

Issue Date: 12.11.2014 Version: 1.1 SDS No.: 000010022600
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SECTION 1: Identification of the substance/mixture and of the company/undertaking

1.1 Product identifier

Product name: CH2F2 38,1110 %;C2HF5 17,9557 %;C2H2F4 43,9332 %

Trade name: R407C

Other Name: R407C

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

Oy Linde Gas Ab Telephone: +358 10 2421

Itsehallintokuja 6

FIN-02600 ESPOO Finland

E-mail: sds.ren@linde.com

1.4 Emergency telephone number: Poison Information Center: open 24 hours a day, tel. 09 471 977

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



Signal Words: Warning

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



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Precautionary Statements

Prevention: None.

Response: None.

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

Disposal: None.

Supplemental label 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.	Notes
Pentafluoroethane	C2HF5	17,9557%	354-33-6	206-557-8	01-2119485636-25	
Difluoromethane	CH2F2	38,1110%	75-10-5	200-839-4	01-2119471312-47	
Norflurane	C2H2F4	43,9332%	811-97-2	212-377-0	01-2119459374-33	

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.

Classification

Chemical name	Classification		Notes
Pentafluoroethane	CLP:	Press. Gas Liquef. Gas;H280	
Difluoromethane	CLP:	Press. Gas Liquef. Gas;H280, Flam. Gas 1;H220	
Norflurane	CLP:	Press. Gas Liquef. Gas;H280	

CLP: Regulation No. 1272/2008.

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

^{##} This substance has workplace exposure limit(s).

PBT: persistent, bioaccumulative and toxic substance.

vPvB: very persistent and very bioaccumulative substance.



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SECTION 4: First aid measures

In high concentrations may cause asphyxiation. Symptoms may include loss of General:

> 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.

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

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. Water spray, fog, CO2, dry chemical, or alcohol resistant

foam.

Unsuitable extinguishing

media:

None.

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

substance or mixture:



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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.

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.



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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 eq. 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.

SECTION 8: Exposure controls/personal protection

8.1 Control Parameters
Occupational Exposure Limits

None of the components have assigned exposure limits.



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DNEL-Values

Critical component	Type	Value	Remarks
Pentafluoroethane	Workers - Inhalation,	16444	Repeated dose toxicity
T chandorocalane	Systemic, long-term	mg/m3	hepeated dose toxicity
Difluoromethane	Workers - Inhalation,	7035	Repeated dose toxicity
	Systemic, long-term	mg/m3	
Norflurane	Workers - Inhalation,	13936	Repeated dose toxicity
	Systemic, long-term	mg/m3	

PNEC-Values

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

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: Wear working gloves while handling containers

Guideline: EN 388 Protective gloves against mechanical risks.

Body protection: No special precautions.



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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: C2HF5: Colorless
CH2F2: Colorless

C2H2F4: Colorless

Odor: C2HF5: faint ethereal CH2F2: Odorless

C2H2F4: faint ethereal

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

exposure.

pH: Not applicable.Melting Point: No data available.

Boiling Point: -43,6 °C

Sublimation Point:Not applicable.Critical Temp. (°C):86,74 °C

Flash Point: Not applicable to gases and gas mixtures. Evaporation Rate: Not applicable to gases and gas mixtures.

Flammability (solid, gas):
Non-Flammable Gas
Flammability Limit - Upper (%):
Not applicable.

Flammability Limit - Lower (%):
Not applicable.

Vapor pressure:
1.190,3 kPa (25 °C)

Vapor density (air=1):
Relative density:
No data available.

Solubility(ies)

Solubility in Water: No data available.

Partition coefficient (n-octanol/water): Not known.

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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.

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.

Acute toxicity - Dermal

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



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Acute toxicity - Inhalation

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

Repeated dose toxicity
Component Information

Pentafluoroethane NOAEL (Rat(Female, Male), Inhalation, 13 Weeks): >= 50.000 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(Male), Inhalation, 14 d): 100.000 ppm(m) Inhalation Experimental

result, Supporting study

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.

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..



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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.

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.

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.



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SECTION 12: Ecological information

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

Difluoromethane LC 50 (Pimephales promelas, 96 h): 1.405 mg/l Remarks: QSAR QSAR, Supporting

study

Norflurane LC 50 (Oncorhynchus mykiss, 96 h): 450 mg/l (semi-static) Remarks: Experimental

result, Key study

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

Difluoromethane EC 50 (Daphnia magna, 48 h): 1.573 mg/l Remarks: QSAR QSAR, Supporting study

Norflurane EC 50 (Daphnia magna, 24 h): 960 mg/l (Static) Remarks: Experimental result, Key

study

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

12.2 Persistence and Degradability

Product Not applicable to gases and gas mixtures...



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Biodegradation

Component Information

Difluoromethane 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.

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: 1.774

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 <u>EU. F-Gases Subject to Emission Limits/Reporting (Annexes I, II), Regulation</u>

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 <u>EU. F-Gases Subject to Emission Limits/Reporting (Annexes I, II), Regulation</u>

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



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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: UN 3340

14.2 UN Proper Shipping Name: REFRIGERANT GAS R 407C(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: –

RID

14.1 UN Number: UN 3340

14.2 UN Proper Shipping Name REFRIGERANT GAS R 407C(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:



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IMDG

14.1 UN Number: UN 3340

14.2 UN Proper Shipping Name: REFRIGERANT GAS R 407C(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 3340

14.2 Proper Shipping Name: Refrigerant gas R 407C(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

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



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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 (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

auide.

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]

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



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Wording of the H-statements in section 2 and 3

H220 Extremely flammable gas.

H280 Contains gas under pressure; may explode if heated.

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.

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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.