manufacturer to manufacturer. As the product is a preparation of several substances, the resistance of the glove material can not be calculated in advance and has therefore to be checked prior to the application.
Leather
Penetration time of glove material
The exact break trough time has to be found out by the manufacturer of the protective gloves and has to be observed. Eye/face protection

Safety glasses

Body protection: Protective work clothing

* SECTION 9: Physical and chemicalproperties

9.1 Information on basic physical and chemical properties

General Information	
Physical state	**Gaseous**
Colour:	**Colourless**
Odour:	**Odourless**
Odour threshold:	**Not determined.**
Melting point/freezing point:	**Undetermined.**
Boiling point or initial boiling point and boiling range	**-45.9 °C**
Flammability	**Product is not flammable.**
Lower and upper explosion limit	
Lower explosive limit:	**None**
Upper explosive limit:	**None**
Flashpoint:	**Not applicable.**
Decomposition temperature:	**>250 °C**
pH	**Not determined.**
Viscosity:	
Kinematic viscosity	**Not determined.**
Dynamic:	**Not determined.**
Solubility	
water:	**Nofurther information available.**
Partition coefficient n-octanol/water (log value)	**Nofurther information available.**
Vapourpressure at 25 °C:	**12900 hPa (saturation steam pressure)**
	Nofurther information available. Density and/or relative density
Density:	**Not determined.**
Relative density	**Not determined.**
Vapour density	**Not determined.**
Particle characteristics	**Nofurther information available.**

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9.2 Other information:

Form:	Liquefied gas
Auto-ignition temperature:	628 °C
Explosive properties:	Not determined. Not applicable.
Evaporation rate	
Information with regard to physical hazard classes Explosives	Not applicable Not applicable
Flammable gases	Not applicable
Aerosols	Not applicable
Oxidising gases	Contains gas under pressure; may explode if heated. Not applicable
Gases under pressure Flammable liquids	Not applicable Not applicable
Flammable solids	Not applicable
Self-reactive substances and mixtures Pyrophoric liquids	Not applicable Not applicable
Pyrophoric solids	
Self-heating substances and mixtures	
Substances and mixtures, which emitflammable gases in contact with water	Not applicable
Oxidising liquids	Not applicable
Oxidising solids	Not applicable
Organic peroxides	Not applicable
Corrosive to metals	Not applicable
Desensitised explosives	Not applicable

SECTION 10: Stability and reactivity

10.1 Reactivity No further relevant information available.

10.2 Chemical stability

Thermal decomposition / conditions to be avoided: To avoid thermal decomposition do not overheat.

10.3 Possibility of hazardous reactions: No dangerous reactions known under normal conditions of use.

10.4 Conditions to avoid: Keep awayfrom heat, sparks,flame, high temperature.

10.5 Incompatible materials: Alkali or alkaline earth metals - powdered Al, Zn, Mg, etc.

10.6 Hazardous decomposition products:

Fluorophosgene in contact with nakedflame or red hot objects.

Hydrofluoric acid, carbonylfluoride

* SECTION 11: Toxicological information

11.1 Information on hazard classes as defined in Regulation (EC) No 1272/2008 Acute toxicity Based on available data, the classification criteria are not met.

LD/LC50 values relevant for classification:

CAS: 75-10-5 Difluoromethane

Inhalative LC0/4h > 520000 ppm (Rat) (OECD 403)

CAS: 354-33-6 Pentafluoroethane

Inhalative LC50/4h > 800000 ppm (Rat)

CAS: 811-97-2 1,1,1,2-Tetrafluoroethane Inhalative LC50/4h > 500000 ppm (Rat)

CAS: 754-12-1 2,3,3,3-tetrafluoro-1-Propene

Inhalative LC50 > 400000 ppm (Rat) (OECD 403)

CAS: 29118-24-9 trans-1,3,3,3-tetrafluoroprop-1-ene Inhalative LC50/4h > 207000 ppm (Rat)

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Skin corrosion/irritation:
Nofurther information available.
Based on available data, the classification criteria are not met.
CAS:354-44-6 Pentafluoroethane The substance is not classified based on the results of tests using rabbits which showed slight irritation (PA T T Y (5 t h , 2 0 0 1)) or no irritation (ECETOC JACC no. 50).
CAS:811-97-2 1,1,1,2-tetrafluoroethane The substance is not classified based on the results of tests using rabbits which showed slight irritation (PA T T Y (5 t h , 2 0 0 1)) or no irritation (ECETOC JACC no. 50).
CAS:29118-24-9 trans-1,3,3,3-tetrafluoroprop-1-ene No skin irritation Rabbit (OECD 404)
Serious eye damage/irritation:
Nofurther information available.
Based on available data, the classification criteria are not met.
CAS:74-10-5 Difluoromethane No information available to indicate irritation.
CAS:811-97-2 1,1,1,2-tetrafluoroethane Not classified due to slight irritation (P A T T Y (5 t h , 2 0 0 1)) and no irritation (ECETOC JACC no. 50) in tests on rabbits.
after inhalation: Nofurther information available.
Respiratory or skin sensitisation:
Based on available data, the classification criteria are not met.
CAS:74-10-5 Difluoromethane No information on sensitisation.
CAS:811-97-2 1,1,1,2-tetrafluoroethane No sensitisation (ECETOC JACC № 50)
Germ cell mutagenicity:
Based on available data, the classification criteria are not met.
CAS:811-97-2 1,1,1,2-tetrafluoroethane As a result of dominant lethal test, micronucleus test and chromosome aberration test in mice by inhalation exposure, all of them came out negative, it was classified out of category. (ECETOC JACC no.50)
Carcinogenicity:
Based on available data, the classification criteria are not met.
CAS:811-97-2 1,1,1,2-tetrafluoroethane The substance is not considered to be carcinogenic as no tumours have been observed in inhalation chronic toxicity and carcinogenicity studies in rats due to exposure testing. (ECETOC JACC no.50)
Reproductive toxicity:
Based on available data, the classification criteria are not met.
CAS:74-10-5 Difluoromethane 50000 ppm (rats and rabbits)
Reproductive NOAEC (inhalation): 208000 mg/m3 (mouse) (OECD 478; read across)
Developmental NOAEC (inhalation): 105000 mg/m3 (rat)
CAS:754-12-1 2,3,3,3-Tetrafluoro-1-propene Two-generation reproductive toxicity Inhalation
Rat NOAEL, Parent 50000ppm
NOAEL, F1 50000ppm
NOAEL, F2 50000ppm
catalytic formality NOAEL 50000ppm (rat) NOAEL 4000ppm (rabbit)
STOT-single exposure:
Based on available data, the classification criteria are not met.
CAS:811-97-2 1,1,1,2-tetrafluoroethane Cannot be classified due to lack ofsufficient data.
STOT-repeated exposure:
Based on available data, the classification criteria are not met.
CAS:811-97-2 1,1,1,2-tetrafluoroethane No adverse effects have been reported in studies on rats, mice or dogs.(ECETOC JACC no.50). Not classified
CAS:29118-24-9 trans-1,3,3,3-tetrafluoroprop-1-ene NOEL 5000ppm (Heart) Rat Inhalation 13weeks
Aspiration hazard:
Based on available data, the classification criteria are not met.
CAS:811-97-2 1,1,1,2-tetrafluoroethane No adverse effects have been reported in studies on rats and mice. (ECETOC JACC no. 50)
Other information (about experimental toxicology): Nofurther information available.
Subacute to chronic toxicity: Nofurther information available.
Additional toxicological information:
CMR effects Not genotoxic

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11.2 Information on other hazards:
Endocrine disrupting properties:

None of the ingredients is listed.
Other information
CAS:74-10-5 Difluoromethane
Cardiac sensitisation NOAEC: 735000 mg/m3
Increasing the aerial concentration to 35% did not induce cardiac sensitisation to adrenaline in dogs.
Ames test: negative (OECD 471)
Chromosome aberration test: Negative (OECD 473)
Mouse micronucleus test: Negative (OECD 474)
Chronic toxicity (inhalation) NOAEC: 50000 ppm (Rat) 90 day 105000 mg/m3 (OECD 413)
CAS:354-44-6 Pentafluoroethane
Cardiac sensitisation: 75000 ppm (Dog)
Developmental NOAEL: 50000 ppm (Rat and rabbit)
Chronic toxicity NOAEC 50000 ppm (Rat) (13 weeks)
CAS:811-97-2 1,1,1,2-tetrafluoroethane
Heartfelt Sense Making 75000 ppm (Dog)
Hepta 300000, 40000 ppm (Rat and rabbit)
chronic toxicity NOEL : 10000 ppm (Rat) (two-year study)
subchronic toxicity NOAEC 50000 ppm (Rat) (13weeks)
CAS:754-12-1 2,3,3,3-Tetrafluoro-1-propene
Repeated dose NOAEL 50000ppm Rat Inhalation 13weeks (OECD 413)
Ames test Positive
Irregular DNA synthesis test Negative (OECD486)
Micronucleus test Negative (rat OECD474)
CAS:29118-24-9 trans-1,3,3,3-tetrafluoroprop-1-ene
No cardiac sensitisation Canine
Chromosome aberration test Negative Chinese hamster ovary cells
Negative Human lymphocytes (OECD 473)
Ames test negative
Micronucleus test negative Mouse
No teratogenicity Rabbit, rat

* SECTION 12: Ecological information

12.1 Toxicity
Aquatic toxicity:

CAS: 75-10-5 Difluoromethane
LC50/96h 1507 mg/l (Fish) (QSAR)
LC50/48h 652 mg/l (Daphnia) (QSAR)
EC50/96h 142 mg/l (Alga) (QSAR)

CAS: 811-97-2 1,1,1,2-Tetrafluoroethane
LC50/96h 450 mg/l (Fish) (EUMethod C.1)
rainbow trout
EC50/48h 980 mg/l (Daphnia) (EUMethod C.2)

CAS: 754-12-1 2,3,3,3-Tetrafluoro-1-propene
LC50/96h > 197 mg/l (Fish) (OECD 203)
EC50/48h > 100 mg/l (Daphnia) (OECD 202)
EC50/72h > 100 mg/l (Alga) (OECD 201)
NOEC > 75 mg/l /3 days (Alga) (OECD 201)

CAS: 754-12-1 2,3,3,3-tetrafluoro-1-Propene
LC50/96h > 197 mg/l (Fish) (OECD 203)

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EC50/48h > 83 mg/l (Daphnia) (OECD 202)
EC50 > 83100 mg/l (Alga) (OECD 201)

CAS: 29118-24-9 trans-1,3,3,3-tetrafluoroprop-1-ene
LC0/96h > 117 mg/l (Fish) (Cyprinus carpio (OECD 203))
EC50/48h > 160 mg/l (Daphnia) (Daphnia magna (OECD 202))
NOEC > 170 mg/l (Alga) (72h) (OECD 201)
12.2 Persistence and degradability: No further relevant information available.
12.3 Bioaccumulative potential: Non significant accumulation in organisms
12.4 Mobility in soil:

CAS: 75-10-5 Difluoromethane
Henry's law constant 295 *h*Pa*m³/mol (air) (25 °C)
log Koc 0.17 (soil)
12.5 Results of PBT and vPvB assessment PBT:
No further relevant information available.
vPvB: No further relevant information available.
12.6 Endocrine disrupting properties The product does not contain substances with endocrine disrupting properties.
12.7 Other adverse effects:
Ecotoxical effects: no data
Additional ecological information:
CAS:74-10-5 Difluoromethane Slightly degradable 5% (28days) (OECD 301 D)
CAS:754-12-1 2,3,3,3-Tetrafluoro-1-propene Persistent (OECD 301F)
CAS:29118-24-9 trans-1,3,3,3-tetrafluoroprop-1-ene Persistent
General notes:
Global warming potential(GWP) : 1386(CO2=1 100year integrated value)(IPCC 4th report estimate) CAS:74-10-5 Difluoromethane
Half-life in air: 1237 days
Ozone depletion factor: 0 (assuming CFC-11 is 1.0)
Global Warming Potential: 675 (assuming CO2 = 1, integrated over 100 years) (IPCC AR4)
CAS:354-44-6 Pentafluoroethane
Ozone depletion factor = 0 (assuming CFC-11 as 1.0)
Global Warming Potential: 3500 (assuming CO2=1, integrated over 100 years) (IPCC AR4)
CAS:811-97-2 1,1,1,2-tetrafluoroethane
Ozone depletion factor = 0 (assuming CFC-11 as 1.0)
Global Warming Potential: 1430 (assuming CO2=1, integrated over 100 years) (IPCC AR4)

SECTION 13: Disposal considerations

13.1 Waste treatment methods
Recommendation:
Disposal must be made according to official regulations.
Incineration in an adequate incinerator is recommended.

Uncleaned packaging
Recommendation: Disposal must be made according to official regulations.

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SECTION 14: Transport information

14.1 UN number orID number
ADR, IMDG, IATA UN3163
14.2 UN proper shipping name:
ADR, IMDG, IATA LIQUEFIED GAS, N.O.S.

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Trade name: R-448A

14.3 Transport hazard class(es):

ADR



Class:	**2 2A Gases.**
Label:	**2.2**

IMDG, IATA



Class:	**2 Gases.**
Label:	**2.2**
14.4 Packing group:	
ADR, IMDG, IATA	**Not applicable**
14.5 Environmental hazards:	
Marine pollutant:	**No**
14.6 Special precautions for user:	**Warning: Gases.**
Hazard identification number (Kemler code):	**20**
EMS Number:	**F-C,S-V**
Stowage Category	**A**
14.7 Maritime transport in bulk according to IMO instruments	**Not applicable.**
Transport/Additional information:	**Avoid direct sunlight. Make sure of no damage, corrosion, leaks on the receptacles. Take necessary measures for preventing cargo shift. ADR**
Limited quantities (LQ):	**120 ml**
Excepted quantities (EQ)	**Code: E1 Maximum net quantity per inner packaging: 30 ml Maximum net quantity per outer packaging: 1000 ml**
Transport category:	**3**
Tunnel restriction code:	**C/E**
IMDG	
Limited quantities (LQ)	**120 ml**
Excepted quantities (EQ)	**Code: E1 Maximum net quantity per inner packaging: 30 ml Maximum net quantity per outer packaging: 1000 ml**
UN "Model Regulation":	**UN 3163 LIQUEFIED GAS, N.O.S., 2.2**

* SECTION 15: Regulatory information

15.1 Safety, health and environmental regulations/legislation specific for the substance or mixture No further relevant information available.
Labelling according to Regulation (EC) No 1272/2008
The product is classified and labelled according to the CLP regulation.
Hazard pictograms



GHS04

Signal word Warning

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Hazard statements
H280 Contains gas under pressure; may explode ifheated.
Precautionary statements
P410+P403 Protect from sunlight. Store in a well-ventilated place.
DIRECTIVE 2011/65/EU on the restriction of the use of certain hazardous substances in electrical and electronic equipment – Annex II

None of the ingredients is listed.
Annex I - RESTRICTED EXPLOSIVES PRECURSORS (Upper limit value for the purpose of licensing under Article 5(3))

None of the ingredients is listed.
Annex II- REPORTABLE EXPLOSIVES PRECURSORS

None of the ingredients is listed.

National regulations No further information available.
15.2 Chemical safety assessment: A Chemical Safety Assessment has not been carried out.

* SECTION 16: Other information

The product is for the industrial use only. We do not guarantee the safety in case the product is used for the other purposes. When using the product for health-care application or food/feed application, consult us in advance.
This information is based on our present knowledge. However, this shall not constitute a guarantee for any specific product features and shall not establish a legally valid contractual relationship.