



SAFETY DATA SHEET

C5H12 8241,25 PPM;C4H10 2,8985 %;CH2F2 16,1916 %;C2HF5 37,1557 %;C2H2F4 42,93 %

Issue Date: 05.07.2018 Version: 1.1 SDS No.: 000010047425
 Last revised date: 06.01.2021 1/21

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

1.1 Product identifier

Product name: C5H12 8241,25 PPM;C4H10 2,8985 %;CH2F2 16,1916 %;C2HF5 37,1557 %;C2H2F4 42,93 %

Trade name: R 438A

Other Name: R438A, HFC-125 45 % (w/w); HFC-134a 44,2 % (w/w); HFC-32 8,5 % (w/w); R-600 1,7 % (w/w); R-601a 0,6 % (w/w)

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

Identified uses: Industrial and professional. Perform risk assessment prior to use.
Refrigerant.

Uses advised against Consumer use.

1.3 Details of the supplier of the safety data sheet

Supplier
 Linde Gas AS Telephone: +4723177200
 Postboks 13 Nydalen
 N-0409 Oslo
 E-mail: sds.ren@linde.com

1.4 Emergency telephone number: +47 22 59 13 00 (24h - Giftinformasjonssentralen)

SECTION 2: Hazards identification

2.1 Classification of the substance or mixture

Classification according to Regulation (EC) No 1272/2008 as amended.

Physical Hazards

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

2.2 Label Elements



SAFETY DATA SHEET

C5H12 8241,25 PPM;C4H10 2,8985 %;CH2F2 16,1916 %;C2HF5 37,1557 %;C2H2F4 42,93 %

Issue Date: 05.07.2018 Version: 1.1 SDS No.: 000010047425
 Last revised date: 06.01.2021 2/21



Signal Word: Warning

Hazard Statement(s): H280: Contains gas under pressure; may explode if heated.

Precautionary Statements

General None.

Prevention: None.

Response: None.

Storage: P403: Store in a well-ventilated place.

Disposal None.

Supplemental information

EIGA-0783: Contains fluorinated greenhouse gases
 EIGA-As: Asphyxiant in high concentrations.

2.3 Other hazards Contact with evaporating liquid may cause frostbite or freezing of skin.

SECTION 3: Composition/information on ingredients

3.2 Mixtures

Chemical name	Chemical formula	Concentration	CAS-No.	REACH Registration No.	M-Factor:	Notes
2-Methylbutane	C5H12	8.241,2500PPM	78-78-4	01-2119475602-38	-	#
Butane	C4H10	2,8985%	106-97-8	01-2119474691-32	-	#
Difluoromethane	CH2F2	16,1916%	75-10-5	01-2119471312-47	-	



SAFETY DATA SHEET

C5H12 8241,25 PPM;C4H10 2,8985 %;CH2F2 16,1916 %;C2HF5 37,1557 %;C2H2F4 42,93 %

Issue Date: 05.07.2018 Version: 1.1 SDS No.: 000010047425
 Last revised date: 06.01.2021 3/21

Norflurane	C2H2F4	42,9300%	811-97-2	01-2119459374-33	-	
Pentafluoroethane	C2HF5	37,1557%	354-33-6	01-2119485636-25	-	

The concentrations of the components in the SDS header, product name on page one and in section 3.2 are in mol due to regulatory requirements. All concentrations are nominal.

This substance has workplace exposure limit(s).
 PBT: persistent, bioaccumulative and toxic substance.
 vPvB: very persistent and very bioaccumulative substance.

Classification

Chemical name	Classification		Notes
2-Methylbutane	CLP:	Flam. Liq. 1;H224, Asp. Tox. 1;H304, STOT SE 3;H336, Aquatic Chronic 2;H411	
Butane	CLP:	, Flam. Gas 1;H220, Press. Gas Liquef. Gas;H280	
Difluoromethane	CLP:	Press. Gas Liquef. Gas;H280, Flam. Gas 1;H220	
Norflurane	CLP:	Press. Gas Liquef. Gas;H280	
Pentafluoroethane	CLP:	Press. Gas Liquef. Gas;H280	

CLP: Regulation No. 1272/2008.

The full text for all H-statements is displayed in section 16.

SECTION 4: First aid measures

General: In high concentrations may cause asphyxiation. Symptoms may include loss of mobility/consciousness. Victim may not be aware of asphyxiation. Remove victim to uncontaminated area wearing self contained breathing apparatus. Keep victim warm and rested. Call a doctor. Apply artificial respiration if breathing stopped.

4.1 Description of first aid measures

Inhalation: In high concentrations may cause asphyxiation. Symptoms may include loss of mobility/consciousness. Victim may not be aware of asphyxiation. Remove victim to uncontaminated area wearing self contained breathing apparatus. Keep victim warm and rested. Call a doctor. Apply artificial respiration if breathing stopped.

Eye contact: Rinse the eye with water immediately. Remove contact lenses, if present and easy to do. Continue rinsing. Flush thoroughly with water for at least 15 minutes. Get immediate medical assistance. If medical assistance is not immediately available, flush an additional 15 minutes.



SAFETY DATA SHEET

C5H12 8241,25 PPM;C4H10 2,8985 %;CH2F2 16,1916 %;C2HF5 37,1557 %;C2H2F4 42,93 %

Issue Date:	05.07.2018	Version: 1.1	SDS No.: 000010047425
Last revised date:	06.01.2021		4/21

Skin Contact: Contact with evaporating liquid may cause frostbite or freezing of skin.

Ingestion: Ingestion is not considered a potential route of exposure.

4.2 Most important symptoms and effects, both acute and delayed: Respiratory arrest. Contact with liquefied gas can cause damage (frostbite) due to rapid evaporative cooling.

4.3 Indication of any immediate medical attention and special treatment needed

Hazards: Respiratory arrest. Contact with liquefied gas can cause damage (frostbite) due to rapid evaporative cooling.

Treatment: Thaw frosted parts with lukewarm water. Do not rub affected area. Get immediate medical advice/attention.

SECTION 5: Firefighting measures

General Fire Hazards: Heat may cause the containers to explode.

5.1 Extinguishing media

Suitable extinguishing media: Material will not burn. In case of fire in the surroundings: use appropriate extinguishing agent.

Unsuitable extinguishing media: None.

5.2 Special hazards arising from the substance or mixture: Fire or excessive heat may produce hazardous decomposition products.

Hazardous Combustion Products: If involved in a fire the following toxic and/or corrosive fumes may be produced by thermal decomposition: Carbon oxides fluorocarbons Hydrogen fluoride ; Carbonyl difluoride

5.3 Advice for firefighters

Special fire fighting procedures: In case of fire: Stop leak if safe to do so. Continue water spray from protected position until container stays cool. Use extinguishants to contain the fire. Isolate the source of the fire or let it burn out.



SAFETY DATA SHEET

C5H12 8241,25 PPM;C4H10 2,8985 %;CH2F2 16,1916 %;C2HF5 37,1557 %;C2H2F4 42,93 %

Issue Date: 05.07.2018 Version: 1.1 SDS No.: 000010047425
Last revised date: 06.01.2021 5/21

Special protective equipment for fire-fighters: Firefighters must use standard protective equipment including flame retardant coat, helmet with face shield, gloves, rubber boots, and in enclosed spaces, SCBA. Guideline: EN 469 Protective clothing for firefighters. Performance requirements for protective clothing for firefighting. EN 15090 Footwear for firefighters. EN 659 Protective gloves for firefighters. EN 443 Helmets for fire fighting in buildings and other structures. EN 137 Respiratory protective devices - Self-contained open-circuit compressed air breathing apparatus with full face mask - Requirements, testing, marking.

SECTION 6: Accidental release measures

- 6.1 Personal precautions, protective equipment and emergency procedures:** Evacuate area. Provide adequate ventilation. Prevent from entering sewers, basements and workpits, or any place where its accumulation can be dangerous. Wear self-contained breathing apparatus when entering area unless atmosphere is proved to be safe. EN 137 Respiratory protective devices - Self-contained open-circuit compressed air breathing apparatus with full face mask - Requirements, testing, marking.
- 6.2 Environmental Precautions:** Prevent further leakage or spillage if safe to do so.
- 6.3 Methods and material for containment and cleaning up:** Provide adequate ventilation.
- 6.4 Reference to other sections:** Refer to sections 8 and 13.



SAFETY DATA SHEET

C5H12 8241,25 PPM;C4H10 2,8985 %;CH2F2 16,1916 %;C2HF5 37,1557 %;C2H2F4 42,93 %

Issue Date:	05.07.2018	Version: 1.1	SDS No.: 000010047425
Last revised date:	06.01.2021		6/21

SECTION 7: Handling and storage:

- 7.1 Precautions for safe handling:** Only experienced and properly instructed persons should handle gases under pressure. Use only properly specified equipment which is suitable for this product, its supply pressure and temperature. Refer to supplier's handling instructions. The substance must be handled in accordance with good industrial hygiene and safety procedures. Protect containers from physical damage; do not drag, roll, slide or drop. Do not remove or deface labels provided by the supplier for the identification of the container contents. When moving containers, even for short distances, use appropriate equipment eg. trolley, hand truck, fork truck etc. Secure cylinders in an upright position at all times, close all valves when not in use. Provide adequate ventilation. Suck back of water into the container must be prevented. Do not allow backfeed into the container. Avoid suckback of water, acid and alkalis. Keep container below 50°C in a well ventilated place. Observe all regulations and local requirements regarding storage of containers. When using do not eat, drink or smoke. Store in accordance with local/regional/national/international regulations. Never use direct flame or electrical heating devices to raise the pressure of a container. Leave valve protection caps in place until the container has been secured against either a wall or bench or placed in a container stand and is ready for use. Damaged valves should be reported immediately to the supplier Close container valve after each use and when empty, even if still connected to equipment. Never attempt to repair or modify container valves or safety relief devices. Replace valve outlet caps or plugs and container caps where supplied as soon as container is disconnected from equipment. Keep container valve outlets clean and free from contaminates particularly oil and water. If user experiences any difficulty operating container valve discontinue use and contact supplier. Never attempt to transfer gases from one container to another. Container valve guards or caps should be in place.

- 7.2 Conditions for safe storage, including any incompatibilities:** Containers should not be stored in conditions likely to encourage corrosion. Stored containers should be periodically checked for general conditions and leakage. Container valve guards or caps should be in place. Store containers in location free from fire risk and away from sources of heat and ignition. Keep away from combustible material.

- 7.3 Specific end use(s):** None.



SAFETY DATA SHEET

C5H12 8241,25 PPM;C4H10 2,8985 %;CH2F2 16,1916 %;C2HF5 37,1557 %;C2H2F4 42,93 %

Issue Date: 05.07.2018
Last revised date: 06.01.2021

Version: 1.1

SDS No.: 000010047425
7/21

SECTION 8: Exposure controls/personal protection

8.1 Control Parameters

Occupational Exposure Limits

Chemical name	Type	Exposure Limit Values	Source
Butane	NORMEN	250 ppm 600 mg/m ³	Norway. Regulation No. 1358 on Measures and Limit Values for Physical and Chemical Factors in Work Environment and Infection Groups for Biological Factors (12 2011)
2-Methylbutane	NORMEN	250 ppm 750 mg/m ³	Norway. Regulation No. 1358 on Measures and Limit Values for Physical and Chemical Factors in Work Environment and Infection Groups for Biological Factors (12 2014)
	TWA	1.000 ppm 3.000 mg/m ³	EU. Indicative Occupational Exposure Limit Values in Directives 91/322/EEC, 2000/39/EC, 2006/15/EC, 2009/161/EU (12 2009)

DNEL-Values

Critical component	Type	Value	Remarks
2-Methylbutane	Workers - Dermal, Systemic, long-term	432 mg/kg bw/day	Repeated dose toxicity
	Workers - Inhalation, Systemic, long-term	3000 mg/m ³	Repeated dose toxicity
Difluoromethane	Workers - Inhalation, Systemic, long-term	7035 mg/m ³	Repeated dose toxicity
	Workers - Inhalation, Systemic, long-term	13936 mg/m ³	Repeated dose toxicity
Pentafluoroethane	Workers - Inhalation, Systemic, long-term	16444 mg/m ³	Repeated dose toxicity
	Workers - Inhalation, Systemic, long-term		

PNEC-Values

Critical component	Type	Value	Remarks



SAFETY DATA SHEET

C5H12 8241,25 PPM;C4H10 2,8985 %;CH2F2 16,1916 %;C2HF5 37,1557 %;C2H2F4 42,93 %

Issue Date: 05.07.2018 Version: 1.1 SDS No.: 000010047425
 Last revised date: 06.01.2021 8/21

Difluoromethane	Aquatic (freshwater)	0,142 mg/l	-
Difluoromethane	Sediment (freshwater)	0,534 mg/kg	-
Norflurane	Aquatic (marine water)	0,01 mg/l	-
Norflurane	Sewage treatment plant	73 mg/l	-
Norflurane	Sediment (freshwater)	0,75 mg/kg	-
Norflurane	Aquatic (freshwater)	0,1 mg/l	-
Pentafluoroethane	Aquatic (freshwater)	0,1 mg/l	-
Pentafluoroethane	Sediment (freshwater)	0,6 mg/kg	-

8.2 Exposure controls

Appropriate engineering controls:

Consider a work permit system e.g. for maintenance activities. Ensure adequate air ventilation. Oxygen detectors should be used when asphyxiating gases may be released. Provide adequate ventilation, including appropriate local extraction, to ensure that the defined occupational exposure limit is not exceeded. Systems under pressure should be regularly checked for leakages. Preferably use permanent leak tight connections (eg. welded pipes). Do not eat, drink or smoke when using the product.

Individual protection measures, such as personal protective equipment

General information:

A risk assessment should be conducted and documented in each work area to assess the risks related to the use of the product and to select the PPE that matches the relevant risk. The following recommendations should be considered. Keep self contained breathing apparatus readily available for emergency use. Personal protective equipment for the body should be selected based on the task being performed and the risks involved.

Eye/face protection:

Safety eyewear, goggles or face-shield to EN166 should be used to avoid exposure to liquid splashes. Wear eye protection to EN 166 when using gases. Guideline: EN 166 Personal Eye Protection.

Skin protection

Hand Protection:

Guideline: EN 388 Protective gloves against mechanical risks.
 Additional Information: Wear working gloves while handling containers



SAFETY DATA SHEET

C5H12 8241,25 PPM;C4H10 2,8985 %;CH2F2 16,1916 %;C2HF5 37,1557 %;C2H2F4 42,93 %

Issue Date:	05.07.2018	Version: 1.1	SDS No.: 000010047425
Last revised date:	06.01.2021		9/21

Body protection:	No special precautions.
Other:	Wear safety shoes while handling containers Guideline: ISO 20345 Personal protective equipment - Safety footwear.
Respiratory Protection:	Not required.
Thermal hazards:	No precautionary measures are necessary.
Hygiene measures:	Specific risk management measures are not required beyond good industrial hygiene and safety procedures. Do not eat, drink or smoke when using the product.
Environmental exposure controls:	For waste disposal, see section 13 of the SDS.

SECTION 9: Physical and chemical properties

9.1 Information on basic physical and chemical properties

Appearance

Physical state:	Gas
Form:	Liquefied gas
Color:	C5H12: Colorless C4H10: Colorless CH2F2: Colorless C2H2F4: Colorless C2HF5: Colorless
Odor:	C5H12: Faint CH2F2: Odorless C2H2F4: faint ethereal C2HF5: faint ethereal C4H10: Very slight odor
Odor Threshold:	Odor threshold is subjective and is inadequate to warn of over exposure.
pH:	Not applicable.
Melting Point:	No data available.
Boiling Point:	No data available.
Sublimation Point:	Not applicable.
Critical Temp. (°C):	No data available.
Flash Point:	Not applicable to gases and gas mixtures.
Evaporation Rate:	Not applicable to gases and gas mixtures.



SAFETY DATA SHEET

C5H12 8241,25 PPM;C4H10 2,8985 %;CH2F2 16,1916 %;C2HF5 37,1557 %;C2H2F4 42,93 %

Issue Date:	05.07.2018	Version: 1.1	SDS No.: 000010047425
Last revised date:	06.01.2021		10/21

Flammability (solid, gas):	Non-Flammable Gas
Flammability Limit - Upper (%):	Not applicable.
Flammability Limit - Lower (%):	Not applicable.
Vapor pressure:	No reliable data available.
Vapor density (air=1):	3,49 (calculated) (15 °C)
Relative density:	No data available.
Solubility(ies)	
Solubility in Water:	No data available.
Partition coefficient (n-octanol/water):	Not known.
Autoignition Temperature:	Not applicable.
Decomposition Temperature:	Not known.
Viscosity	
Kinematic viscosity:	No data available.
Dynamic viscosity:	No data available.
Explosive properties:	Not applicable.
Oxidizing properties:	Not applicable.

9.2 Other information: Gas/vapour heavier than air. May accumulate in confined spaces, particularly at or below ground level.

SECTION 10: Stability and reactivity

10.1 Reactivity:	No reactivity hazard other than the effects described in sub-section below.
10.2 Chemical Stability:	Stable under normal conditions.
10.3 Possibility of hazardous reactions:	None.
10.4 Conditions to avoid:	Open flames and high energy ignition sources. The product is not flammable in air under ambient conditions of temperature and pressure. When pressurised with air or oxygen, the mixture may become flammable. Certain mixtures of HCFCs or HFCs with chlorine may become flammable or reactive under certain conditions.
10.5 Incompatible Materials:	No reaction with any common materials in dry or wet conditions. Alkali metals. Alkali earth metals. Chemically-active metals (such as calcium, powdered aluminum, zinc, and magnesium)
10.6 Hazardous Decomposition Products:	Under normal conditions of storage and use, hazardous decomposition products should not be produced.



SAFETY DATA SHEET

C5H12 8241,25 PPM;C4H10 2,8985 %;CH2F2 16,1916 %;C2HF5 37,1557 %;C2H2F4 42,93 %

Issue Date: 05.07.2018 Version: 1.1 SDS No.: 000010047425
 Last revised date: 06.01.2021 11/21

SECTION 11: Toxicological information

General information: None.

11.1 Information on toxicological effects

Acute toxicity - Oral Product Based on available data, the classification criteria are not met.

Component Information
 2-Methylbutane LD 50 (Rat): > 2.000 mg/kg Remarks: Read-across based on grouping of substances (category approach), Key study

Acute toxicity - Dermal Product Based on available data, the classification criteria are not met.

Acute toxicity - Inhalation Product Based on available data, the classification criteria are not met.

Component Information
 2-Methylbutane LC 50 (Rat, 4 h): > 25,3 mg/l Remarks: Vapor Read-across based on grouping of substances (category approach), Key study
 Butane LC 50 (Rat, 10 min): > 800000 ppm Remarks: Inhalation Experimental result, Key study

Repeated dose toxicity Component Information
 2-Methylbutane NOAEL (Rat(Female, Male), Inhalation, 13 Weeks): > 2.220 ppm(m) Inhalation Experimental result, Key study
 Butane NOAEL (Rat(Female, Male), Inhalation, >= 42 d): 16.000 ppm(m) Inhalation Experimental result, Key study
 Difluoromethane NOAEL (Rat(Female, Male), Inhalation, 28 d): 49.500 ppm(m) Inhalation Experimental result, Supporting study
 Norflurane NOAEL (Rat(Female, Male), Inhalation, 2 yr): 50.000 ppm(m) Inhalation Experimental result, Key study
 Pentafluoroethane NOAEL (Rat(Female, Male), Inhalation, 13 Weeks): >= 50.000 ppm(m) Inhalation Experimental result, Key study



SAFETY DATA SHEET

C5H12 8241,25 PPM;C4H10 2,8985 %;CH2F2 16,1916 %;C2HF5 37,1557 %;C2H2F4 42,93 %

Issue Date: 05.07.2018 Version: 1.1 SDS No.: 000010047425
Last revised date: 06.01.2021 12/21

Skin Corrosion/Irritation

Product Based on available data, the classification criteria are not met.

Component Information

2-Methylbutane in vivo (Rabbit): Not classified as an Irritant Read-across based on grouping of substances (category approach), Key study

Serious Eye Damage/Eye Irritation

Product Based on available data, the classification criteria are not met.

Component Information

2-Methylbutane in vivo (Rabbit, 24 hrs): Not irritating OECD GHS

Respiratory or Skin Sensitization

Product Based on available data, the classification criteria are not met.

Germ Cell Mutagenicity

Product Based on available data, the classification criteria are not met.

Carcinogenicity

Product Based on available data, the classification criteria are not met.

Reproductive toxicity

Product Based on available data, the classification criteria are not met.

Specific Target Organ Toxicity - Single Exposure

Product Based on available data, the classification criteria are not met.

Specific Target Organ Toxicity - Repeated Exposure

Product Based on available data, the classification criteria are not met.

Aspiration Hazard

Product Not applicable to gases and gas mixtures..



SAFETY DATA SHEET

C5H12 8241,25 PPM;C4H10 2,8985 %;CH2F2 16,1916 %;C2HF5 37,1557 %;C2H2F4 42,93 %

Issue Date: 05.07.2018 Version: 1.1 SDS No.: 000010047425
 Last revised date: 06.01.2021 13/21

Other Relevant Toxicity Information

Norflurane	Cardiac sensitisation threshold limit 40000 ppm Beagle (dog)NOAEC Cardiac sensitisation threshold limit 80000 ppm Beagle (dog)LOAEC Light hydrocarbons like this one have been associated with cardiac sensitization in abuse situations. Hypoxia or the injection of adrenaline-like substances enhances these effects. May produce irregular heart beat and nervous symptoms.
Pentafluoroethane	Cardiac sensitisation threshold limit 100000 ppm Beagle (dog)NOAEC Cardiac sensitisation threshold limit 75000 ppm Beagle (dog)LOAEC Light hydrocarbons like this one have been associated with cardiac sensitization in abuse situations. Hypoxia or the injection of adrenaline-like substances enhances these effects. May produce irregular heart beat and nervous symptoms.
Difluoromethane	Cardiac sensitisation threshold limit >350000 ppm Beagle (dog)LOAEC Cardiac sensitisation threshold limit 350000 ppm Beagle (dog)NOAEC Light hydrocarbons like this one have been associated with cardiac sensitization in abuse situations. Hypoxia or the injection of adrenaline-like substances enhances these effects.



SAFETY DATA SHEET

C5H12 8241,25 PPM;C4H10 2,8985 %;CH2F2 16,1916 %;C2HF5 37,1557 %;C2H2F4 42,93 %

Issue Date: 05.07.2018 Version: 1.1 SDS No.: 000010047425
 Last revised date: 06.01.2021 14/21

SECTION 12: Ecological information

12.1 Toxicity

Acute toxicity

Product No ecological damage caused by this product.

Acute toxicity - Fish

Component Information

2-Methylbutane	LL 50 (Oncorhynchus mykiss, 96 h): 34,05 mg/l (QSAR) Remarks: QSAR QSAR, Key study
Butane	LC 50 (Various, 96 h): 24,11 mg/l (QSAR) Remarks: QSAR QSAR, Key study
Difluoromethane	LC 50 (Various, 96 h): 1.507 mg/l Remarks: QSAR QSAR, Key study
Norflurane	LC 50 (Oncorhynchus mykiss, 96 h): 450 mg/l (semi-static) Remarks: Experimental result, Key study
Pentafluoroethane	LC 50 (Oncorhynchus mykiss, 96 h): 450 mg/l (semi-static) Remarks: Read-across from supporting substance (structural analogue or surrogate), Weight of Evidence study

Acute toxicity - Aquatic Invertebrates

Component Information

2-Methylbutane	EC 50 (Daphnia magna, 48 h): 59,44 mg/l (QSAR) Remarks: QSAR QSAR, Key study
Butane	LC 50 (Daphnid, 48 h): 14,22 mg/l (QSAR) Remarks: QSAR QSAR, Key study
Difluoromethane	EC 50 (Daphnid, 48 h): 652 mg/l Remarks: QSAR QSAR, Key study
Norflurane	EC 50 (Daphnia magna, 24 h): 960 mg/l (Static) Remarks: Experimental result, Key study
Pentafluoroethane	EC 50 (Daphnia magna, 48 h): > 200 mg/l (Static) Remarks: Read-across from supporting substance (structural analogue or surrogate), Weight of Evidence study

Toxicity to microorganisms

Component Information

Chronic Toxicity - Aquatic Invertebrates

Component Information

2-Methylbutane	NOAEL (Daphnia magna, 21 d): 13,29 mg/l (QSAR) QSAR QSAR, Key study
----------------	---



SAFETY DATA SHEET

C5H12 8241,25 PPM;C4H10 2,8985 %;CH2F2 16,1916 %;C2HF5 37,1557 %;C2H2F4 42,93 %

Issue Date: 05.07.2018 Version: 1.1 SDS No.: 000010047425
 Last revised date: 06.01.2021 15/21

Pentafluoroethane EC 50 (16 d): 12 mg/l

**Toxicity to Aquatic Plants
 Component Information**

2-Methylbutane NOEC (Algae (Pseudokirchneriella subcapitata), 72 h): 7,51 mg/l
 EC 50 (Algae (Pseudokirchneriella subcapitata), 72 h): 10,7 mg/l
 Butane LC50 (Alga, 72 h): 7,7 mg/l
 Difluoromethane EC 50 (Alga, 96 h): 142 mg/l
 Pentafluoroethane EC 50 (Green Algae, 72 h): 142 mg/l

**12.2 Persistence and Degradability
 Product**

Not applicable to gases and gas mixtures..

**Biodegradation
 Component Information**

2-Methylbutane 71,43 % (28 d) Detected in water. Experimental result, Key study
 Butane 50 % (3 d) Detected in water. QSAR, Weight of Evidence study
 Difluoromethane 5 % (28 d) Detected in water. Experimental result, Key study
 Norflurane 3 % (28 d) Detected in water. Experimental result, Key study
 Pentafluoroethane 5 % (28 d) Detected in water. Experimental result, Key study

**12.3 Bioaccumulative potential
 Product**

The subject product is expected to biodegrade and is not expected to persist for long periods in an aquatic environment.

**Bioconcentration Factor (BCF)
 Component Information**

2-Methylbutane Pimephales promelas, Bioconcentration Factor (BCF): 171 Aquatic sediment Read-across based on grouping of substances (category approach), Key study



SAFETY DATA SHEET

C5H12 8241,25 PPM;C4H10 2,8985 %;CH2F2 16,1916 %;C2HF5 37,1557 %;C2H2F4 42,93 %

Issue Date: 05.07.2018 Version: 1.1 SDS No.: 000010047425
 Last revised date: 06.01.2021 16/21

**12.4 Mobility in soil
Product**

Because of its high volatility, the product is unlikely to cause ground or water pollution.

**Component Information
Norflurane**

Henry's Law Constant: 8.580 MPa (25 °C)

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

Not classified as PBT or vPvB.

12.6 Other adverse effects:

Global Warming Potential

Global warming potential: 2.264,6
 Contains fluorinated greenhouse gases When discharged in large quantities may contribute to the greenhouse effect. For GWP value of mixture and quantities, refer to container label.

**Component Information
2-Methylbutane**

EU. Non-Fluorinated Substance GWPs (Annex IV), Regulation 517/2014/EU on fluorinated greenhouse gases
 - Global warming potential: 5 100-yr

Butane

EU. Non-Fluorinated Substance GWPs (Annex IV), Regulation 517/2014/EU on fluorinated greenhouse gases
 - Global warming potential: 4

Difluoromethane

EU. F-Gases Subject to Emission Limits/Reporting (Annexes I, II), Regulation 517/2014/EU on FGGs
 - Global warming potential: 675 Annex 1: Fluorinated greenhouse gases referred to in Point 1 of Article 2; Section 1:Hydrofluorocarbons (HFCs) and its mixtures

Norflurane

EU. F-Gases Subject to Emission Limits/Reporting (Annexes I, II), Regulation 517/2014/EU on FGGs
 - Global warming potential: 1430 Annex 1: Fluorinated greenhouse gases referred to in Point 1 of Article 2; Section 1:Hydrofluorocarbons (HFCs) and its mixtures

Pentafluoroethane

EU. F-Gases Subject to Emission Limits/Reporting (Annexes I, II), Regulation 517/2014/EU on FGGs
 - Global warming potential: 3500 Annex 1: Fluorinated greenhouse gases referred to in Point 1 of Article 2; Section 1:Hydrofluorocarbons (HFCs) and its mixtures



SAFETY DATA SHEET

C5H12 8241,25 PPM;C4H10 2,8985 %;CH2F2 16,1916 %;C2HF5 37,1557 %;C2H2F4 42,93 %

Issue Date:	05.07.2018	Version: 1.1	SDS No.: 000010047425
Last revised date:	06.01.2021		17/21

SECTION 13: Disposal considerations

13.1 Waste treatment methods

General information: Avoid discharges to atmosphere. Do not discharge into any place where its accumulation could be dangerous. Refer to manufacturer or supplier for information on recovery or recycling.

Disposal methods: Refer to the EIGA code of practice (Doc.30 "Disposal of Gases", downloadable at <http://www.eiga.org>) for more guidance on suitable disposal methods. Dispose of container via supplier only. Discharge, treatment, or disposal may be subject to national, state, or local laws.

European Waste Codes

Container: 14 06 01*: chlorofluorocarbons, HCFC, HFC

SECTION 14: Transport information

ADR

14.1 UN Number:	UN 1078
14.2 UN Proper Shipping Name:	REFRIGERANT GAS, N.O.S.(1,1,1,2-Tetrafluoroethane, Pentafluoroethane)
14.3 Transport Hazard Class(es)	
Class:	2
Label(s):	2.2
Hazard No. (ADR):	20
Tunnel restriction code:	(C/E)
14.4 Packing Group:	-
14.5 Environmental hazards:	Not applicable
14.6 Special precautions for user:	-



SAFETY DATA SHEET

C5H12 8241,25 PPM;C4H10 2,8985 %;CH2F2 16,1916 %;C2HF5 37,1557 %;C2H2F4 42,93 %

Issue Date:	05.07.2018	Version: 1.1	SDS No.: 000010047425
Last revised date:	06.01.2021		18/21

RID

14.1 UN Number:	UN 1078
14.2 UN Proper Shipping Name	REFRIGERANT GAS, N.O.S.(1,1,1,2-Tetrafluoroethane, Pentafluoroethane)
14.3 Transport Hazard Class(es)	
Class:	2
Label(s):	2.2
14.4 Packing Group:	-
14.5 Environmental hazards:	Not applicable
14.6 Special precautions for user:	-

IMDG

14.1 UN Number:	UN 1078
14.2 UN Proper Shipping Name:	REFRIGERANT GAS, N.O.S.(1,1,1,2-Tetrafluoroethane, Pentafluoroethane)
14.3 Transport Hazard Class(es)	
Class:	2.2
Label(s):	2.2
EmS No.:	F-C, S-V
14.4 Packing Group:	-
14.5 Environmental hazards:	Not applicable
14.6 Special precautions for user:	-

IATA

14.1 UN Number:	UN 1078
14.2 Proper Shipping Name:	Refrigerant gas, n.o.s.(1,1,1,2-Tetrafluoroethane, Pentafluoroethane)
14.3 Transport Hazard Class(es):	
Class:	2.2
Label(s):	2.2
14.4 Packing Group:	-
14.5 Environmental hazards:	Not applicable
14.6 Special precautions for user:	-
Other information	
Passenger and cargo aircraft:	Allowed.
Cargo aircraft only:	Allowed.

14.7 Transport in bulk according to Annex II of MARPOL and the IBC Code: Not applicable



SAFETY DATA SHEET

C5H12 8241,25 PPM;C4H10 2,8985 %;CH2F2 16,1916 %;C2HF5 37,1557 %;C2H2F4 42,93 %

Issue Date: 05.07.2018

Version: 1.1

SDS No.: 000010047425

Last revised date: 06.01.2021

19/21

Additional identification:

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. Before transporting product containers ensure that they are firmly secured. Ensure that the container valve is closed and not leaking. Container valve guards or caps should be in place. Ensure adequate air ventilation.

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

Regulation (EC) No. 1907/2006 Annex XVII Substances subject to restriction on marketing and use:

Chemical name	CAS-No.	Concentration
Butane	106-97-8	1,0 - 10%

Directive 92/85/EEC: on the safety and health of pregnant workers and workers who have recently given birth or are breast feeding.:

Chemical name	CAS-No.	Concentration
2-Methylbutane	78-78-4	0,1 - 1,0%

EU. Directive 2012/18/EU (SEVESO III) on major accident hazards involving dangerous substances, as amended.:Not applicable

Directive 98/24/EC on the protection of workers from the risks related to chemical agents at work:

Chemical name	CAS-No.	Concentration
Butane	106-97-8	1,0 - 10%
2-Methylbutane	78-78-4	0,1 - 1,0%

National Regulations

Council Directive 89/391/EEC on the introduction of measures to encourage improvements in the safety and health of workers at work Directive 89/686/EEC on personal protective equipment Only products that comply with the food regulations



SAFETY DATA SHEET

C5H12 8241,25 PPM;C4H10 2,8985 %;CH2F2 16,1916 %;C2HF5 37,1557 %;C2H2F4 42,93 %

Issue Date: 05.07.2018 Version: 1.1 SDS No.: 000010047425
 Last revised date: 06.01.2021 20/21

(EC) No. 1333/2008 and (EU) No. 231/2012 and are labelled as such may be used as food additives.

This Safety Data Sheet has been produced to comply with Regulation (EU) 2015/830.

15.2 Chemical safety assessment: No Chemical Safety Assessment has been carried out.

SECTION 16: Other information

Revision Information: Not relevant.

Key literature references and sources for data: Various sources of data have been used in the compilation of this SDS, they include but are not exclusive to:
 Agency for Toxic Substances and Diseases Registry (ATSDR) (<http://www.atsdr.cdc.gov/>).
 European Chemical Agency: Guidance on the Compilation of Safety Data Sheets.
 European Chemical Agency: Information on Registered Substances <http://apps.echa.europa.eu/registered/registered-sub.aspx#search>
 European Industrial Gases Association (EIGA) Doc. 169 "Classification and Labelling guide", as amended.
 International Programme on Chemical Safety (<http://www.inchem.org/>)
 ISO 10156:2010 Gases and gas mixtures - Determination of fire potential and oxidizing ability for the selection of cylinder valve outlets.
 Matheson Gas Data Book, 7th Edition.
 National Institute for Standards and Technology (NIST) Standard Reference Database Number 69.
 The ESIS (European chemical Substances Information System) platform of the former European Chemicals Bureau (ECB) ESIS (<http://ecb.jrc.ec.europa.eu/esis/>).
 The European Chemical Industry Council (CEFIC) ERICards.
 United States of America's National Library of Medicine's toxicology data network TOXNET (<http://toxnet.nlm.nih.gov/index.html>)
 Threshold Limit Values (TLV) from the American Conference of Governmental Industrial Hygienists (ACGIH).
 Substance specific information from suppliers.
 Details given in this document are believed to be correct at the time of publication.

Classification and procedure used to derive the classification for mixtures according to Regulation (EC) 1272/2008 [CLP]

Classification according to Regulation (EC) No 1272/2008 as amended.	Classification procedure
Gases under pressure, Liquefied gas	On basis of test data



SAFETY DATA SHEET

C5H12 8241,25 PPM;C4H10 2,8985 %;CH2F2 16,1916 %;C2HF5 37,1557 %;C2H2F4 42,93 %

Issue Date: 05.07.2018 Version: 1.1 SDS No.: 000010047425
 Last revised date: 06.01.2021 21/21

Wording of the H-statements in section 2 and 3

H220	Extremely flammable gas.
H224	Extremely flammable liquid and vapor.
H280	Contains gas under pressure; may explode if heated.
H304	May be fatal if swallowed and enters airways.
H336	May cause drowsiness or dizziness.
H411	Toxic to aquatic life with long lasting effects.

Training information: Users of breathing apparatus must be trained. The hazard of asphyxiation is often overlooked and must be stressed during operator training. Ensure operators understand the hazards.

Classification according to Regulation (EC) No 1272/2008 as amended.
 Press. Gas Liq. Gas, H280

Other information: Before using this product in any new process or experiment, a thorough material compatibility and safety study should be carried out. Ensure adequate air ventilation. Ensure all national/local regulations are observed. Whilst proper care has been taken in the preparation of this document, no liability for injury or damage resulting from its use can be accepted.

Last revised date: 06.01.2021

Disclaimer: This information is provided without warranty. The information is believed to be correct. This information should be used to make an independent determination of the methods to safeguard workers and the environment.