1. Identification of the substance/mixture and of the company/undertaking

1.1 Product identifier

<table>
<thead>
<tr>
<th>Commercial name</th>
<th>R134a</th>
</tr>
</thead>
<tbody>
<tr>
<td>Chemical description</td>
<td>1, 1, 1, 2 – Tetrafluoroethane</td>
</tr>
<tr>
<td>CAS:</td>
<td>811-97-2</td>
</tr>
<tr>
<td>EC:</td>
<td>212-377-0</td>
</tr>
<tr>
<td>REACH:</td>
<td>01-2119459374-33-0012</td>
</tr>
<tr>
<td>Chemical formula:</td>
<td>C2H2F4</td>
</tr>
</tbody>
</table>

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

<table>
<thead>
<tr>
<th>Industrial sector</th>
<th>Refrigeration, Air-conditioning and Automotive</th>
</tr>
</thead>
<tbody>
<tr>
<td>Relevant identified uses</td>
<td>Refrigerant gas for refrigeration and air-conditioning systems</td>
</tr>
<tr>
<td>Application</td>
<td>Industrial and professional</td>
</tr>
</tbody>
</table>

1.3 Details of the supplier of the safety data sheet

REFRIGERANT BOYS S.R.L.
Corso XX Settembre
21052 - Busto Arsizio VA
tel: +39 329 1858456
mail: service@refrigerantboys.it

1.4 Emergency telephone number

CAV-CNIT Anti-Poison National Information Centre +39 0382 24444 Hours: 24 h / 24 h

2. Hazards identification

2.1 Classification of the substance or mixture

*Classification under Regulation (EC) 1272/2008 (CLP)*

H280: Contains gas under pressure; may explode if heated.

2.2 Label elements

**Dangerous pictogram**

GHS04

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

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

3.1 Substances

<table>
<thead>
<tr>
<th>Name of the substance</th>
<th>%</th>
<th>CAS No.</th>
<th>EC No.</th>
<th>REACH No.</th>
<th>Classification under Regulation (EC) n. 1272/2008 (CLP)</th>
</tr>
</thead>
<tbody>
<tr>
<td>1, 1, 1, 2 – Tetrafluoroethane</td>
<td>100%</td>
<td>811-97-2</td>
<td>212-377-0</td>
<td>01-2119459374-33-0012</td>
<td>Press. Gas (Liq.), H280</td>
</tr>
</tbody>
</table>

For more information on hazardous components, 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. 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 Remove patience from exposure to fresh air. Administer oxygen if necessary. Obtain immediate medical attention.

Skin contact In case of contact with skin, wash immediately with plenty of water. Remove contaminated clothing. If irritation or blistering occurs, call a physician.

Eye contact Remove contact lenses, if present. Rinse immediately with plenty of water, also under the eyelids, for at least 15 minutes. If symptoms persist, call a physician.

Ingestion Unlikely route of exposure. As this product is a gas, refer to the section “Inhalation”. Do not induce vomiting without medical advice. Obtain immediate medical attention.

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

The product is not flammable.

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”.

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 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 data available.

<table>
<thead>
<tr>
<th>Components</th>
<th>CAS No.</th>
<th>TLV-TWA</th>
<th>Parameters</th>
<th>Font</th>
<th>Year</th>
</tr>
</thead>
<tbody>
<tr>
<td>1,1,1,2-Tetrafluoroethane</td>
<td>811-97-2</td>
<td>8 h</td>
<td>4,240 mg/m³</td>
<td>AGCIH</td>
<td>2002</td>
</tr>
<tr>
<td></td>
<td></td>
<td>15 min.</td>
<td>1,000 ppm</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>9,740 mg/m³</td>
<td>AGCIH</td>
<td>2002</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>1,250 ppm</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

**DNEL**

<table>
<thead>
<tr>
<th>Components</th>
<th>CAS No.</th>
<th>Inhalation</th>
</tr>
</thead>
<tbody>
<tr>
<td>1,1,1,2-Tetrafluoroethane</td>
<td>811-97-2</td>
<td>DNEL - Workers 13939 mg/m³ (long term exposure — systemic effects)</td>
</tr>
<tr>
<td></td>
<td></td>
<td>DNEL - Consumers 2476 mg/m³ (long term exposure — systemic effects)</td>
</tr>
</tbody>
</table>

**PNEC**

<table>
<thead>
<tr>
<th>Components</th>
<th>CAS No.</th>
<th>PNEC values</th>
</tr>
</thead>
<tbody>
<tr>
<td>1,1,1,2-Tetrafluoroethane</td>
<td>811-97-2</td>
<td>Freshwater 0,1 mg/l</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Freshwater sediments 0,75 mg/kg dw*</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Intermittent release 1 mg/l 0,01 mg/l</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Marine water 0,01 mg/l</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Purification plant 73 mg/l</td>
</tr>
</tbody>
</table>

*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). If splashes, goggles or face shield.

b) Skin protection

i) Hand protection

Protective gloves resistant to chemical products (EN374). 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

In case of insufficient ventilation, wear self-contained breathing apparatus. (EN133).

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 13.

9. Physical and chemical properties

9.1 Information on basic physical and chemical properties

- a) Appearance: Liquefied gas
- b) Colour: Colourless
- c) Odour: Ethereal
- d) Odour threshold: Odour threshold is subjective and inadequate to warn for overexposure.
- e) pH: n.a.
- f) Melting point: -101 °C (-149.8 °F)
- g) Initial boiling point: -26.5 °C @ 1.013 hPa
- h) Flash point: n.d.a.
- i) Evaporation rate: > 1 / CCl4
- j) Flammability: Not flammable
- k) Upper/lower flammability: n.a.
- l) Vapour pressure: 4,70 bar @ 20 °C - 13,20 bar @ 50 °C
- m) Relative vapour density: 3,5 (air=1)
- n) Solubility: 1,930 mg/l
- o) Partition coefficient: n-Octanol/water: 1,06 log Kow
- p) Auto-ignition temperature: > 750°C
- q) Explosive properties: Not explosive according with EU criteria
- r) Oxidising properties: Not oxidising according with EU criteria

9.2 Other information

- Molecular mass: 102 g/mol
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
This product is non-reactive under normal handling and storage conditions.

10.4 Conditions to avoid
Contains 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), powdered metals and oxidizing agents.

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
   \textit{Inhalation route}
   
   LC50: > 500 000 ppm
   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 sensitisation
   LC50: > 500 000 ppm
   Exposure time: 4 h
   Animal species: Rat

e) Germ cell mutagenicity
   \textit{in vitro genotoxicity}
   In vitro test: Ames
   Result: Negative

   \textit{in vivo genotoxicity}
   Based on available data the classification criteria are not met.

f) Carcinogenicity
   Based on available data the classification criteria are not met.

g) Reproductive toxicity
   Based on available data the classification criteria are not met.

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

i) STOT-repeated exposure
   Inhalation (experimental result, support study)
   NOAEL: ≥ 50000 ppm
   Animal species: Rat

j) Aspiration hazard
   Based on available data the classification criteria are not met.
Other information
Cardiac sensitization
   NOAEC: 40 000 ppm
   LOAEC: 80 000 ppm
   Animal species: Dog

12. Ecological information

12.1 Toxicity

Fish
   LC50: 450 mg/l
   Exposition time: 96 h
   Species: Oncorhynchus mykiss (Rainbow trout)

Aquatic invertebrates
   EC50: 980 mg/l
   Exposition time: 48 h
   Species: Daphnia magna (Water flea)

Algae
   EC50: > 118 mg/l
   Exposition time: 72 h
   Species: Selenastrum capricornutum (Fresh water algae)

12.2 Persistence and degradability
Water: 3% biodegradation after 28 days
Air: Medium life 9.7 years

12.3 Bioaccumulative potential
Log Pow 1.06

12.4 Mobility in soil
Log Koc 1.50

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) = 1.430

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
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 3159

14.2 UN Proper shipping name
1, 1, 1, 2 – Tetrafluoroethane

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)
<table>
<thead>
<tr>
<th>Classification code</th>
<th>Kemler code</th>
</tr>
</thead>
<tbody>
<tr>
<td>2</td>
<td>2A</td>
</tr>
<tr>
<td></td>
<td>20</td>
</tr>
</tbody>
</table>

14.4 Packing group
<table>
<thead>
<tr>
<th>Packing instruction</th>
</tr>
</thead>
<tbody>
<tr>
<td>n.a.</td>
</tr>
<tr>
<td>P200</td>
</tr>
</tbody>
</table>

14.5 Environmental hazards
No

Additional information
Tunnel restriction code of total load
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)
<table>
<thead>
<tr>
<th>Class/Division</th>
</tr>
</thead>
<tbody>
<tr>
<td>2</td>
</tr>
<tr>
<td>2.2</td>
</tr>
</tbody>
</table>

14.4 Packing group
| Passenger and cargo aircraft |
| Only cargo aircraft          |
| n.a.                         |
| 200                          |
| 200                          |

14.5 Environmental hazards
No

Transport by sea (IMDG)

14.3 Transport hazard class(es)
<table>
<thead>
<tr>
<th>Class/Division</th>
</tr>
</thead>
<tbody>
<tr>
<td>2</td>
</tr>
<tr>
<td>2.2</td>
</tr>
<tr>
<td>F-C, S-V</td>
</tr>
</tbody>
</table>

14.4 Packing group
<table>
<thead>
<tr>
<th>Packing instruction</th>
</tr>
</thead>
<tbody>
<tr>
<td>n.a.</td>
</tr>
<tr>
<td>P200</td>
</tr>
</tbody>
</table>

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 to 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) = 1.430

Additional regulations/legislations
The Seveso Directive 96/82/EC: Not included
15.2 Chemical safety assessment
A Chemical Safety Assessment (CSA) has been made for this product.

16. Other information
This Material Safety Data Sheet has been made in compliance with the European Directive in force.

Text of H and P phrases in section 2 and 3
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 Classification under Regulation (EC) n. 1272/2008
Press. Gas (Liq.) Pressurized gas : Liquefied gas

Date of revision
Version 5
Revision date: 01.2019
Version 4
Date: 09.2018
Version 3
Date: 10.2015

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-Flouro-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 MARitme POLution
Log Koc Logarithm Partition coefficient Soil/water
Log Kow (Pow) Logarithm Partition coefficient n-Octanol/water
n.a. not applicable
NOAEC No Observed Adverse Concentration Level
NOAEL No Observed Adverse Effect Level
ODP Ozone Depleting Potential
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 transport of 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
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.