

**KRYON HFO-1234yf****SECTION 1: Identification of the substance/mixture and of the company/undertaking****1.1. Product identifier**

Product name : KRYON HFO-1234yf

SDS-number : GG\_GF 079

Type of product : Substance

Remarks : SDS according to Art. 31 of Regulation (EC) 1907/2006.

Chemical name : 2,3,3,3-Tetrafluoroprop-1-ene

CAS-No. : 754-12-1

REACH Registration Number : no data available

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

Use of the Substance/Mixture : Refrigerant

Uses advised against : Direct evaporation applications

Short title of exposure scenarios : Industrial Use, Heat Transfer Fluids – Refrigerants, Coolants  
Professional Use, Heat Transfer Fluids – Refrigerants, Coolants  
Formulation of preparations  
Use, service life, and waste stage environmental exposure

**1.3. Details of the supplier of the safety data sheet**

Company : General Gas S.r.l.  
Via Aosta , 5  
Cernusco Sul Naviglio  
(MI) – 20063  
ITALIA

Telephone : +39 02 92141835

For further information,  
please contact: : m.migliaccio@gas-tec.it


**KRYON HFO-1234yf****1.4. Emergency telephone number**

Emergency telephone number : Members of Public: +353 (01) 809 2166. (8.00 a.m. to 10.00 p.m. 7 days a week) Healthcare Professionals: +353 (01) 809 2566 (24 hour service) 112 tel. +39 3355644288 (Only for technical support)

**SECTION 2: Hazards identification****2.1. Classification of the substance or mixture****REGULATION (EC) No 1272/2008**

Flammable gases Category 1B  
H221 Flammable gas.  
Gases under pressure Liquefied gas  
H280 Contains gas under pressure; may explode if heated.

**2.2. Label elements****REGULATION (EC) No 1272/2008**

Hazard pictograms : 

Signal word : Danger

Hazard statements : H221 Flammable gas.  
H280 Contains gas under pressure; may explode if heated.

Precautionary statements : P210 Keep away from heat, hot surfaces, sparks, open flames and other ignition sources. No smoking.  
P377 Leaking gas fire: Do not extinguish, unless leak can be stopped safely.  
P381 In case of leakage, eliminate all ignition sources.  
P410 + P403 Protect from sunlight. Store in a well-ventilated place.

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Special labelling of certain products : Contains fluorinated greenhouse gases.

**2.3. Other hazards**

Vapours are heavier than air and can cause suffocation by reducing oxygen available for breathing. Rapid evaporation of the liquid may cause frostbite. This substance/mixture contains no components considered to be either persistent, bioaccumulative and toxic (PBT), or very persistent and very bioaccumulative (vPvB) at levels of 0.1% or higher. The substance/mixture does not contain components considered to have endocrine disrupting properties according to REACH Article 57(f) or Commission Delegated regulation (EU) 2017/2100 or Commission Regulation (EU) 2018/605 at levels of 0.1% or higher.

**SECTION 3: Composition/information on ingredients****3.1. Substances**

Chemical name	CAS-No. Index-No. REACH Registration Number EC-No.	Classification 1272/2008	Concentration	Remarks
2,3,3,3-Tetrafluoroprop-1-ene	754-12-1 468-710-7	Press. Gas Liquefied gas; H280 Flam. Gas 1B; H221	100 %	

**3.2. Mixtures**

Not applicable

Occupational Exposure Limit(s), if available, are listed in Section 8.  
For the full text of the H-Statements mentioned in this Section, see Section 16.

**SECTION 4: First aid measures****4.1 Description of first aid measures***General advice:*

First aider needs to protect himself. Move out of dangerous area. Take off all contaminated clothing immediately.

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*Inhalation:*

When inhaled remove to fresh air and seek medical aid. If breathing is irregular or stopped, administer artificial respiration. If unconscious, place in recovery position and seek medical advice.

*Skin contact:*

Rapid evaporation of the liquid may cause frostbite. In case of contact with liquid, thaw frosted parts with water, then remove clothing carefully. Wash with plenty of water. Wash contaminated clothing before re-use. Consult a physician.

*Eye contact:*

Protect unharmed eye. Rinse immediately with plenty of water, also under the eyelids, for at least 15 minutes. Call a physician immediately.

*Ingestion:*

Ingestion is unlikely because of the physical properties and is not expected to be hazardous.

**4.2. Most important symptoms and effects, both acute and delayed**

No data available

**4.3. Indication of any immediate medical attention and special treatment needed**

Adrenaline derivatives are contra-indicated. Treat symptomatically.

See Section 11 for more detailed information on health effects and symptoms.

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**KRYON HFO-1234yf****SECTION 5: Firefighting measures****5.1. Extinguishing media**

*Suitable extinguishing media:*

Use water spray, alcohol-resistant foam, dry chemical or carbon dioxide.

**5.2. Special hazards arising from the substance or mixture**

Flammable gas.

Contents under pressure.

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

Vapors may travel to areas away from work site before igniting/flashing back to vapor source.

Fire or intense heat may cause violent rupture of packages.

Cool closed containers exposed to fire with water spray.

Do not allow run-off from fire fighting to enter drains or water courses.

In case of fire hazardous decomposition products may be produced such as:

Hydrogen fluoride

Carbonyl halides

Carbon monoxide

Carbon dioxide (CO<sub>2</sub>)

**5.3. Advice for firefighters**

Wear full protective clothing and self-contained breathing apparatus.

Evacuate personnel to safe areas. Leaking gas fire: Do not extinguish, unless leak can be stopped safely. Eliminate all ignition sources if safe to do so.

**SECTION 6: Accidental release measures****6.1. Personal precautions, protective equipment and emergency procedures**

Immediately evacuate personnel to safe areas. Keep people away from and upwind of spill/leak. Wear personal protective equipment. Unprotected persons must be kept away. Wear self-contained breathing apparatus and protective suit. Eliminate all ignition sources if safe to do so. Avoid skin contact with leaking liquid (danger of frostbite). Ventilate the area. Vapors may travel to areas away from work site before igniting/flashing back to vapor source. Vapours are heavier than air and can cause suffocation by reducing oxygen available for breathing. Ensure that the oxygen content is  $\geq 19.5\%$ .

**6.2. Environmental precautions**

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The product evaporates readily. Prevent product from entering drains.

**6.3. Methods and materials for containment and cleaning up**

Use explosion-proof equipment.

No sparking tools should be used.

Ventilate the area.

Allow to evaporate.

Inform the responsible authorities in case of gas leakage, or of entry into waterways, soil or drains.

Pay attention to the spreading of gases especially at ground level (heavier than air) and to the direction of the wind.

**6.4. Reference to other sections**

For personal protection see section 8.

**SECTION 7: Handling and storage****7.1. Precautions for safe handling***Advice on safe handling:*

Exhaust ventilation at the object is necessary. Pressurized container: protect from sunlight and do not expose to temperatures exceeding 50 °C. Do not pierce or burn, even after use. Use suitably rated equipment.

*Advice on protection against fire and explosion:*

Keep product and empty container away from heat and sources of ignition. Fire or intense heat may cause violent rupture of packages. Use suitably rated equipment.

*Hygiene measures:*

Provide adequate ventilation. Do not smoke. When using do not eat or drink.

**7.2. Conditions for safe storage, including any incompatibilities***Further information on storage conditions:*

Keep containers tightly closed in a cool, well-ventilated place. Containers should be protected against falling down. Protect from warmth. Keep away from direct sunlight. Keep only in the original container at temperature not exceeding 50°C

**7.3. Specific end use(s)**

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no additional data available

**SECTION 8: Exposure controls/personal protection**

**8.1. Control parameters**

**Occupational exposure limits:**

Components	Basis / Value type	Value / Form of exposure	Exceeding Factor	Remarks
2,3,3,3-Tetrafluoroprop-1-ene	WEEL TWA	500 ppm		
2,3,3,3-Tetrafluoroprop-1-ene	HONEYWELL TWA	500 ppm		

WEEL - US Workplace Environmental Exposure Level

TWA - Time weighted average

**DNEL/ PNEC-Values**

Component	End-use/impact	Exposure duration	Value	Exposure routes	Remarks
2,3,3,3-Tetrafluoroprop-1-ene	Workers / Long-term systemic effects		950 mg/m3	Inhalation	
2,3,3,3-Tetrafluoroprop-1-ene	Consumers / Long-term systemic effects		113,1 mg/m3	Inhalation	
2,3,3,3-Tetrafluoroprop-1-ene	Workers / Acute systemic effects		186400 mg/m3	Inhalation	
2,3,3,3-Tetrafluoroprop-1-ene	Consumers / Acute systemic effects		186400 mg/m3	Inhalation	

Component	Environmental compartment /	Remarks

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	Value	
2,3,3,3-Tetrafluoroprop-1-ene	Fresh water: 0,1 mg/l	
2,3,3,3-Tetrafluoroprop-1-ene	Marine water: 0,01 mg/l	
2,3,3,3-Tetrafluoroprop-1-ene	Fresh water sediment: 1,51 mg/kg	
2,3,3,3-Tetrafluoroprop-1-ene	Marine sediment: 0,151 mg/kg	
2,3,3,3-Tetrafluoroprop-1-ene	Soil: 1,49 mg/kg	

**8.2. Exposure controls****Occupational exposure controls**

The Personal Protective Equipment must be in accordance with EN standards: respirator EN 136, 140, 149; safety glasses EN 166; protective suit: EN 340, 463, 468, 943-1, 943-2; gloves EN 374, 511; safety shoes EN-ISO 20345.

**Engineering measures**

Highly effective exhaust ventilation

**Personal protective equipment***Respiratory protection:*

In case of insufficient ventilation wear suitable respiratory equipment.

Self-contained breathing apparatus (EN 133)

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

*Hand protection:*

Protective gloves against cold  
(EN 511)

*Eye protection:*

Safety goggles

*Skin and body protection:*

Wear suitable protective equipment.



**KRYON HFO-1234yf****Environmental exposure controls**

Handle in accordance with local environmental regulations and good industrial practices.

**SECTION 9: Physical and chemical properties****9.1. Information on basic physical and chemical properties**

- (a) Physical state : gaseous
- (b) Colour : colourless
- (c) Odour : slight, original odour
- (d) Melting point/freezing point : Not applicable, as this product is a gas.
- (e) Boiling point/boiling range : -29,4 °C
- (f) Flammability : Flammable gas.  
Method: Flammability (gases)
- (g) Lower and upper explosion limit : Lower explosion limit  
6,2 %(V)  
Method: ASTM E681-04  
Lower flammability limit
- : Upper explosion limit  
12,3 %(V)  
Method: ASTM E681-04  
Upper flammability limit
- (h) Flash point : Not applicable, as this product is a gas.
- (i) Auto-ignition temperature : 405 °C
- (j) Decomposition temperature : Stable under normal conditions.
- (k) pH : Not applicable, as this product is a gas.
- (l) Viscosity, kinematic : Not applicable, as this product is a gas.

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(m) Solubility(ies) : Water solubility:  
198,2 mg/l  
at 24 °C  
Method: 92/69/EEC, A.6

(n) Partition coefficient: n-  
octanol/water : log Pow 2,15  
Method: 92/69/EEC, A.8

(o) Vapour pressure : 6.067 hPa  
at 21,1 °C  
  
14.203 hPa  
at 54,4 °C

(p) Density and / or relative  
density : 1,1 g/cm<sup>3</sup>  
at 25 °C

(q) Relative vapour density : 4

(r) Particle characteristics : No data available

**9.2 Other Information**

Oxidizing properties : Not applicable: Not expected to have oxidizing properties  
based on theoretical evaluation

Evaporation rate : Not applicable, as this product is a gas.

Viscosity, dynamic : Not applicable, as this product is a gas.

**SECTION 10: Stability and reactivity****10.1. Reactivity**

Stable under normal conditions.

**10.2. Chemical stability**

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Stable under normal conditions.

**10.3. Possibility of hazardous reactions**

Hazardous polymerisation does not occur.

**10.4. Conditions to avoid**

Do not pierce or burn, even after use. Do not spray on a naked flame or any incandescent material.  
Heat, flames and sparks.  
Pressurized container. Protect from sunlight and do not expose to temperatures exceeding 50 °C.

**10.5. Incompatible materials**

Alkali metals  
Oxidizers (e.g. peroxide residues present in insufficiently cured rubbers)  
Finely divided metal powders such as aluminum, magnesium, or zinc.

**10.6. Hazardous decomposition products**

In case of fire hazardous decomposition products may be produced such as:  
Hydrogen fluoride  
Carbonyl halides  
Carbon monoxide  
Carbon dioxide (CO<sub>2</sub>)

**SECTION 11: Toxicological information****11.1. Information on hazard classes as defined in Regulation (EC) No 1272/2008****(a) Acute toxicity**

*Acute oral toxicity:*

Not applicable  
study technically not feasible

*Acute dermal toxicity:*

Not applicable  
study technically not feasible

*Acute inhalation toxicity:*

LC50  
Species: Rat

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Value: > 400000 ppm  
Exposure time: 4 h  
Method: OECD Test Guideline 403

*Acute toxicity (other routes of administration):*  
No data available

**(b) Skin corrosion/irritation:**

Not applicable  
study technically not feasible

**(c) Serious eye damage/eye irritation:**

Not applicable  
study technically not feasible

**(d) Respiratory or skin sensitisation:**

Route of exposure: Dermal  
Not applicable, as this product is a gas.  
study technically not feasible

**(e) Germ cell mutagenicity:**

Test Method: Ames test  
Result: 20% and higher, positive in TA 100 and e. coli WP2 uvrA, negative in TA98, TA100, and TA1535.  
Method: OECD Test Guideline 471

Test Method: Chromosome aberration test in vitro  
Cell type: Human lymphocytes  
Result: negative  
Method: OECD Test Guideline 473  
Note: Dose 760,000 ppm

Species: Mouse  
Cell type: Micronucleus  
Dose: up to 200,000 ppm (4 hour)  
Method: OECD Test Guideline 474  
Result: negative

Test Method: Unscheduled DNA synthesis  
Dose: up to 50,000 ppm (4 weeks)  
Method: OECD Test Guideline 486  
Result: negative

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Species: Rat  
Cell type: Micronucleus  
Dose: up to 50,000 ppm (4 weeks)  
Method: OECD Test Guideline 474  
Result: negative

**(f) Carcinogenicity:**

Species: Rat  
Note: Not classified as a human carcinogen. Substance not expected to be a carcinogen based on available data.

**(g) Reproductive toxicity:**

Species: Rat  
Application Route: Inhalation exposure  
Exposure time: Two-generation reproductive toxicity  
NOAEL,parent: 50,000 ppm  
NOAEL,F1: 50,000 ppm  
NOAEL,F2: 50,000 ppm  
Test Type: Two-generation study  
Method: OECD Test Guideline 416  
Species: Rat  
Route of Application: Inhalation  
General Toxicity - Parent: NOAEC: 50.000 ppm  
General Toxicity F1: NOAEC: 50.000 ppm  
Method: OECD Test Guideline 414  
Species: Rat  
Route of Application: inhalation (gas)  
General Toxicity Maternal: NOAEL: 50.000 ppm  
Developmental Toxicity: NOAEL: 50.000 ppm  
Method: OECD Test Guideline 414  
Species: Rabbit  
Route of Application: inhalation (gas)  
General Toxicity Maternal: LOAEC: 2.500 ppm  
Embryo-foetal toxicity: NOAEC: 4.000 ppm  
Remarks: Embryo-fetal toxicity observed at maternally toxic concentrations

**(h) STOT-single exposure:**

No data available

**(i) STOT - repeated exposure:**

Species: Rat  
Application Route: Inhalation  
Exposure time: 2 Weeks

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NOEL: 50000

Method: OECD Test Guideline 412

Species: Rat

Application Route: Inhalation

Exposure time: 4 Weeks

NOAEL: 50000 ppm

Method: OECD Test Guideline 412

Species: Rat

Application Route: Inhalation

Exposure time: 13 Weeks

NOAEL: 50000 ppm

Method: OECD Test Guideline 413

Species: Rabbit, male

Application Route: Inhalation

Exposure time: 28 d

NOEL: 500

Method: OECD Test Guideline 412

Note: There are no observed toxicological effects, which result in classification as a specific target organ toxicant.

Species: Rabbit, female

Application Route: Inhalation

Exposure time: 28 d

NOEL: 1000

Method: OECD Test Guideline 412

Note: There are no observed toxicological effects, which result in classification as a specific target organ toxicant.

Species: Mini-pig

Application Route: Inhalation

Exposure time: 28 d

NOAEL: 10000 ppm

Note: highest exposure tested

**(j) Aspiration hazard:**

Not applicable, as this product is a gas.

**11.2. Information on other hazards**

*Endocrine disrupting properties*

No data available

*Other information:*

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Cardiac Sensitization (dog): No effects for exposures up to 12% (120,189 ppm)

**SECTION 12: Ecological information****12.1. Toxicity***Toxicity to fish:*

LC50

Species: Cyprinus carpio (Carp)

Value: &gt; 197 mg/l

Exposure time: 96 h

Method: OECD Test Guideline 203

No demonstrable toxic effect in saturated solution.

*Toxicity to aquatic plants:*

EC50

Species: Scenedesmus capricornutum (fresh water algae)

Value: &gt; 100 mg/l

Method: OECD Test Guideline 201

*Toxicity to aquatic invertebrates:*

EC50

Species: Daphnia magna (Water flea)

Value: &gt; 83 mg/l

Exposure time: 48 h

Method: OECD Test Guideline 202

**12.2. Persistence and degradability***Biodegradability:*

Result: Not readily biodegradable.

Method: OECD Test Guideline 301F

**12.3. Bioaccumulative potential**

Due to the distribution coefficient n-octanol/water, accumulation in organisms is not expected.

**12.4. Mobility in soil**

No data available

**12.5. Results of PBT and vPvB assessment**

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Substance is not persistent, bioaccumulative, and toxic (PBT).  
Substance is not very persistent and very bioaccumulative (vPvB).

**12.6. Endocrine disrupting properties**

No data available

**12.7. Other adverse effects**

An environmental hazard cannot be excluded in the event of unprofessional handling or disposal.

**SECTION 13: Disposal considerations****13.1. Waste treatment methods***Product:*

Dispose according to legal requirements.

*Packaging:*

Legal requirements are to be considered in regard of reuse or disposal of used packaging materials

*Further information:*

Provisions relating to waste:

EC Directive 2006/12/EC; 2008/98/EEC

Regulation No. 1013/2006

For personal protection see section 8.

**SECTION 14: Transport information****14.1 UN number or ID number**

ADR/RID:3161

IMDG:3161

IATA:3161

**14.2 UN proper shipping name**

ADR/RID:LIQUEFIED GAS, FLAMMABLE, N.O.S.( R-1234yf)

IMDG:LIQUEFIED GAS, FLAMMABLE, N.O.S.( R-1234yf)

IATA:Liquefied gas, flammable, n.o.s.( R-1234yf)

**14.3 Transport hazard class(es)**

ADR/RID:2.1

IMDG: 2.1

IATA: 2.1

**14.4 Packaging group**

No data available

**14.5 Environmental hazards**



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ADR/RID: no

Marine pollutant: no

**14.6 Special precautions for user**

IMDG Code segregation group according chapter 3.1.4.4 : NONE,

**14.7 Maritime transport in bulk according to IMO instruments**

No data available

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

Basis	Value	Remarks
Directive 2012/18/EC SEVESO III Listed in Regulation : P2: Flammable gases	<b>Quantity:</b> 10 t <b>Quantity:</b> 50 t	
Substances of very high concern (SVHC)		This product does not contain substances of very high concern according to Regulation (EC) No Article 57 above the respective regulatory 1907/2006 (REACH), concentration limit of $\geq 0.1\%$ (w/w).
Regulation (EC) No. 1907/2006, Annex XIV		Not listed
Regulation (EC) No. 1907/2006, Annex XVII Number in Regulation: 40		Listed
Regulation (EU) 2019/1021 on persistent organic pollutants (recast) EU POPs		Not listed
Regulation (EC) No 1005/2009 EU ODS		Not listed

*Global warming potential :*

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**Other inventory information**

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US. Toxic Substances Control Act  
On TSCA Inventory

Australia. Inventory of Industrial Chemicals (AIIC), as amended  
On the inventory, or in compliance with the inventory

Canada. Canadian Environmental Protection Act (CEPA). Domestic Substances List (DSL)  
All components of this product are on the Canadian DSL

Japan. Kashin-Hou Law List  
On the inventory, or in compliance with the inventory

Korea. Existing Chemicals Inventory (KECI)  
On the inventory, or in compliance with the inventory

Philippines. Inventory of Chemicals and Chemical Substances (PICCS)  
On the inventory, or in compliance with the inventory

China. Inventory of Existing Chemical Substances (IECSC)  
On the inventory, or in compliance with the inventory

New Zealand. Inventory of Chemicals (NZIoC), as published by ERMA New Zealand  
On the inventory, or in compliance with the inventory

Taiwan Chemical Substance Inventory (TCSI)  
On the inventory, or in compliance with the inventory

## 15.2 Chemical safety assessment

A Chemical Safety Assessment has been carried out.

## SECTION 16: Other information

### Text of H-statements referred to under heading 3

2,3,3,3-Tetrafluoroprop-1-ene : H280 Contains gas under pressure; may explode if heated.  
H221 Flammable gas.

### Further information

**KRYON HFO-1234yf**

All directives and regulations refer to amended versions.  
Vertical lines in the left hand margin indicate a relevant amendment from the previous version.

## Abbreviations:

EC European Community  
CAS Chemical Abstracts Service  
DNEL Derived no effect level  
PNEC Predicted no effect level  
vPvB Very persistent and very bioaccumulative substance  
PBT Persistent, bioaccumulative and toxic substance

The information provided in this Safety Data Sheet is correct to the best of our knowledge, information and belief at the date of its publication. The information given is designed only as a guidance for safe handling, use, processing, storage, transportation, disposal and release and is not to be considered a warranty or quality specification. The information relates only to the specific material designated and may not be valid for such material used in combination with any other materials or in any process, unless specified in the text. Final determination of suitability of any material is the sole responsibility of the user.

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