SAFETY DATA SHEET

According to Regulation (EC) No. 1907/2006 (REACH) Article 31, Annex II as amended

C2HF5 3,7049 %;C3H2F4 14,483 %;CH2F2 81,8121 %

Issue Date: Revision Date: Last revised date :	26.10.2016 21.02.2024 12.02.2019	Version: 1.2	SDS No.: 000010035476 1/28

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

1.1 Product identifier

Product name: C2HF5 3,7049 %;C3H2F4 14,483 %;CH2F2 81,8121 %

Trade name: R452B

Other Name: R-452B, HFC-32 67 % (w/w); HFC-1234yf 26 % (w/w); HFC-125 7 % (w/w)

UFI: WD7J-SWUG-UW0R-FKFA

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 Uses other than those listed above are not supported. Contact supplier for more information on uses.

1.3 Details of the supplier of the safety data sheet

Supplier

Linde Gas AB
Rättarvägen 3
169 68 Solna

Telephone: +46 8 7069500

E-mail: sds.ren@linde.com

1.4 Emergency telephone number: Poison center: 020-99 60 00 (24 h). Emergency number: 112

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.

Flammable gas	Category 1	H220: Extremely flammable gas.

2.2 Label Elements

Signal Word: Danger

Hazard Statement(s):
H220: Extremely flammable gas.
H280: Contains gas under pressure; may explode if heated.

Precautionary Statements

General None.

Prevention: P210: Keep away from heat, hot surfaces, sparks, open flames and other ignition sources. No smoking.

Response: P377: Leaking gas fire: Do not extinguish, unless leak can be stopped safely.
P381: In case of leakage, eliminate all ignition sources.

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

Disposal None.

Supplemental information
EIGA-0783: Contains fluorinated greenhouse gases

Unknown toxicity - Health
Acute toxicity, inhalation, gas 85,52 %

Unknown toxicity - Environment

Acute hazards to the aquatic environment	0 %
Chronic hazards to the aquatic environment	0 %

2.3 Other hazards

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

Endocrine disrupting properties-Toxicity

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.

Endocrine disrupting properties-Ecotoxicity

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

3.2 Mixtures

Chemical name	Chemical formula	Concentration	CAS-No.	EC No.	REACH Registration No.	M-Factor:	Notes
Pentafluoroethane	C2HF5	3,7049%	354-33-6	206-557-8	01-2119485636-25	-	#
Difluoromethane	CH2F2	81,8121%	75-10-5	200-839-4	01-2119471312-47	-	
2,3,3,3-Tetrafluoropropene	C3H2F4	14,4830%	754-12-1	616-220-0	01-0000019665-61	-	

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).
This substance is listed as SVHC.PBT: persistent, bioaccumulative and toxic substance.
vPvB: very persistent and very bioaccumulative substance.

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Classification

Chemical name	Classification		Notes
Pentafluoroethane	CLP:	Classification: Press. Gas: Liquef. Gas: H280; Supplemental label information: EIGA0357, EIGA0783; EIGA0357; Specific concentration limit: None known. Acute toxicity, oral: None known. Acute toxicity, inhalation: LC Lo: > 800000 ppm Acute toxicity, dermal: None known.	
Difluoromethane	CLP:	Classification: Flam. Gas: 1B: H220; Press. Gas: Liquef. Gas: H280; Supplemental label information: EIGA0783; Specific concentration limit: None known. Acute toxicity, oral: None known. Acute toxicity, inhalation: LC 0: > 520000 ppm Acute toxicity, dermal: None known.	
2,3,3,3-Tetrafluoropropene	CLP:	Classification: Flam. Gas: 1B: H221; Press. Gas: Liquef. Gas: H280; Supplemental label information: None known. Specific concentration limit: None known. Acute toxicity, oral: None known. Acute toxicity, inhalation: LC 50: > 405000 ppm Acute toxicity, dermal: None known.	

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.

Skin Contact: Contact with evaporating liquid may cause frostbite or freezing of skin. In case of frostbite spray with water for at least 15 minutes. Apply a sterile dressing. Get medical attention.

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. Irregular cardiac activity. Loss of co-ordination. May cause drowsiness or dizziness.

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. Because of possible disturbances of cardiac rhythm, catecholamine drugs, such as epinephrine, that may be used in situations of emergency life supportshould be used with special caution.

SECTION 5: Firefighting measures

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

5.1 Extinguishing media

Suitable extinguishing media: Water Spray or Fog. Dry powder. Foam.

Unsuitable extinguishing media: Carbon Dioxide.

5.2 Special hazards arising from the substance or mixture:

No data available.

Hazardous Combustion Products: If involved in a fire the following toxic and/or corrosive fumes may be produced by thermal decomposition: Hydrogen fluoride, a corrosive and toxic gas, and other potentially hazardous fluorine-containing compounds may be released upon combustion. Carbon oxides

5.3 Advice for firefighters

Special fire-fighting procedures: In case of fire: Stop leak if safe to do so. Do not extinguish flames at leak because possibility of uncontrolled explosive reignition exists. 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.

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.

SAFETY DATA SHEET

According to Regulation (EC) No. 1907/2006 (REACH) Article 31, Annex II as amended

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SECTION 6: Accidental release measures

6.1 Personal precautions, protective equipment and emergency procedures: Evacuate area. Provide adequate ventilation. Consider the risk of potentially explosive atmospheres . In case of leakage, eliminate all ignition sources. Monitor the concentration of the released product. 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. Eliminate sources of ignition.

6.4 Reference to other sections: Refer to sections 8 and 13.

SAFETY DATA SHEET

According to Regulation (EC) No. 1907/2006 (REACH) Article 31, Annex II as amended

C2HF5 3,7049 %;C3H2F4 14,483 %;CH2F2 81,8121 %

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. Purge system with dry inert gas (e.g. helium or nitrogen) before gas is introduced and when system is placed out of service. Purge air from system before introducing gas. Containers, which contain or have contained flammable or explosive substances, must not be inerted with liquid carbon dioxide. Assess the risk of a potentially explosive atmosphere and the need for suitable equipment i.e. explosion-proof. Take precautionary measures against static discharges. Keep away from ignition sources (including static discharges). Provide electrical earthing of equipment and electrical equipment usable in explosive atmospheres. Use non-sparking tools. Refer to supplier's handling instructions. The substance must be handled in accordance with good industrial hygiene and safety procedures. Ensure the complete system has been (or is regularly) checked for leaks before use. 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: All electrical equipment in the storage areas should be compatible with the risk of a potentially explosive atmosphere. Segregate from oxidant gases and other oxidants being stored. 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.

SECTION 8: Exposure controls/personal protection

8.1 Control Parameters

Occupational Exposure Limits

Chemical name	Type	Form of exposure	Exposure Limit Values		Source
Pentafluoroethane	NGV		500 ppm	2.500 mg/m3	Sweden. Occupational Exposure Limit Values, as amended (2015)
	KTV		750 ppm	3.750 mg/m3	Sweden. Occupational Exposure Limit Values, as amended (2015)

Please refer to the latest edition of the appropriate source text and consult an industrial hygienist or similar professional, or local agencies, for further information.

Biological Limit Values

No biological exposure limits noted for the ingredient(s).

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DNEL-Values

Critical component	Type	Value	Remarks
Pentafluoroethane	Workers - Inhalation, Systemic, long-term	16444 mg/m3	Repeated dose toxicity
	Workers - Inhalation, Systemic, short-term		Low hazard (no threshold derived)
	Workers - Inhalation, Local, long-term, Local, short-term		Low hazard (no threshold derived)
	Workers - Oral, Systemic, long-term, Systemic, short-term		Low hazard (no threshold derived)
	Workers - Oral, Local, long-term, Local, short-term		Low hazard (no threshold derived)
	Workers - Eyes, Local effect		Low hazard (no threshold derived)
Difluoromethane	Workers - Inhalation, Systemic, long-term	7035 mg/m3	Repeated dose toxicity
2,3,3,3-Tetrafluoropropene	Workers - Inhalation, Systemic, long-term	950 mg/m3	Repeated dose toxicity
	Workers - Eyes, Local effect		Low hazard (no threshold derived)

PNEC-Values

Critical component	Type	Value	Remarks

Pentafluoroethane	Aquatic (freshwater)	0,1 mg/l	-
Pentafluoroethane	Sediment (freshwater)	0,6 mg/kg	-
Difluoromethane	Aquatic (freshwater)	0,313 mg/l	-
Difluoromethane	Sediment (freshwater)	1,807 mg/kg	-
2,3,3,3-Tetrafluoropropene	Aquatic (freshwater)	0,1 mg/l	-
2,3,3,3-Tetrafluoropropene	Aquatic (marine water)	0,01 mg/l	-
2,3,3,3-Tetrafluoropropene	Sediment (freshwater)	1,51 mg/kg	-
2,3,3,3-Tetrafluoropropene	Soil	1,49 mg/kg	-
2,3,3,3-Tetrafluoropropene	Sediment (marine water)	0,151 mg/kg	-

8.2 Exposure controls

Appropriate engineering controls:

Consider a work permit system e.g. for maintenance activities. Ensure adequate air ventilation. Provide adequate general and local exhaust ventilation. Keep concentrations well below lower explosion limits. Gas detectors should be used when quantities of flammable gases or vapours 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. Product to be handled in a closed system. Only use permanent leak tight installations (e.g. welded pipes). Take precautionary measures against static discharges.

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. Refer to local regulations for restriction of emissions to the atmosphere. See section 13 for specific methods for waste gas treatment. Do not eat, drink or smoke when using the product.

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

Body protection:
Wear fire resistant or flame retardant clothing.
Guideline: ISO/TR 2801:2007 Clothing for protection against heat and flame -- General recommendations for selection, care and use of protective clothing.

Other:
Wear safety shoes while handling containers
Guideline: ISO 20345 Personal protective equipment - Safety footwear.

Respiratory Protection:
When allowed by a risk assessment Respiratory Protective Equipment (RPE) may be used The selection of the Respiratory Protective Device (RPD) must be based on known or anticipated exposure levels, the hazards of the product and the safe working limits of the selected RPD. Self-contained breathing apparatus (SCBA) or positive pressure airline with mask are to be used in oxygen-deficient atmospheres
Guideline: EN 137 Respiratory protective devices - Self-contained open-circuit compressed air breathing apparatus with full face mask - Requirements, testing, marking.

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: C2HF5: Colorless
CH2F2: Colorless
C3H2F4: Colorless

Odor: C2HF5: faint ethereal
CH2F2: Odorless
C3H2F4: Ethereal odor

Odor Threshold: Odor threshold is subjective and is inadequate to warn of over exposure.

Melting Point: No data available.

Boiling Point: No data available.

Flammability: Flammable gas

Upper/lower limit on flammability or explosive limits

Explosive limit - upper: (Measured) 23,3 %(V)

Explosive limit - lower: (Measured) 12 %(V)

Flash Point: Not applicable to gases and gas mixtures.

Autoignition Temperature: Not applicable.

Decomposition Temperature: Not known.

pH: Not applicable

Viscosity

Dynamic viscosity: No data available.

Kinematic viscosity: No data available.

Solubility(ies)	
Solubility in Water:	No data available.
Solubility (other):	No data available.
Partition coefficient (n-octanol/water):	Not known.
Dispersion Stability:	No data available.
Vapor pressure:	10,3 bar (59 °F/15 °C)
Relative density:	0,99 (77 °F/25 °C)
Density:	No data available.
Relative vapor density:	2,2 77 °F/25 °C
Particle characteristics:	Not applicable

9.2 Other information

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:	Can form a potentially explosive atmosphere in air. May react violently with oxidants.
10.4 Conditions to avoid:	Keep away from heat, hot surfaces, sparks, open flames and other ignition sources. No smoking.
10.5 Incompatible Materials:	Air and oxidizers. For material compatibility see latest version of ISO-11114. Strong alkalis. Strong oxides. 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.

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SECTION 11: Toxicological information

General information: None.

11.1 Information on hazard classes as defined in Regulation (EC) No 1272/2008

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

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

Pentafluoroethane	LC Lo (Sprague-Dawley rat, Female, Male, 4 h): > 800000 ppm (OECD Guideline 403 (Acute Inhalation Toxicity)) Remarks: Experimental result, Key study 1 = reliable without restrictions ALC (Sprague-Dawley rat, Male, 4 h): > 709000 ppm Remarks: Experimental result, Supporting study 1 = reliable without restrictions
Difluoromethane	LC 0 (Wistar rat, Female, Male, 4 h): > 520000 ppm (OECD Guideline 403 (Acute Inhalation Toxicity)) Remarks: Inhalation; vapor Experimental result, Key study
2,3,3,3-Tetrafluoropropene	LC 50 (Rat, 4 h): > 405000 ppm

Repeated dose toxicity
Component Information

Pentafluoroethane	NOAEL (Rat(Female, Male), Inhalation, 13 Weeks): >= 50.000 ppm(m) Inhalation Experimental result, Key study
Difluoromethane	NOAEL (Wistar-derived rat(Female, Male), Inhalation, 28 d): 49.500 ppm(m) Inhalation Experimental result, Supporting study NOAEL (Wistar-derived rat(Female, Male), Inhalation, 13 Weeks): 49.100 ppm(m) Inhalation Experimental result, Key study

2,3,3,3-Tetrafluoropropene	NOAEL - No Observable Adverse Effect Level (Rat, Inhalation, 13 Weeks): 50000 ppm LOAEL - Lowest Observable Adverse Effect Level (Rat, Inhalation, 13 Weeks): 50000 ppm

Skin Corrosion/Irritation

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

Serious Eye Damage/Eye Irritation

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

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.

In vitro

Component Information

Pentafluoroethane	Chromosome aberration (OECD Guideline 473 (In Vitro Mammalian Chromosome Aberration Test)): Negative. Ames test in vitro: (OECD Guideline 471 (Bacterial Reverse Mutation Test)): Negative.
Difluoromethane	Ames test in vitro: (OECD Guideline 471 (Bacterial Reverse Mutation Test)): Negative. Chromosome aberration (OECD Guideline 473 (In Vitro Mammalian Chromosome Aberration Test)): Negative. In vitro gene mutations test on mammalian cells:: Negative.
2,3,3,3-Tetrafluoropropene	Ames test in vitro: (OECD Guideline 471 (Bacterial Reverse Mutation Test)): Mutagenic

In vivo

Component Information

Pentafluoroethane	Micronucleus test in vivo mouse: (OECD Guideline 474 (Mammalian Erythrocyte Micronucleus Test)) Inhalation (Mouse): Negative.
Difluoromethane	Micronucleus test in vivo mouse: (OECD Guideline 474 (Mammalian Erythrocyte Micronucleus Test)) (Mouse): Negative.

2,3,3,3-Tetrafluoropropene	Chromosome aberration (OECD Guideline 474 (Mammalian Erythrocyte Micronucleus Test)): Negative.

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.

Reproductive toxicity (Fertility)
Component Information

2,3,3,3-Tetrafluoropropene	Rat NOAEL - No Observable Adverse Effect Level: 50.000 ppm

Developmental toxicity (Teratogenicity)
Component Information

Difluoromethane	Rabbit (Female) Inhalation (OECD Guideline 414 (Prenatal Developmental Toxicity Study))
2,3,3,3-Tetrafluoropropene	Rat Inhalation (OECD Guideline 414 (Prenatal Developmental Toxicity Study))

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..

11.2 Information on other hazards

Endocrine disrupting properties
Product: 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.;
Components:

Pentafluoroethane	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.;
Difluoromethane	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.;
2,3,3,3-Tetrafluoropropene	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.;

Other information

Product: No data available.

SECTION 12: Ecological information

General information: Not applicable

12.1 Toxicity

Acute toxicity

Product No ecological damage caused by this product.

Acute toxicity - Fish

Component Information

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 1 = reliable without restrictions
Difluoromethane	LC 50 (Fish (freshwater), 96 h): 1.731 mg/l Remarks: QSAR, Key study 2 = reliable with restrictions
2,3,3,3-Tetrafluoropropene	LC 50 (Carp (Cyprinus carpio), 96 h): > 197 mg/l

Acute toxicity - Aquatic Invertebrates

Component Information

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 2 = reliable with restrictions
Difluoromethane	EC 50 (Daphnid, 48 h): 652 mg/l Remarks: QSAR, Key study 2 = reliable with restrictions LC 50 (Daphnid, 48 h): 833 mg/l Remarks: QSAR, Key study 2 = reliable with restrictions
2,3,3,3-Tetrafluoropropene	EC 50 (Water flea (Daphnia magna), 48 h): > 100 mg/l

Toxicity to microorganisms
Component Information

Difluoromethane	Static EC 50 (Algae (Pseudokirchneriella subcapitata), 72 h): > 118 mg/l (OECD Guideline 201 (Freshwater Alga and Cyanobacteria, Growth Inhibition Test)) EC 50 (Alga, 96 h): 313 mg/l (estimated)

Chronic Toxicity - Fish
Component Information

Pentafluoroethane	NOEC (30 d): 32 mg/l QSAR
Difluoromethane	NOEC (Danio rerio; Pimephales promelas, 30 d): 169 mg/l QSAR, Supporting study 4 = not assignable

Chronic Toxicity - Aquatic Invertebrates
Component Information

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

Toxicity to Aquatic Plants
Component Information

Pentafluoroethane	EC 50 (Green Algae, 72 h): 142 mg/l
Difluoromethane	EC 50 (Alga, 96 h): 142 mg/l
2,3,3,3-Tetrafluoropropene	NOEC (Algae (Pseudokirchneriella subcapitata), 72 h): > 75 mg/l (OECD Guideline 201 (Freshwater Alga and Cyanobacteria, Growth Inhibition Test))

12.2 Persistence and Degradability

Product Not applicable to gases and gas mixtures..

Biodegradation

Component Information

Pentafluoroethane	5 % (28 d) Detected in water. Experimental result, Key study
Difluoromethane	5 % (28 d) Detected in water. Experimental result, Key study
2,3,3,3-Tetrafluoropropene	< 5 % (28 d, OECD 301F/ ISO 9408/ EEC 92/69/V, C.4-D)

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.

12.4 Mobility in soil

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

12.5 Results of PBT and vPvB assessment

Product Not classified as PBT or vPvB.

Global Warming Potential

Global warming potential: 698,3
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

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
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
2,3,3,3-Tetrafluoropropene	EU. F-Gases Subject to Emission Limits/Reporting (Annexes I, II), Regulation 517/2014/EU on FGGs - Global warming potential: 4 Annex 2: Other fluorinated greenhouse gases subject to reporting in accordance with Article 19; Section 1: Unsaturated hydro(chloro)fluorocarbons

12.6 Endocrine disrupting properties:

Product:	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.
Components:	
Pentafluoroethane	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.
Difluoromethane	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.
2,3,3,3-Tetrafluoropropene	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.

12.7 Other adverse effects:

Other hazards

Product:	No data available.

Other effects:

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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 or ID number:	UN 3161
14.2 UN Proper Shipping Name:	LIQUEFIED GAS, FLAMMABLE, N.O.S.(Difluoromethane, 2,3,3,3-Tetrafluoropropene)
14.3 Transport Hazard Class(es)	
Class:	2
Label(s):	2.1
Hazard No. (ADR):	23
Tunnel restriction code:	(B/D)
14.4 Packing Group:	–
Limited quantity	None.
Excepted quantity	None.
14.5 Environmental hazards:	Not applicable
14.6 Special precautions for user:	–

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RID

14.1 UN number or ID number:	UN 3161
14.2 UN Proper Shipping Name	LIQUEFIED GAS, FLAMMABLE, N.O.S.(Difluoromethane, 2,3,3,3-Tetrafluoropropene)
14.3 Transport Hazard Class(es)	
Class:	2
Label(s):	2.1
14.4 Packing Group:	–
Limited quantity	None.
Excepted quantity	None.
14.5 Environmental hazards:	Not applicable
14.6 Special precautions for user:	–

IMDG

14.1 UN number or ID number:	UN 3161
14.2 UN Proper Shipping Name:	LIQUEFIED GAS, FLAMMABLE, N.O.S.(Difluoromethane, 2,3,3,3-Tetrafluoropropene)
14.3 Transport Hazard Class(es)	
Class:	2.1
Label(s):	2.1
EmS No.:	F-D, S-U
14.4 Packing Group:	–
Limited quantity	None.
Excepted quantity	None.
14.5 Environmental hazards:	Not applicable
14.6 Special precautions for user:	–

IATA

14.1 UN number or ID number:	UN 3161
14.2 Proper Shipping Name:	Liquefied gas, flammable, n.o.s.(Difluoromethane, 2,3,3,3-Tetrafluoropropene)
14.3 Transport Hazard Class(es):	
Class:	2.1
Label(s):	2.1
14.4 Packing Group:	–
Limited quantity	None.

Excepted quantity	None.
14.5 Environmental hazards:	Not applicable
14.6 Special precautions for user:	–
Other information	
Passenger and cargo aircraft:	Forbidden.
Cargo aircraft only:	Allowed.

14.7 Maritime transport in bulk according to IMO instruments
Not applicable for product as supplied.

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

EU. REACH Annex XIV, Substances Subject to Authorization as amended: None present or none present in regulated quantities.

Regulation (EU) No. 649/2012 concerning the export and import of dangerous chemicals, Annex I, Part 1 as amended: None present or none present in regulated quantities.

Regulation (EU) No. 649/2012 concerning the export and import of dangerous chemicals, Annex I, Part 2 as amended: None present or none present in regulated quantities.

Regulation (EU) No. 649/2012 concerning the export and import of dangerous chemicals, Annex I, Part 3 as amended: None present or none present in regulated quantities.

Regulation (EU) No. 649/2012 concerning the export and import of dangerous chemicals, Annex V as amended:

None present or none present in regulated quantities.

EU. Directive 2012/18/EU (SEVESO III) on major accident hazards involving dangerous substances, Annex I:

Classification	Lower-tier Requirements	Upper-tier Requirements
P2. FLAMMABLE GASES	10 t	50 t

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 2016/425/EEC on personal protective equipment Directive 2014/34/EU on equipment and protective systems intended for use in potentially explosive atmospheres (ATEX) Only products that comply with the food regulations (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) 2020/878.

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

SECTION 16: Other information

Revision Information: Not relevant.

Abbreviations and acronyms:

SWO:	Sweden. Occupational Exposure Limit Values, as amended
SWO / KTV:	Short Term Exposure Limit (STEL):
SWO / NGV:	Time Weighted Average (TWA):

ADN - European Agreement concerning the International Carriage of Dangerous Goods by Inland Waterways; ADR - Agreement concerning the International Carriage of Dangerous Goods by Road; AIIC - Australian Inventory of Industrial Chemicals; ASTM - American Society for the Testing of Materials; bw - Body weight; CLP - Classification Labelling Packaging Regulation; Regulation (EC) No 1272/2008; CMR - Carcinogen, Mutagen or Reproductive Toxicant; DIN - Standard of the German Institute for Standardisation; DSL - Domestic Substances List (Canada); ECHA - European Chemicals Agency; EC-Number - European Community number; ECx - Concentration associated with x% response; EIGA - European Industrial Gases Association; ELx - Loading rate associated with x% response; EmS - Emergency Schedule; ENCS - Existing and New Chemical Substances (Japan); ErCx - Concentration associated with x% growth rate response; GHS - Globally Harmonized System; GLP - Good Laboratory Practice; IARC - International Agency for Research on Cancer; IATA - International Air Transport Association; IBC - International Code for the Construction and Equipment of Ships carrying Dangerous Chemicals in Bulk; IC50 - Half maximal inhibitory concentration; ICAO - International Civil Aviation Organization; IECSC - Inventory of Existing Chemical Substances in China; IMDG - International Maritime Dangerous Goods; IMO - International Maritime Organization;

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ISHL - Industrial Safety and Health Law (Japan); ISO - International Organisation for Standardization; KECI - Korea Existing Chemicals Inventory; LC50 - Lethal Concentration to 50 % of a test population; LD50 - Lethal Dose to 50% of a test population (Median Lethal Dose); MARPOL - International Convention for the Prevention of Pollution from Ships; n.o.s. - Not Otherwise Specified; NO(A)EC - No Observed (Adverse) Effect Concentration; NO(A)EL - No Observed (Adverse) Effect Level; NOELR - No Observable Effect Loading Rate; NZIoC - New Zealand Inventory of Chemicals; OECD - Organization for Economic Co-operation and Development; OPPTS - Office of Chemical Safety and Pollution Prevention; PBT - Persistent, Bioaccumulative and Toxic substance; PICCS - Philippines Inventory of Chemicals and Chemical Substances; (Q)SAR - (Quantitative) Structure Activity Relationship; REACH - Regulation (EC) No 1907/2006 of the European Parliament and of the Council concerning the Registration, Evaluation, Authorisation and Restriction of Chemicals; RID - Regulations concerning the International Carriage of Dangerous Goods by Rail; SADT - Self-Accelerating Decomposition Temperature; SDS - Safety Data Sheet; SVHC - substance of very high concern; TCSI - Taiwan Chemical Substance Inventory; TECI - Thailand Existing Chemicals Inventory; TRGS - Technical Rule for Hazardous Substances; TSCA - Toxic Substances Control Act (United States); UN - United Nations; vPvB - Very Persistent and Very Bioaccumulative

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 5 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]

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Classification according to Regulation (EC) No 1272/2008 as amended.	Classification procedure
Gases under pressure, Liquefied gas	On basis of test data
Flammable gas, Category 1	On basis of test data
Flammable gas, Category 1B	On basis of test data

Wording of the H-statements in section 2 and 3

H220	Extremely flammable gas.
H280	Contains gas under pressure; may explode if heated.

Training information: Users of breathing apparatus must be trained. Ensure operators understand the flammability hazard.

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

Press. Gas Liq. Gas, H280

Flam. Gas 1, H220

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. Ensure equipment is adequately earthed. 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. ASHRAE: A2L

Last revised date: 21.02.2024

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.