

**Solstice® 452A**

000000022311

Version 1.1

Revision Date 03.09.2017

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

**1.1. Product identifier**

Product name : Solstice® 452A  
SDS-number : 000000022311  
Type of product : Mixture  
Remarks : SDS according to Art. 31 of Regulation (EC) 1907/2006.

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

Use of the Substance/Mixture : Refrigerant  
Uses advised against : none

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

Company : Honeywell Fluorine Products Europe B.V.  
Laarderhoogtweg 18  
1101 EA Amsterdam  
Netherlands  
Telephone : (31) 020 5656911  
Telefax : (31) 020 5656600  
For further information,  
please contact: PMTEU Product Stewardship:  
SafetyDataSheet@Honeywell.com  
Honeywell International, Inc.  
115 Tabor Road  
Morris Plains, NJ 07950-2546  
USA

**1.4. Emergency telephone number**

Emergency telephone number : +1-703-527-3887 (ChemTrec-Transport)  
+1-303-389-1414 (Medical)  
Country based Poison Control Center : see chapter 15.1

**SECTION 2: Hazards identification**

**2.1. Classification of the substance or mixture**

**REGULATION (EC) No 1272/2008**

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

**2.2. Label elements**


**REGULATION (EC) No 1272/2008**

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Hazard pictograms	:		
Signal word	:	Warning	
Hazard statements	:	H280	Contains gas under pressure; may explode if heated.
Precautionary statements	:	P260 P410 + P403	Do not breathe dust/ fume/ gas/ mist/ vapours/ spray. Protect from sunlight. Store in a well-ventilated place.

**2.3. Other hazards**

Rapid evaporation of the liquid may cause frostbite.

**SECTION 3: Composition/information on ingredients**

**3.1. Substance**

Not applicable

**3.2. Mixture**

Chemical name	CAS-No. Index-No. REACH Registration Number EC-No.	Classification 1272/2008	Concentration	Remarks
Pentafluoroethane	354-33-6 01-2119485636-25 206-557-8	Press. Gas ; H280	>= 25 % - < 50 %	1*
2,3,3,3-Tetrafluoroprop-1-ene	754-12-1 01-0000019665-61 468-710-7	Flam. Gas 1; H220 Press. Gas ; H280	>= 25 % - < 50 %	1*
Difluoromethane	75-10-5 01-2119471312-47 200-839-4	Flam. Gas 1; H220 Press. Gas ; H280	>= 10 % - < 20 %	1*

1\* - For specific concentration limits see Annexes of 1272/2008

Remaining components of this product are non-hazardous and/or are present at concentrations below reportable limits.

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

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**SECTION 4: First aid measures**

**4.1 Description of first aid measures**

*General advice:*

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

*Inhalation:*

Move to fresh air. If breathing is irregular or stopped, administer artificial respiration. Use oxygen as required, provided a qualified operator is present. Call a physician. Do not give drugs from adrenaline-ephedrine group.

*Skin contact:*

After contact with skin, wash immediately with plenty of water. If there is evidence of frostbite, bathe (do not rub) with lukewarm (not hot) water. If water is not available, cover with a clean, soft cloth or similar covering. If symptoms persist, call a physician.

*Eye contact:*

Remove contact lenses. Rinse immediately with plenty of water, also under the eyelids, for at least 15 minutes. If eye irritation persists, consult a specialist.

*Ingestion:*

Ingestion is unlikely because of the physical properties and is not expected to be hazardous. As this product is a gas, refer to the inhalation section.

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

no data available

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

Do not give adrenaline or similar drugs.

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

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**SECTION 5: Firefighting measures**

**5.1. Extinguishing media**

*Suitable extinguishing media:*

The product is not flammable.

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

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

Contents under pressure.

This product is not flammable at ambient temperatures and atmospheric pressure.

However, this material can ignite when mixed with air under pressure and exposed to strong ignition sources.

Container may rupture on heating.

Cool closed containers exposed to fire with water spray.

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

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

Fire may cause evolution of:

Halogenated compounds

Hydrogen fluoride

Carbonyl halides

Carbon oxides

**5.3. Advice for firefighters**

Wear full protective clothing and self-contained breathing apparatus.

Use extinguishing measures that are appropriate to local circumstances and the surrounding environment.

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**SECTION 6: Accidental release measures**

**6.1. Personal precautions, protective equipment and emergency procedures**

Immediately contact emergency personnel. Wear personal protective equipment. Unprotected persons must be kept away. Ensure adequate ventilation. In case of insufficient ventilation wear suitable respiratory equipment. Vapours are heavier than air and can cause suffocation by reducing oxygen available for breathing. Ensure that the oxygen content is  $\geq 19.5\%$ .

**6.2. Environmental precautions**

Prevent further leakage or spillage if safe to do so. The product evaporates readily.

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

Ventilate the area.

**6.4. Reference to other sections**

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For personal protection see section 8.

**SECTION 7: Handling and storage**

**7.1. Precautions for safe handling**

*Advice on safe handling:*

Open drum carefully as content may be under pressure. The product should only be used in areas from which all naked lights and other sources of ignition have been excluded. Pressurized container. Protect from sunlight and do not expose to temperatures exceeding 50 °C. Do not pierce or burn, even after use. Do not spray on a naked flame or any incandescent material. Do not use in areas without adequate ventilation. Contaminated equipment (brushes, rags) must be cleaned immediately with water.

*Advice on protection against fire and explosion:*

The product is not flammable. Can form a combustible mixture with air at pressures above atmospheric pressure. Normal measures for preventive fire protection.

*Hygiene measures:*

Handle in accordance with good industrial hygiene and safety practice. Ensure adequate ventilation, especially in confined areas. Avoid contact with skin, eyes and clothing. Remove and wash contaminated clothing before re-use. Keep working clothes separately. When using, do not eat, drink or smoke.

**7.2. Conditions for safe storage, including any incompatibilities**

*Further information on storage conditions:*

Store in original container. Keep away from direct sunlight. Keep containers tightly closed in a cool, well-ventilated place.

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

no additional data available

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

**8.1. Control parameters**

*Occupational exposure limits:*

Components	Basis / Value type	Value / Form of exposure	Exceeding Factor	Remarks
Pentafluoroethane	HONEYWELL TWA	1.000 ppm		We are not aware of any national exposure limit.

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2,3,3,3-Tetrafluoroprop-1-ene	WEEL TWA	500 ppm		
2,3,3,3-Tetrafluoroprop-1-ene	HONEYWELL TWA	500 ppm		
Difluoromethane	HONEYWELL TWA	2.200 mg/m3 1.000 ppm		We are not aware of any national exposure limit.

TWA - Time weighted average

**DNEL/ PNEC-Values**

Component	End-use / Impact	Exposure duration	Value	Exposure routes	Remarks
Pentafluoroethane	Workers / Long-term systemic effects		16444 mg/m3	Inhalation	
Pentafluoroethane	Consumers / Long-term systemic effects		1753 mg/m3	Inhalation	
2,3,3,3-Tetrafluoroprop-1-ene	Workers / Long-term systemic effects		950 mg/m3	Inhalation	
Difluoromethane	Workers / Long-term systemic effects		7035 mg/m3	Inhalation	
Difluoromethane	Consumers / Long-term systemic effects		750 mg/m3	Inhalation	

Component	Environmental compartment / Value	Remarks
Pentafluoroethane	Fresh water: 0,1 mg/l	Assessment factor: 1000
Pentafluoroethane	Fresh water sediment: 0,6 mg/kg dw	
2,3,3,3-Tetrafluoroprop-1-ene	Fresh water: > 0,1 mg/l	
2,3,3,3-Tetrafluoroprop-1-ene	Marine water: > 0,01 mg/l	
2,3,3,3-Tetrafluoroprop-1-ene	Fresh water sediment: > 1,77 mg/kg	
2,3,3,3-Tetrafluoroprop-1-ene	Marine sediment: > 0,178 mg/kg	
2,3,3,3-Tetrafluoroprop-1-ene	Soil: > 1,54 mg/kg	

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Difluoromethane	Fresh water: 0,142 mg/l	Assessment factor: 1000
Difluoromethane	Fresh water sediment: 0,534 mg/kg dw	

**8.2. Exposure controls**

**Occupational exposure controls**

The Personal Protective Equipment must be in accordance with EN standards:respirator EN 136, 140, 149; safety glasses EN 166; protective suit: EN 340, 463, 468, 943-1, 943-2; gloves EN 374, 511; safety shoes EN-ISO 20345.  
Do not breathe gas.

**Engineering measures**

General room ventilation is adequate for storage and handling.  
Perform filling operations only at stations with exhaust ventilation facilities.

**Personal protective equipment**

*Respiratory protection:*

In case of insufficient ventilation wear suitable respiratory equipment.  
Self-contained breathing apparatus (EN 133)

*Hand protection:*

Glove material: Viton (R)  
Protective gloves against cold  
(EN 511)

*Eye protection:*

Wear as appropriate:  
Safety glasses with side-shields  
If splashes are likely to occur, wear:  
Goggles or face shield, giving complete protection to eyes

*Skin and body protection:*

Wear suitable protective equipment.  
Wear as appropriate:  
Protective suit

**Environmental exposure controls**

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

**SECTION 9: Physical and chemical properties**

**9.1. Information on basic physical and chemical properties**

Form : Liquefied gas

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Colour	:	clear colourless
Odour	:	slight ether-like
Melting point/range	:	no data available
Boiling point/boiling range	:	no data available
Flash point	:	Not applicable
Flammability (solid, gas)	:	does not ignite
Ignition temperature	:	no data available
Lower explosion limit	:	Not applicable
Upper explosion limit	:	Not applicable
Vapour pressure	:	1,07 MPa at 21,1 °C
Density	:	1,14 g/cm <sup>3</sup>
pH	:	no data available
Water solubility	:	negligible
Partition coefficient: n- octanol/water	:	no data available
Relative vapour density	:	no data available

**9.2 Other Information**

no additional data available

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**SECTION 10: Stability and reactivity**

**10.1. Reactivity**

Stable under normal conditions.

**10.2. Chemical stability**

no data available

**10.3. Possibility of hazardous reactions**



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Hazardous polymerization does not occur.

**10.4. Conditions to avoid**

Heating will cause pressure rise with risk of bursting  
Pressurized container. Protect from sunlight and do not expose to temperatures exceeding 50 °C.  
Do not pierce or burn, even after use. Do not spray on a naked flame or any incandescent material.  
Can form a combustible mixture with air at pressures above atmospheric pressure.

**10.5. Incompatible materials**

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

**10.6. Hazardous decomposition products**

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

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**SECTION 11: Toxicological information**

**11.1. Information on toxicological effects**

*Acute oral toxicity:*  
Not applicable

*Acute dermal toxicity:*  
no data available

*Acute inhalation toxicity:*  
LC50  
Species: Rat  
Value: > 520000 ppm  
Exposure time: 4 h  
Test substance: Difluoromethane (HFC-32)

LC50  
Species: Rat  
Value: > 400000 ppm  
Exposure time: 4 h  
Test substance: 2,3,3,3-Tetrafluoroprop-1-ene

Species: Rat  
Value: > 769000 ppm  
Exposure time: 4 h

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Test substance: Ethane, pentafluoro- (HFC-125)

*Skin irritation:*

no data available

*Eye irritation:*

no data available

*Respiratory or skin sensitisation:*

Cardiac sensitization

Species: dogs

Test substance: Difluoromethane (HFC-32)

No-observed-effect level

>350 000 ppm

Cardiac sensitization

Species: dogs

Result: No effects observed for exposures up to 12% (120,189 ppm).

Test substance: 2,3,3,3-Tetrafluoroprop-1-ene

Cardiac sensitization

Species: dogs

Test substance: Ethane, pentafluoro- (HFC-125)

No-observed-effect level

75 000 ppm

Lowest observed effect level

100 000 ppm

*Repeated dose toxicity:*

Species: Rat

Application Route: Inhalation

Exposure time: 90 d

NOEL: 50000 ppm

Test substance: Difluoromethane (HFC-32)

Note: Subchronic toxicity

Species: Rat

Application Route: Inhalation

Exposure time: 4 Weeks

NOEL: 50000 ppm

Test substance: Ethane, pentafluoro- (HFC-125)

Note: Subchronic toxicity

Species: Rat

Application Route: Inhalation

Exposure time: 2 Weeks

NOEL: 50000 ppm

Test substance: 2,3,3,3-Tetrafluoroprop-1-ene

Species: Rat

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Application Route: Inhalation  
Exposure time: 4 Weeks  
NOAEL: 50000 ppm  
Test substance: 2,3,3,3-Tetrafluoroprop-1-ene

Species: Rat  
Application Route: Inhalation  
Exposure time: 13 Weeks  
NOAEL: 50000 ppm  
Test substance: 2,3,3,3-Tetrafluoroprop-1-ene

Species: Rabbit, male  
Application Route: Inhalation  
Exposure time: 28 d  
NOEL: 500 ppm  
Test substance: 2,3,3,3-Tetrafluoroprop-1-ene

Species: Rabbit, female  
Application Route: Inhalation  
Exposure time: 28 d  
NOEL: 1000 ppm  
Test substance: 2,3,3,3-Tetrafluoroprop-1-ene

Species: Mini-pig  
Application Route: Inhalation  
Exposure time: 28 d  
NOAEL: 10,000 ppm  
Test substance: 2,3,3,3-Tetrafluoroprop-1-ene  
Note: highest exposure tested

### *Germ cell mutagenicity:*

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

Test substance: 2,3,3,3-Tetrafluoroprop-1-ene

Test Method: Ames test  
Result: negative  
Test substance: Difluoromethane (HFC-32)

Test Method: Ames test  
Result: negative  
Test substance: Ethane, pentafluoro- (HFC-125)

Species: Mouse  
Cell type: Bone marrow  
Method: Mutagenicity (micronucleus test)  
Test substance: Difluoromethane (HFC-32)  
Result: negative

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Test Method: Unscheduled DNA synthesis  
Dose: up to 50,000 ppm (4 weeks)  
Test substance: 2,3,3,3-Tetrafluoroprop-1-ene  
Result: negative

Species: Mouse  
Cell type: Micronucleus  
Dose: up to 200,000 ppm (4 hour)  
Test substance: 2,3,3,3-Tetrafluoroprop-1-ene  
Result: negative

Species: Rat  
Cell type: Micronucleus  
Dose: up to 50,000 ppm (4 weeks)  
Test substance: 2,3,3,3-Tetrafluoroprop-1-ene  
Result: negative

Species: Rat  
Application Route: Inhalation exposure  
Exposure time: Two-generation reproductive toxicity  
NOAEL,parent: 50,000 ppm  
NOAEL,F1: 50,000 ppm  
NOAEL,F2: 50,000 ppm  
Test substance: 2,3,3,3-Tetrafluoroprop-1-ene  
Species: Rabbit  
Dose: NOAEL (No observed adverse effect level) - 4,000 ppm  
Test substance: 2,3,3,3-Tetrafluoroprop-1-ene  
Species: Rat  
Dose: NOAEL (No observed adverse effect level) - 50,000 ppm  
Test substance: 2,3,3,3-Tetrafluoroprop-1-ene  
Species: Rabbit  
Dose: NOEL - 50,000 ppm  
Test substance: Difluoromethane (HFC-32)  
Note: Did not show teratogenic effects in animal experiments.  
Species: Rat  
Dose: NOEL - 50,000 ppm  
Test substance: Difluoromethane (HFC-32)  
Note: Did not show teratogenic effects in animal experiments.  
Species: Rat  
Application Route: Inhalation exposure  
NOAEL, Teratog:  $\geq 50,000$  ppm  
NOAEL, Maternal:  $\geq 50,000$  ppm  
Test substance: Ethane, pentafluoro- (HFC-125)  
Note: Did not show teratogenic effects in animal experiments.  
Species: Rabbit  
Application Route: Inhalation exposure  
NOAEL, Teratog:  $\geq 50,000$  ppm  
NOAEL, Maternal:  $\geq 50,000$  ppm  
Test substance: Ethane, pentafluoro- (HFC-125)

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Note: Did not show teratogenic effects in animal experiments.

*Aspiration hazard:*  
no data available

*Other information:*  
Rapid evaporation of the liquid may cause frostbite.  
Vapours are heavier than air and can cause suffocation by reducing oxygen available for breathing.  
Handle in accordance with good industrial hygiene and safety practice.

### SECTION 12: Ecological information

#### 12.1. Toxicity

*Toxicity to fish:*

LC50

Species: Cyprinus carpio (Carp)

Value: > 197 mg/l

Exposure time: 96 h

Method: OECD Test Guideline 203

Test substance: 2,3,3,3-Tetrafluoroprop-1-ene

No demonstrable toxic effect in saturated solution.

*Toxicity to aquatic plants:*

EC50

Species: Scenedesmus capricornutum (fresh water algae)

Value: > 100 mg/l

Test substance: 2,3,3,3-Tetrafluoroprop-1-ene

*Toxicity to aquatic invertebrates:*

EC50

Species: Daphnia magna (Water flea)

Value: > 83 mg/l

Exposure time: 48 h

Method: OECD Test Guideline 202

Test substance: 2,3,3,3-Tetrafluoroprop-1-ene

#### 12.2. Persistence and degradability

*Biodegradability:*

Result: Not readily biodegradable.

Test substance: Ethane, pentafluoro- (HFC-125)

*Biodegradability:*

Biodegradation: 5 %

Result: Not readily biodegradable.

Method: OECD 301 D

Test substance: 2,3,3,3-Tetrafluoroprop-1-ene

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**12.3. Bioaccumulative potential**

no data available

**12.4. Mobility in soil**

no data available

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

no data available

**12.6. Other adverse effects**

Accumulation in aquatic organisms is unlikely.

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**SECTION 13: Disposal considerations**

**13.1. Waste treatment methods**

*Product:*

Dispose according to legal requirements.

*Packaging:*

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

*Further information:*

Provisions relating to waste:  
EC Directive 2006/12/EC; 2008/98/EEC  
Regulation No. 1013/2006

For personal protection see section 8.

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**SECTION 14: Transport information**

**ADR/RID**

UN Number : 3163  
Description of the goods : LIQUEFIED GAS, N.O.S.  
(PENTAFLUOROETHANE, R-1234yf, DIFLUOROMETHANE)  
Class : 2  
Classification Code : 2A  
Hazard Identification : 20  
Number  
ADR/RID-Labels : 2.2  
Environmentally hazardous : no

**IATA**

UN Number : 3163  
Description of the goods : Liquefied gas, n.o.s.  
(Pentafluoroethane, R-1234yf, Difluoromethane)  
Class : 2.2

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Hazard Labels : 2.2

**IMDG**

UN Number : 3163  
Description of the goods : LIQUEFIED GAS, N.O.S.  
(PENTAFLUOROETHANE, R-1234yf, DIFLUOROMETHANE)  
Class : 2.2  
Hazard Labels : 2.2  
EmS Number : F-C, S-V  
Marine pollutant : no

**SECTION 15: Regulatory information**

**15.1 Safety, health and environmental regulations/legislation specific for the substance or mixture**

**Poison Control Center**

Country	Phone Number
Austria	+4314064343
Belgium	070 245245
Bulgaria	(+35929154233
Croatia	(+3851)23-48-342
Cyprus	no data available
Czech Republic	+420224919293; +420224915402
Denmark	82121212
Estonia	16662; (+372)6269390
Finland	9471977
France	+33(0)145425959
Greece	no data available
Hungary	(+36-80)201-199
Iceland	5432222
Ireland	+353(1)8092166
Italy	no data available
Germany	Berlin : 030/19240
	Bonn : 0228/19240
	Erfurt : 0361/730730
	Freiburg : 0761/19240
	Göttingen : 0551/19240
	Homburg : 06841/19240
	Mainz : 06131/19240

Country	Phone Number
Latvia	+37167042473
Liechtenstein	no data available
Lithuania	+370532362052
Luxembourg	070245245; (+352)80002-5500
Malta	no data available
Netherlands	030-2748888
Norway	22591300
Poland	no data available
Portugal	808250143
Romania	no data available
Slovakia (NTIC)	+421 2 54 774 166
Slovenia	no data available
Spain	+34915620420
Sweden	112 (begär Giftinformation);+46104566786
United Kingdom	no data available

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Munich : 089/19240

**Other inventory information**

US. Toxic Substances Control Act  
On TSCA Inventory

Australia. Industrial Chemical (Notification and Assessment) Act  
On the inventory, or in compliance with the inventory

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

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

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

Philippines. The Toxic Substances and Hazardous and Nuclear Waste Control Act  
Not in compliance with the inventory

China. Inventory of Existing Chemical Substances  
Not in compliance with the inventory

New Zealand. Inventory of Chemicals (NZIoC), as published by ERMA New Zealand  
Not in compliance with the inventory

**15.2 Chemical safety assessment**

A Chemical Safety Assessment has not been carried out.

**SECTION 16: Other information**

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

Pentafluoroethane	: H280	Contains gas under pressure; may explode if heated.
2,3,3,3-Tetrafluoroprop-1-ene	: H220 H280	Extremely flammable gas. Contains gas under pressure; may explode if heated.
Difluoromethane	: H220 H280	Extremely flammable gas. Contains gas under pressure; may explode if heated.



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### Further information

All directives and regulations refer to amended versions.

Vertical lines in the left hand margin indicate a relevant amendment from the previous version.

Abbreviations:

EC European Community

CAS Chemical Abstracts Service

DNEL Derived no effect level

PNEC Predicted no effect level

vPvB Very persistent and very bioaccumulative substance

PBT Persistent, bioaccumulative und toxic substance

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

This information should not constitute a guarantee for any specific product properties.

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