

1. Identification of the substance/mixture and of the company/undertaking**1.1 Product identifier**

Commercial name	R407C
Our code	TR407
Chemical description	Mixture composed of 1,1,1,2-Tetrafluoroethane (HFC R134a), Pentafluoroethane (HFC R125), Difluoromethane (HFC R32) Chemical formula: C ₂ H ₂ F ₄ + C ₂ HF ₅ +CH ₂ F ₂

1.2 Relevant identified uses of the substance or mixture and uses advised against

Industrial sector	Refrigeration and Air-conditioning
Relevant identified uses	Refrigerant gas for refrigeration and air-conditioning systems
Application	Industrial and professional

1.3 Details of the supplier of the safety data sheet

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1.4 Emergency telephone number:

MARIEL Srl	+39 0322 838319	Mon/Fri: 8.30-12.00 / 13.30-17.30
CAV-CNIC Anti-poison National Information Centre	+39 0382 24444	Hours: 24 h / 24 h

2. Hazards identification**2.1 Classification of the substance or mixture**



H280: Contains gas under pressure; may explode if heated

2.2 Label elements**Dangerous pictogram**

GHS04

Signal word	Warning	
Hazard statements (H)	H280	Contains gas under pressure; may explode if heated.
Precautionary statements (P)	P410	Protect from sunlight.
	P403	Store in a well-ventilated place.
Other information	Contains greenhouse gases disciplined by Kyoto Protocol	

2.3 Other hazards

Vapours are heavier than air and can cause rapid suffocation by reducing oxygen available for breathing.
Contact with liquid can cause frostbite and severe damage to the eyes.

3. Composition/information on ingredients

3.2 Mixtures

Substance name	%	CAS No.	EC No.	REACH No.	Classification Reg. (EC) 1272/2008 (CLP) and Directive 67/548/EEC
1,1,1,2-Tetrafluoroethane	> =52%	811-97-2	212-377-0	01-2119459374-33-0012	Press. Gas (Liq.), H280
Pentafluoroethane	> =25%	354-33-6	206-557-8	01-2119485636-25-0025	Press. Gas (Liq.), H280
Difluoromethane	> =23%	75-10-5	200-839-4	01-2119471312-47-0024	Flam. Gas 1, H220 Press. Gas (Liq.), H280 F+ ; R12

For more information, see sections 8, 11, 12 and 16.

4. First aid measures



General information: If the person is unconscious, place it in the recovery position and get immediately medical attention. Take off all contaminated clothing immediately. Do not give anything to an unconscious person. If breathing is irregular, give oxygen. If breathing stopped, administer artificial respiration. If symptoms persist, call a physician.

Notes to physician: Do not give adrenaline-ephedrine or similar drugs group.

4.1 Description of first aid measures

Inhalation	Move to fresh air. If breathing is difficult, give oxygen. Call a physician.
Skin contact	The rapid evaporation of the liquid may cause frostbite. In case of contact with skin, thaw frosted parts with water, then remove clothing carefully. Consult a physician in case of persistent pain.
Eye contact	Remove contact lenses. Immediately flush eyes with plenty of water, also under the eyelids, for at least 15 minutes. Consult a doctor.
Ingestion	Ingestion is unlikely because of the physical properties and is not expected to be hazardous (gas). Refer to the inhalation section.

4.2 Most important symptoms and effects, both acute and delayed

In high concentrations may cause asphyxiation. Symptoms may include loss of mobility/consciousness. Victim may not be aware of asphyxiation. In low concentrations may cause narcotic effects. Symptoms may include dizziness, headache, nausea and loss of co-ordination

5. Firefighting measures

5.1 Extinguishing media

Suitable extinguishing media	Water spray, alcohol-resistant foam, dry chemical or CO2
No suitable extinguishing media	None to our knowledge.

5.2 Special hazards arising from the substance or mixture

Specific hazards Contents under pressure.

On heating: heating will cause a rise in pressure with a risk of bursting. Toxic and corrosive vapours are released.

Cool down the containers exposed to heat with a water spray.

Vapours are heavier than air and can cause rapid suffocation by reducing oxygen available for breathing.

5.3 Advice for firefighters

Wear self-contained positive pressure breathing apparatus (SCBA) and protective suit.

Avoid contact with skin and eyes.

Do not breathe gas/fumes/vapour.

Other information

Use extinguishing measures that are appropriate to local circumstances and the surrounding environment.

For more information, see section 10.

6. Accidental release measure

6.1 Personal precautions, protective equipment and emergency procedures

Immediately contact emergency personnel.

Immediately evacuate personnel to safe areas. Unprotected persons must be kept away.

Wear personal protective equipment refer to section 8 "Exposure controls/personal protection".

Remove all sources of ignition.

Avoid contact with skin (possible frostbite).

Ventilate the area/local. In case of insufficient ventilation, wear self-contained breathing apparatus.

6.2 Environmental precautions

Do not allow product to spread into the environment.

Avoid spillage and prevent possible losses.

6.3 Methods and material for containment and cleaning up

Ventilate / aerate the area or local.

6.4 Reference to other sections

For further information on personal protection, refer to section 8 and 13.

7. Handling and storage

7.1 Precautions for safe handling

Technical measures Handle and open container with care. Caution when opening, pressurized container.
 Protect from sunlight and do not expose to temperatures exceeding 50° C (122 °F).
 Do not spray on a naked flame or any incandescent material.
 Do not use in area without adequate ventilation.
 Do not pierce or burn, even after use.
 Follow the general precautions for handling, storing, and using compressed gases.

Industrial hygiene Ensure adequate ventilation of the working area.
 Do not drink, eat or smoke in the working area.

7.2 Conditions for safe storage, including any incompatibilities

Requirements for storage areas and containers

Keep containers tightly closed in a dry, cool and well-ventilated place, away from any ignition or heat sources.

Store in original container. Protect from sunlight and do not expose to temperatures exceeding 50° C (122 °F).

7.3 Specific end use(s)

For professional and industrial use only.

8. Exposure controls/personal protection

8.1 Control parameters

OEL (Occupational Exposure Limit): No exposure limit was defined for any components of the mixture.

Components	CAS No.	TLV-TWA	Parameters	Font	Year
1,1,1,2-Tetrafluoroethane	811-97-2	8 h	4,240 mg/m ³ 1,000 ppm	AGCIH	OES (UK) 2002
		15 min.	9,740 mg/m ³ 1,250 ppm		
Pentafluoroethane	354-33-6	8 h	4.900 mg/m ³ 1,000 ppm	ACGIH (WEEL)	//
Difluoromethane	75-10-5	8 h	2.200 mg/m ³ 1.000 ppm	ACGIH (WEEL)	1995 - 1996

DNEL			
Component	CAS No.	Inhalation	
1,1,1,2-Tetrafluoroethane	811-97-2	DNEL – Workers DNEL – Consumers	13936 mg/m ³ (long-term exposure – systemic effects) 2476 mg/m ³ (long-term exposure – systemic effects)
Pentafluoroethane	354-33-6	DNEL- Workers DNEL – Consumers	16444 mg/m ³ (long-term exposure – systemic effects) 1753 mg/m ³ (long-term exposure – systemic effects)
Difluoromethane	75-10-5	DNEL – Workers DNEL - Consumers	7035 mg/m ³ (long-term exposure – systemic effects) 750 mg/m ³ (long-term exposure – systemic effects)

PNEC			
Component	CAS No.	PNEC values	
1,1,1,2-Tetrafluoroethane	811-97-2	0,1 mg/l 0,01 mg/l 0,75 mg/kg 73 mg/l	Fresh water Marine water Fresh water sediment Sew age treatment plant
Pentafluoroethane	354-33-6	0,1 mg/l 0,6 mg/kg dw*	Fresh water Fresh water sediment
Difluoromethane	75-10-5	0,142 mg/l 0,534 mg/kg dw* 1,42 mg/l	Fresh water Fresh water sediment Intermittent release

*dry weight

8.2 Exposure controls

Ensure adequate ventilation. In case of insufficient ventilation, wear self-contained breathing apparatus.

Wash the hands before and after using the gas. Do not smoke.

Personal protective equipment must comply with EU directives: respiratory protective equipment EN 136, 140, 149; eye protection (protective goggles or safety glasses) EN 166; skin protection EN 340, 463, 468, 943-1, 943-2; hands protection (protective gloves) EN374, safety boots EN ISO 20345.

8.2.2 Individual protection measures, such as personal protective equipment

a) Eye/face protection

Safety glasses with side-shields (according to directive EN 166).

b) Skin protection

i) Hand protection

It is recommended to use protective gloves against cold. (EN 511).

The penetration time of the gloves must be greater than the period of expected use. Gloves should be replaced immediately if they show signs of wear or deterioration.

ii) Other

Wear safety shoes while handling containers.

Apron or protective clothing are not necessary.

c) Respiratory protection

The vapours are heavier than air and can cause asphyxia caused to an reduction of oxygen level. In case of insufficient ventilation, wear self-contained breathing apparatus (EN 133).



8.2.3. Environmental exposure controls

Handling in accordance with good industrial hygiene and safety practice.

Avoid leakage or spillage in the environmental.

Avoid dispersion in the air.

For more information, see section 7 and 13.

9. Physical and chemical properties

9.1 Information on basic physical and chemical properties

a) Appearance	Liquefied gas
Colour	Colorless
b) Odour	Ethereal
c) Odour threshold	Odour threshold is subjective and inadequate to warn for overexposure
d) pH	n.a.
e) Melting point (°C)	- 101 °C (- 149.8 °F) 1,1,1,2-Tetrafluoroethane - 103 °C (- 154.4 °F) Pentafluoroethane - 136 °C (- 212.8 °F) Difluoromethane
f) Initial boiling point	- 43,9 °C (- 47.02 °F)
g) Flash point	n.a.
h) Evaporation rate	Not applicable to gas and gas mixtures
i) Flammability (solid, liquid)	n.a.
j) Upper/Lower flammability	n.a.
k) Vapour pressure	16,53 bar @ 20 °C (68 °F)
l) Vapour density	1,16 g/cm ³ @ 21,1°C (70 °F)
m) Relative density	Heavier than air (air=1)
n) Solubility (in the water)	1930 1,1,1,2-Tetrafluoroethane 280000 Pentafluoroethane 900 Difluoromethane
o) Partition coefficient: n-Octanol/water	1,06 log Pow 1,1,1,2-Tetrafluoroethane 1,48 log Pow Pentafluoroethane 0,21 log Pow Difluoromethane
q) Auto-ignition temperature	Not applicable to gas and gas mixtures
r) Decomposition temperature	Not applicable to gas and gas mixtures
s) Viscosity	n.a.
t) Explosive properties	n.a.
u) Oxidising properties	n.a.

10. Stability and reactivity

10.1 Reactivity

Stable under normal handling and storage conditions.

10.2 Chemical stability

Stable under normal handling and storage conditions.

10.3 Possibility of hazardous reactions

The product is non-reactive under normal handling and storage conditions.

10.4 Conditions to avoid

Contains gas under pressure, may explode if heated.

Protect from sunlight and do not expose to temperatures exceeding 50 °C.

Keep away from heat, sparks, open flame or other sources of ignition. Do not smoke.

Do not pierce or burn, even after use.

Do not spray on a naked flame or any incandescent material.

10.5 Incompatible materials

No reaction with common materials in dry or wet conditions.

Avoid contact with alkaline and caustic products, alkaline-earth metals (e.g. calcium, aluminum powder, zinc and magnesium).

10.6 Hazardous decomposition products

No hazardous decomposition under normal conditions.

In case of fire, for thermal decomposition, the following substances can be released: halogen acids, carbon oxides (CO, CO₂), fluorocarbons, carbonyl halides.

11. Toxicological information

11.1 Information on toxicological effects

a) Acute toxicity

Inhalation

1,1,1,2-Tetrafluoroethane	LC50: > 500 000 ppm Exposure time: 4 h Animal species: Rat
Pentafluoroethane	LC50: > 800 000 ppm (OECD 403) Exposure time: 4 h Animal species: Rat
Difluoromethane	LC50: > 520 000 ppm (OECD 403) Exposure time: 4 h Animal species: Rat

b) Skin corrosion/Skin irritation Based on available data the classification criteria are not met.

c) Serious eye damage/irritation Based on available data the classification criteria are not met.

d) Respiratory or skin sensitisation

1,1,1,2-Tetrafluoroethane	LC50: > 500 000 ppm Exposure time: 4 h Animal species: Rat
Pentafluoroethane	LC50: > 800 000 ppm Exposure time: 4 h Animal species: Rat
Difluoromethane	LC50: > 520 000 ppm Exposure time: 4 h Animal species: Rat

e) Germ cell mutagenicity

in vitro genotoxicity

1,1,1,2-Tetrafluoroethane	In vitro tests no showed mutagenic effects.
Pentafluoroethane	Test: Ames Result: Negative
Difluoromethane	Test: Ames Result: Negative

in vivo genotoxicity

Difluoromethane	Exposed tissue: Bone marrow Method: Mutagenicity (micronucleus test) Result: Negative Animal species: Mouse
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f) Carcinogenicity Based on available data the classification criteria are not met.

g) Reproductive toxicity

1,1,1,2-Tetrafluoroethane	Inhalation NOAEC: 208 000 mg/m ³ Animal species: Rat
Difluoromethane	Inhalation NOAEC: 208 000 mg/m ³ Animal species: Rat

h) STOT-single exposure Based on available data the classification criteria are not met.

i) STOT-repeated exposure

1,1,1,2-Tetrafluoroethane	Inhalation (experimental result, support study) NOAEL: 100 000ppm Animal species: Rat
Pentafluoroethane	Inhalation (experimental result, support study) NOAEL: ≥ 50 000ppm Animal species: Rat

Difluoromethane Inhalation (experimental result, support study)
NOAEL: 49 500 ppm
Exposition time: 28 days
Animal species: Rat

11.2 Other information

1,1,1,2-Tetrafluoroethane Cardiac sensitization.
NOAEC: 40 000 ppm
LOAEL: 80 000 ppm
Animal species: Dog

Pentafluoroethane Cardiac sensitization.
NOAEC: 100 000 ppm
LOAEC: 75 000 pp;
Animal species: Dog

Difluoromethane Cardiac sensitization.
NOAEC: 350 000 ppm
LOAEC: >350 000 ppm
Animal species: Dog

12. Ecological information

12.1 Toxicity

Fish

1,1,1,2-Tetrafluoroethane LC50: 450 mg/l
Exposition time: 96 h
Species: *Oncorhynchus mykiss* (Rainbow trout)

Pentafluoroethane LC50: > 100 mg/l
Exposition time: 96 h
Species: *Oncorhynchus mykiss* (Rainbow trout)

Difluoromethane LC50: 1.045 mg/l
Exposure time: 96 h
Species: *Pimephales promelas*
Remarks: QSAR, supporting study

Aquatic invertebrates

1,1,1,2-Tetrafluoroethane EC50: 980 mg/l
Exposition time: 48 h
Species: *Daphnia magna* (Water flea)

Pentafluoroethane EC50: > 100 mg/l
Exposition time: 48 h
Species: *Daphnia magna* (Water flea)

Difluoromethane EC50: 1.573 mg/l
Exposure time: 48 h
Species: *Daphnia magna* (Water flea)
Remarks: QSAR, supporting study

Algae

1,1,1,2-Tetrafluoroethane EC50: > 118 mg/l
Exposition time: 72 h
Species: *Selenastrum capricornutum* (Fresh water algae)

Pentafluoroethane EC50: > 114 mg/l
Exposition time: 72 h
Species: *Selenastrum capricornutum* (Fresh water algae)

Difluoromethane EC50: 142 mg/l
Exposure time: 96 h
Species: Algae

12.2 Persistence and degradability

The mixture is not easily biodegradable.

1,1,1,2-Tetrafluoroethane Water: 3% of biodegradation after 28 days - Air: average life of 9.7 years
 Pentafluoroethane Water: 5% of biodegradation after 28 days - Air: average life of 28.3 years (estimated value)
 Difluoromethane Water: 5% of biodegradation after 28 days - Air: average life of 4 years

12.3 Bioaccumulative potential

1,1,1,2-Tetrafluoroethane 1,06 log Pow
 Pentafluoroethane 1,48 log Pow
 Difluoromethane 0,21 log Pow

12.4 Mobility in soil

1,1,1,2-Tetrafluoroethane 1,50 log Koc
 Pentafluoroethane 1,30 – 1,70 log Koc
 Difluoromethane No data available

12.5 Results of PBT and vPvB assessment

Not classified as PBT or vPvB.

12.6 Other adverse effects

Ozone Depletion Potential ODP (R-11=1) = 0
 Global Warming Potential GWP (CO2=1) = 1.774

13. Disposal consideration

13.1 Waste treatment methods

Product Take all necessary measures to prevent the production of residuals, value the possible methods of regeneration or recycling. Dispose in accordance with local, state, and federal regulations. Do not discharge into drains or environment.
 Packaging Reuse and recycle the packaging after its reclaim. Dispose of non-reusable packaging in accordance with local, state, and federal regulations.

European Waste Code (EWC)

Product 14 06 01: organic solvents, refrigerants and foam / aerosol propellants of waste-chlorofluorocarbons, HCFC, HFC.
 Packaging 15 01 11: metallic packaging containing a hazardous solid porous matrix (for example asbestos), including empty pressure containers.

Additional information

Waste directives and regulations: Directive 2006/12/CE, Directive 91/689/CE, Regulation (EC) no. 1013/2006.
 Dispose of waste product in compliance with EC, state and/or local regulations.
 For more information, see section 8.

14. Transport information

14.1 UN Number UN 3340
 14.2 UN proper shipping name Refrigerant gas R407C

Hazard labels
 ADR/RID, IMDG, IATA/ICAO



2.2 Non-flammable, non-toxic gas

Transport by road (ADR) / Transport by rail (RID)

14.3 Transport hazard class(es)	2
Classification code	2A
Kemler code	20

14.4 Packing group <i>Packing instruction</i>	P200
14.5 Environmental hazards	No
Additional information <i>Tunnel restriction code of total load</i>	Code C/E - Tank carriage: Passage forbidden through tunnels of category C, D & E Code E (Other carriage): Passage forbidden through tunnels of category E

Transport by air (IATA/ICAO)

14.3 Transport hazard class(es) <i>Division</i>	2 2.2
14.4 Packing group <i>Packing instruction (Passengers and Cargo)</i> <i>Passengers and Cargo flights</i> <i>Only Cargo flights</i>	200 200 200
14.5 Environmental hazards	No

Transport by sea (IMDG)

14.3 Transport hazard class(es) <i>Division</i> <i>Emergency Schedule (EmS)</i>	2 2.2 F-C; S-V
14.4 Packing group <i>Packing instruction</i>	P200
14.5 Environmental hazards	No

14.6 Special precautions for user

Avoid transport on vehicles where the load space is not separated from the driver's compartment.
Ensure vehicle driver is aware of the potential hazards of the load and knows what to do in the event of an accident or an emergency.
Ensure that containers are firmly secured.
Ensure there is adequate ventilation.

14.7 Transport in bulk according in Annex II of MarPol and the IBC Code

Not applicable.

15. Regulatory information

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

Ozone Depletion Potential ODP (R-11=1) = 0
Global Warming Potential GWP (CO2=1) = 1.774

Additional regulations/legislations

Regulation (UE) n. 517/2014
Seveso Directive: 2012/18/UE (Seveso III): Not included

15.2 Chemical safety assessment

A Chemical Safety Assessment (CSA) has not been carried out.

16. Other information

This Material Safety Data Sheet has been made according EU regulation in force.

Full text of H and P phrases in section 2 and 3

H220 Extremely flammable gas
H280 Contains gas under pressure; may explode if heated.
P410 Protect from sunlight.
P403 Store in a well-ventilated place.

Text of “Security code” in section 3; under Regulation (EC) 1272/2008 (CLP) and Classification n. 67/548/EEC

Press. Gas (Liq.) Pressurized gas : Liquefied gas
 F+ ; R12 Extremely Flammable

History	Version 4 by Mariel Srl Revision date: 05/2019	Version 3 Date: 09/2018	Version 2 Date: 07/2013	Version 1 Date: 09/2008
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b) Abbreviations and acronyms

ADR	Accord Dangerous Route
CAS	Chemical Abstracts Service
CE / EC	European Community
CLP	Classification, Labelling and Packaging
CSA	Chemical Safety Assessment
DNEL	Derived No-Effect Level
EC50	Effective Concentration 50%
EmS	Emergency Schedule
EWC	European Waste Code
GHS	Globally Harmonised System
GWP	Global Warming Potential
HCFC	Hydro-Chloro-Fluoro-Carbons
HFC	Hydro-Fluoro-Carbons
IATA	International Air Transport Association
IBC code	International Bulk Chemical code
ICAO	International Civil Aviation Organization
IMDG code	International Maritime Dangerous Goods code
LC50	Lethal Concentration 50%
LOAEC	Lowest Observed Adverse Effect Concentration
MARPOL	MARitime POLLution
Log Koc	Logarithm Partition coefficient Soil/Water
Log Kow (Pow)	Logarithm Partition coefficient n-Octanol/Water
n.a.	not applicable
n.d.a.	no data available
NOAEC	No Observed Adverse Concentration Level
NOAEL	No Observed Adverse Effect Level
ODP	Ozone Depleting Potential
OECD	Organisation for Economic Cooperation and Development
OEL	Occupational Exposure Limit
PBT	Persistent Bio-accumulative Toxic
PNEC	Predicted No Effect Concentration
REACH	Registration, Evaluation, Authorisation and Restriction of Chemicals
RID	Rail International Dangerous Goods
STOT-RE	Specific Target Effect Concentration - repeated exposure
STOT-SE	Specific Target Effect Concentration - single exposure
TLV	Threshold Limit Value
TWA	Time Weighted Average
UE / EU	European Union
vPvB	very Persistent very Bioaccumulative
WEEL	Workplace Environmental Exposure Level

Notice of liability

This information should not constitute a guarantee for any specific product properties. This information are only a guidance for safe handling, use, processing, storage, transportation, disposal and release and are not to be considered a warranty or a quality specification.

The information contained in this safety data sheet are based on our current knowledge and EU and national laws; they describe the product only with regard to safety requirements. The conditions of the user are beyond our knowledge and control. The product should not be used for purpose other than those specified. It is always the responsibility of the user to take all the necessary measures to comply with the requirements of current legislation. The information contained in this form should not considered as a guarantee of its properties.