

SAFETY DATA SHEET



Opteon™ XL41 (R-454B) Refrigerant

Version 7.0	Revision Date: 2025/03/05	SDS Number (Internal): 3071290-00025	MSDS number: AA00152-0000143545 Date of last issue: 2024/10/28 Date of first issue: 2018/08/09
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1. PRODUCT AND COMPANY IDENTIFICATION

Product name : Opteon™ XL41 (R-454B) Refrigerant

SDS-Identcode : 130000143545

Recommended use of the chemical and restrictions on use

Recommended use : Refrigerant

Restrictions on use : For professional and industrial installation and use only.
Do not use product for anything outside of the above specified uses

Manufacturer or supplier's details

Company : Chemours Korea Inc.

Address : 12FL, Majestarcity Tower 1, 12, Seocho-daero 38-gil, Seocho-gu, Seoul 06655, Korea

Telephone : 82-2-2015-5000

Emergency telephone number : 080-880-0454

Telefax : 82-2-2015-5091

2. HAZARDS IDENTIFICATION

GHS Classification

Flammable gases : Category 1

Gases under pressure : Liquefied gas

GHS label elements

Hazard pictograms :



Signal word : Danger

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

Precautionary statements : **Prevention:**

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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:

P410 + P403 Protect from sunlight. Store in a well-ventilated place.

Other hazards which do not result in classification

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

Misuse or intentional inhalation abuse may cause death without warning symptoms, due to cardiac effects.

Rapid evaporation of the product may cause frostbite.

May displace oxygen and cause rapid suffocation.

3. COMPOSITION/INFORMATION ON INGREDIENTS

Substance / Mixture : Mixture

Components

Chemical name	Common Name	CAS-No.	Concentration (% w/w)
Difluoromethane#	No data available	75-10-5	68.9
2,3,3,3-Tetrafluoropropene#	No data available	754-12-1	30.9445

Voluntarily-disclosed substance

4. FIRST AID MEASURES

General advice	: In the case of accident or if you feel unwell, seek medical advice immediately. When symptoms persist or in all cases of doubt seek medical advice.
In case of eye contact	: Get medical attention immediately.
In case of skin contact	: Thaw frosted parts with lukewarm water. Do not rub affected area. Get medical attention immediately.
If inhaled	: If inhaled, remove to fresh air. If not breathing, give artificial respiration. If breathing is difficult, give oxygen. Get medical attention immediately.

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If swallowed	: Ingestion is not considered a potential route of exposure.
Most important symptoms and effects, both acute and delayed	: May cause cardiac arrhythmia. Other symptoms potentially related to misuse or inhalation abuse are Cardiac sensitisation Anaesthetic effects Light-headedness Dizziness confusion Lack of coordination Drowsiness Unconsciousness Gas reduces oxygen available for breathing. Contact with liquid or refrigerated gas can cause cold burns and frostbite.
Protection of first-aiders	: No special precautions are necessary for first aid responders.
Notes to physician	: Because of possible disturbances of cardiac rhythm, catecholamine drugs, such as epinephrine, that may be used in situations of emergency life support should be used with special caution.

5. FIREFIGHTING MEASURES

Suitable and unsuitable extinguishing media

Suitable extinguishing media : Water spray
Alcohol-resistant foam
Carbon dioxide (CO₂)
Dry chemical

Unsuitable extinguishing media : None known.

Specific hazards during fire-fighting : Vapours may form flammable mixture with air
Exposure to combustion products may be a hazard to health.
If the temperature rises there is danger of the vessels bursting due to the high vapor pressure.

Hazardous combustion products : Hydrogen fluoride
carbonyl fluoride
Carbon oxides
Fluorine compounds

Specific extinguishing methods : Use extinguishing measures that are appropriate to local circumstances and the surrounding environment.
Fight fire remotely due to the risk of explosion.

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Use water spray to cool unopened containers.
Leaking gas fire: Do not extinguish, unless leak can be stopped safely.
Remove undamaged containers from fire area if it is safe to do so.
Evacuate area.

Special protective equipment for firefighters : Wear self-contained breathing apparatus for firefighting if necessary.
Use personal protective equipment.

6. ACCIDENTAL RELEASE MEASURES

Personal precautions, protective equipment and emergency procedures : Evacuate personnel to safe areas.
Only trained personnel should re-enter the area.
Remove all sources of ignition.
Avoid skin contact with leaking liquid (danger of frostbite).
Ventilate the area.
Follow safe handling advice (see section 7) and personal protective equipment recommendations (see section 8).

Environmental precautions : Avoid release to the environment.
Prevent further leakage or spillage if safe to do so.
Retain and dispose of contaminated wash water.

Methods and materials for containment and cleaning up : Ventilate the area.
Non-sparking tools should be used.
Suppress (knock down) gases/vapours/mists with a water spray jet.
Local or national regulations may apply to releases and disposal of this material, as well as those materials and items employed in the cleanup of releases. You will need to determine which regulations are applicable.
Sections 13 and 15 of this SDS provide information regarding certain local or national requirements.

7. HANDLING AND STORAGE

Technical measures : Use equipment rated for cylinder pressure. Use a backflow preventative device in piping. Close valve after each use and when empty.

Local/Total ventilation : If sufficient ventilation is unavailable, use with local exhaust ventilation.
If advised by assessment of the local exposure potential, use only in an area equipped with explosion-proof exhaust ventilation.

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- Advice on safe handling : Avoid breathing gas.
Handle in accordance with good industrial hygiene and safety practice, based on the results of the workplace exposure assessment
Keep container tightly closed.
Wear cold insulating gloves/ face shield/ eye protection.
Valve protection caps and valve outlet threaded plugs must remain in place unless container is secured with valve outlet piped to use point.
Prevent backflow into the gas tank.
Use a check valve or trap in the discharge line to prevent hazardous back flow into the cylinder.
Use a pressure reducing regulator when connecting cylinder to lower pressure (<3000 psig) piping or systems.
Close valve after each use and when empty. Do NOT change or force fit connections.
Prevent the intrusion of water into the gas tank.
Never attempt to lift cylinder by its cap.
Do not drag, slide or roll cylinders.
Use a suitable hand truck for cylinder movement.
Keep away from heat, hot surfaces, sparks, open flames and other ignition sources. No smoking.
Take precautionary measures against static discharges.
Take care to prevent spills, waste and minimize release to the environment.
- Conditions for safe storage : Cylinders should be stored upright and firmly secured to prevent falling or being knocked over.
Separate full containers from empty containers.
Do not store near combustible materials.
Avoid area where salt or other corrosive materials are present.
Keep in properly labelled containers.
Keep tightly closed.
Keep in a cool, well-ventilated place.
Keep away from direct sunlight.
Store in accordance with the particular national regulations.
Keep away from heat and sources of ignition.
- Materials to avoid : Do not store with the following product types:
Strong oxidizing agents
- Recommended storage temperature : < 52 °C
- Storage period : > 10 yr
- Further information on storage stability : The product has an indefinite shelf life when stored properly.

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8. EXPOSURE CONTROLS/PERSONAL PROTECTION

Components with workplace control parameters

Contains no substances with occupational exposure limit values.

Engineering measures : Minimize workplace exposure concentrations.
If sufficient ventilation is unavailable, use with local exhaust ventilation.
If advised by assessment of the local exposure potential, use only in an area equipped with explosion-proof exhaust ventilation.

Personal protective equipment. Among the following personal protective equipment, the PPEs which require safety certification need to be certified by KOSHA.

Respiratory protection : Use a positive pressure air supplied respirator if there is any potential for uncontrolled release, exposure levels are unknown.

Eye protection : Wear the following personal protective equipment:
Chemical resistant goggles must be worn.
Face-shield

Hand protection
Material : Impervious gloves

Remarks : Choose gloves to protect hands against chemicals depending on the concentration and quantity of the hazardous substance and specific to place of work. For special applications, we recommend clarifying the resistance to chemicals of the aforementioned protective gloves with the glove manufacturer. Wash hands before breaks and at the end of workday. Breakthrough time is not determined for the product. Change gloves often!

Skin and body protection : Wear the following personal protective equipment:
If assessment demonstrates that there is a risk of explosive atmospheres or flash fires, use flame retardant antistatic protective clothing.

Protective measures : Wear cold insulating gloves/ face shield/ eye protection.

Hygiene measures : If exposure to chemical is likely during typical use, provide eye flushing systems and safety showers close to the working place.
When using do not eat, drink or smoke.
Wash contaminated clothing before re-use.

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9. PHYSICAL AND CHEMICAL PROPERTIES

Appearance	: Liquefied gas
Colour	: colourless
Odour	: slight, ether-like
Odour Threshold	: No data available
pH	: No data available
Melting point/freezing point	: No data available
Initial boiling point and boiling range	: -50.9 °C
Flash point	: Not applicable
Evaporation rate	: > 1 (CCL4=1.0)
Flammability (solid, gas)	: Flammable
Upper explosion limit / Upper flammability limit	: Upper flammability limit 23.6 %(V) Method: ASTM E681
Lower explosion limit / Lower flammability limit	: Lower flammability limit 11.3 %(V) Method: ASTM E681
Vapour pressure	: 15,856 hPa (25 °C)
Solubility(ies) Water solubility	: No data available
Relative vapour density	: 2.2 (Air = 1.0)
Relative density	: 0.98 (25 °C)
Density	: 0.98 g/cm ³ (25 °C) (as liquid)
Partition coefficient: n-	: Not applicable

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octanol/water

Auto-ignition temperature : 496 °C

Decomposition temperature : No data available

Viscosity
Viscosity, kinematic : Not applicable

Explosive properties : Not explosive

Oxidizing properties : The substance or mixture is not classified as oxidizing.

Molecular weight : No data available

Particle characteristics
Particle size : Not applicable

10. STABILITY AND REACTIVITY

Chemical stability and possibility of hazardous reactions : Reactivity:
Not classified as a reactivity hazard.
Chemical stability:
Stable if used as directed. Follow precautionary advice and avoid incompatible materials and conditions.
Possibility of hazardous reactions:
Vapours may form flammable mixture with air
Can react with strong oxidizing agents.
Flammable gas.

Conditions to avoid : Heat, flames and sparks.

Incompatible materials : Avoid impurities (e.g. rust, dust, ash), risk of decomposition.
Incompatible with acids and bases.
Incompatible with oxidizing agents.
Oxygen
Peroxides
peroxide compounds
Powdered metals

Hazardous decomposition products : No hazardous decomposition products are known.

11. TOXICOLOGICAL INFORMATION

Information on likely routes of exposure : Inhalation
Skin contact
Eye contact

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Health hazard information

Acute toxicity

No data available

Components:

Difluoromethane:

Acute oral toxicity	: Assessment: The substance or mixture has no acute oral toxicity
Acute inhalation toxicity	: LC50 (Rat): > 520000 ppm Exposure time: 4 h Test atmosphere: gas Method: OECD Test Guideline 403 No observed adverse effect concentration (Dog): 350000 ppm Test atmosphere: gas Remarks: Cardiac sensitisation Lowest observed adverse effect concentration (Dog): > 350000 ppm Test atmosphere: gas Remarks: Cardiac sensitisation Cardiac sensitisation threshold limit (Dog): > 735,000 mg/m3 Test atmosphere: gas Remarks: Cardiac sensitisation
Acute dermal toxicity	: Assessment: The substance or mixture has no acute dermal toxicity

2,3,3,3-Tetrafluoropropene:

Acute inhalation toxicity	: LC50 (Rat): > 405800 ppm Exposure time: 4 h Test atmosphere: gas Method: OECD Test Guideline 403 No observed adverse effect concentration (Dog): 120000 ppm Test atmosphere: gas Remarks: Cardiac sensitisation Lowest observed adverse effect concentration (Dog): > 120000 ppm Test atmosphere: gas Remarks: Cardiac sensitisation Cardiac sensitisation threshold limit (Dog): > 559,509 mg/m3 Test atmosphere: gas Remarks: Cardiac sensitisation
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Skin corrosion/irritation

No data available

Components:

Difluoromethane:

|| Result : No skin irritation

2,3,3,3-Tetrafluoropropene:

|| Result : No skin irritation

Serious eye damage/eye irritation

No data available

Components:

Difluoromethane:

|| Result : No eye irritation

2,3,3,3-Tetrafluoropropene:

|| Result : No eye irritation

Respiratory or skin sensitisation

Respiratory sensitisation

No data available

Skin sensitisation

No data available

Components:

Difluoromethane:

|| Exposure routes : Skin contact
|| Result : negative

2,3,3,3-Tetrafluoropropene:

|| Exposure routes : Skin contact
|| Result : negative

Carcinogenicity

No data available

Components:

Difluoromethane:

|| No data available

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2,3,3,3-Tetrafluoropropene:

|| No data available

|| Result : negative

|| Carcinogenicity - Assessment : Weight of evidence does not support classification as a carcinogen

Germ cell mutagenicity

No data available

Components:

Difluoromethane:

|| No data available

|| Genotoxicity in vitro : Test Type: Bacterial reverse mutation assay (AMES)
Method: OECD Test Guideline 471
Result: negative

Test Type: Chromosome aberration test in vitro
Method: OECD Test Guideline 473
Result: negative

|| Genotoxicity in vivo : Test Type: Mammalian erythrocyte micronucleus test (in vivo cytogenetic assay)
Species: Mouse
Application Route: inhalation (gas)
Method: OECD Test Guideline 474
Result: negative

|| Germ cell mutagenicity- Assessment : Weight of evidence does not support classification as a germ cell mutagen.

2,3,3,3-Tetrafluoropropene:

|| No data available

|| Genotoxicity in vitro : Test Type: Bacterial reverse mutation assay (AMES)
Method: OECD Test Guideline 471
Result: positive

Test Type: Chromosome aberration test in vitro
Method: OECD Test Guideline 473
Result: negative

|| Genotoxicity in vivo : Test Type: Mammalian erythrocyte micronucleus test (in vivo cytogenetic assay)
Species: Mouse
Application Route: inhalation (gas)
Method: OECD Test Guideline 474

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	Result: negative
	Test Type: In vivo mammalian alkaline comet assay
	Species: Rat
	Application Route: inhalation (gas)
	Method: OECD Test Guideline 489
	Result: negative
	Test Type: Mammalian erythrocyte micronucleus test (in vivo cytogenetic assay)
	Species: Rat
	Application Route: inhalation (gas)
	Method: OECD Test Guideline 474
	Result: negative
Germ cell mutagenicity- Assessment	: Weight of evidence does not support classification as a germ cell mutagen.

Reproductive toxicity

No data available

Components:

Difluoromethane:

No data available

Effects on fertility	: Species: Mouse Application Route: Inhalation Result: negative Remarks: Based on data from similar materials
Effects on foetal development	: Test Type: Combined repeated dose toxicity study with the reproduction/developmental toxicity screening test Species: Rat Application Route: inhalation (gas) Method: OECD Test Guideline 414 Result: negative Test Type: Combined repeated dose toxicity study with the reproduction/developmental toxicity screening test Species: Rabbit Application Route: inhalation (gas) Method: OECD Test Guideline 414 Result: negative
Reproductive toxicity - Assessment	: Weight of evidence does not support classification for reproductive toxicity

2,3,3,3-Tetrafluoropropene:

No data available

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|------------------------------------|---|
| Effects on fertility | : Test Type: Two-generation reproduction toxicity study
Species: Rat
Application Route: inhalation (gas)
Method: OECD Test Guideline 416
Result: negative |
| Effects on foetal development | : Test Type: Prenatal development toxicity study (teratogenicity)
Species: Rat
Application Route: inhalation (gas)
Method: OECD Test Guideline 414
Result: negative |
| Reproductive toxicity - Assessment | : Weight of evidence does not support classification for reproductive toxicity, No effects on or via lactation |

STOT - single exposure

No data available

Components:

Difluoromethane:

- | | |
|-----------------|--|
| Exposure routes | : inhalation (gas) |
| Assessment | : No significant health effects observed in animals at concentrations of 20000 ppmV/4h or less |

2,3,3,3-Tetrafluoropropene:

- | | |
|-----------------|--|
| Exposure routes | : inhalation (gas) |
| Assessment | : No significant health effects observed in animals at concentrations of 20000 ppmV/4h or less |

STOT - repeated exposure

No data available

Components:

Difluoromethane:

- | | |
|-----------------|---|
| Exposure routes | : inhalation (gas) |
| Assessment | : No significant health effects observed in animals at concentrations of 250 ppmV/6h/d or less. |

2,3,3,3-Tetrafluoropropene:

- | | |
|-----------------|---|
| Exposure routes | : inhalation (gas) |
| Assessment | : No significant health effects observed in animals at concentrations of 250 ppmV/6h/d or less. |

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Repeated dose toxicity

Components:

Difluoromethane:

Species	: Rat, male and female
NOAEL	: 49100 ppm
LOAEL	: > 49100 ppm
Application Route	: inhalation (gas)
Exposure time	: 13 Weeks
Method	: OECD Test Guideline 413

2,3,3,3-Tetrafluoropropene:

Species	: Rat, male and female
NOAEL	: 50000 ppm
LOAEL	: >50000 ppm
Application Route	: inhalation (gas)
Exposure time	: 13 Weeks
Method	: OECD Test Guideline 413

Aspiration toxicity

No data available

Components:

Difluoromethane:

|| No aspiration toxicity classification

2,3,3,3-Tetrafluoropropene:

|| No aspiration toxicity classification

Experience with human exposure

No data available

Toxicology, Metabolism, Distribution

No data available

Neurological effects

No data available

Further information

No data available

12. ECOLOGICAL INFORMATION

Ecotoxicity

Components:

Difluoromethane:

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Toxicity to fish	: LC50 (Fish): 1,507 mg/l Exposure time: 96 h Method: ECOSAR (Ecological Structure Activity Relationships)
Toxicity to daphnia and other aquatic invertebrates	: EC50 (Daphnia (water flea)): 652 mg/l Exposure time: 48 h Method: ECOSAR (Ecological Structure Activity Relationships)
Toxicity to algae/aquatic plants	: EC50 (green algae): 142 mg/l Exposure time: 96 h Method: ECOSAR (Ecological Structure Activity Relationships)

2,3,3,3-Tetrafluoropropene:

Toxicity to fish	: LC50 (Cyprinus carpio (Carp)): > 197 mg/l Exposure time: 96 h Method: OECD Test Guideline 203
Toxicity to daphnia and other aquatic invertebrates	: EC50 (Daphnia magna (Water flea)): > 100 mg/l Exposure time: 48 h Method: OECD Test Guideline 202
Toxicity to algae/aquatic plants	: EC50 (Selenastrum capricornutum (green algae)): > 100 mg/l Exposure time: 72 h Method: OECD Test Guideline 201 NOEC (Selenastrum capricornutum (green algae)): > 75 mg/l Exposure time: 3 d Method: OECD Test Guideline 201

Persistence and degradability

Components:

Difluoromethane:

Biodegradability	: Result: Not readily biodegradable. Method: OECD Test Guideline 301D
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2,3,3,3-Tetrafluoropropene:

Biodegradability	: Result: Not readily biodegradable. Method: OECD Test Guideline 301F
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Bioaccumulative potential

Components:

Difluoromethane:

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Partition coefficient: n-octanol/water : log Pow: 0.714

2,3,3,3-Tetrafluoropropene:

Bioaccumulation : Remarks: Bioaccumulation is unlikely.

Partition coefficient: n-octanol/water : log Pow: 2 (25 °C)

Mobility in soil

No data available

Other adverse effects

No data available

13. DISPOSAL CONSIDERATIONS

Disposal methods

Waste from residues : Dispose of contents and container according to wastes control act.

Contaminated packaging : Empty containers should be taken to an approved waste handling site for recycling or disposal.
Empty pressure vessels should be returned to the supplier.
Empty containers retain residue and can be dangerous.
Do not pressurize, cut, weld, braze, solder, drill, grind, or expose such containers to heat, flame, sparks, or other sources of ignition. They may explode and cause injury and/or death.
If not otherwise specified: Dispose of as unused product.

Disposal precautions

Dispose of contents and container according to wastes control act.

14. TRANSPORT INFORMATION

International Regulations

UNRTDG

UN number : UN 3161
Proper shipping name : LIQUEFIED GAS, FLAMMABLE, N.O.S.
(Difluoromethane, 2,3,3,3-Tetrafluoropropene)
Class : 2.1
Packing group : Not assigned by regulation
Labels : 2.1
Environmentally hazardous : no

IATA-DGR

UN/ID No. : UN 3161
Proper shipping name : Liquefied gas, flammable, n.o.s.

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(Difluoromethane, 2,3,3,3-Tetrafluoropropene)

Class : 2.1
Packing group : Not assigned by regulation
Labels : Flammable Gas
Packing instruction (cargo aircraft) : 200
Packing instruction (passenger aircraft) : Not permitted for transport

IMDG-Code

UN number : UN 3161
Proper shipping name : LIQUEFIED GAS, FLAMMABLE, N.O.S.
(Difluoromethane, 2,3,3,3-Tetrafluoropropene)

Class : 2.1
Packing group : Not assigned by regulation
Labels : 2.1
EmS Code : F-D, S-U
Marine pollutant : no

Transport in bulk according to Annex II of MARPOL 73/78 and the IBC Code

Not applicable for product as supplied.

National Regulations

Refer to section 15 for specific national regulation.

Special precautions for user

The transport classification(s) provided herein are for informational purposes only, and solely based upon the properties of the unpackaged material as it is described within this Safety Data Sheet. Transportation classifications may vary by mode of transportation, package sizes, and variations in regional or country regulations.

15. REGULATORY INFORMATION

National regulatory information

Regulation under the Occupational Safety and Health Act

Harmful Substances Prohibited from Manufacturing

Not applicable

Harmful Substances Required Permission for Manufacture

Not applicable

Harmful Agents to be kept below Occupational Exposure Limits

Not applicable

Harmful Agents Required to be kept below Permission Levels

Not applicable

Hazardous substances requiring management

Not applicable

Special Management Materials

Not applicable

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Controlled Substances Subject to Environment Monitoring

Not applicable

Controlled Substances Subject to Health Examination

Not applicable

Hazardous Substances Subject to Process Safety Management (PSM) Reporting Obligation

Chemical name/Classification	Manufacturing or handling quantity	Storage quantity
Flammable gases	5,000 kg	200,000 kg

K-OSHA Hazardous Substances (Occupational Safety and Health Regulations, Table 1)

Category
Flammable gas

K-OSHA Hazardous Substances (Occupational Safety and Health Regulations, Table 9)

Category	Manufacturing or handling quantity
Flammable gas	50 cubic metre

Regulation under the Chemicals Control Act

Toxic Chemicals

Not applicable

Restricted Chemicals

Not applicable

Prohibited Chemicals

Not applicable

Toxic Release Inventory

Chemical name	CAS-No.	Group	Threshold limits (%)
Hydrofluorocarbons	75-10-5	Group II	≥ 1 %

Accident Precaution Chemicals

Not applicable

Dangerous Substances Safety Management Act

Not Applicable to Dangerous Materials

Wastes Control Act

Industrial general wastes

Follow article 13 of the act to dispose the product waste

Other requirements in domestic and other countries

Montreal Protocol : Difluoromethane

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16. OTHER INFORMATION

Other information : Opteon™ and any associated logos are trademarks or copyrights of The Chemours Company FC, LLC.
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Further information

Sources of key data used to compile the Safety Data Sheet : Internal technical data, data from raw material SDSs, OECD eChem Portal search results and European Chemicals Agency, <http://echa.europa.eu/>

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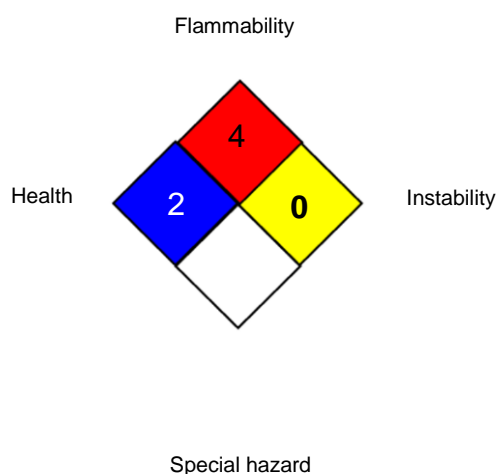
Number of Revision : 24

Revision Date : 2025/03/05

Items where changes have been made to the previous version are highlighted in the body of this document by two vertical lines.

Date format : yyyy/mm/dd

NFPA:



Full text of other abbreviations

SAFETY DATA SHEET



Opteon™ XL41 (R-454B) Refrigerant

Version	Revision Date:	SDS Number (Internal):	MSDS number: AA00152-0000143545
7.0	2025/03/05	3071290-00025	Date of last issue: 2024/10/28
			Date of first issue: 2018/08/09

AIIC - Australian Inventory of Industrial Chemicals; ANTT - National Agency for Transport by Land of Brazil; ASTM - American Society for the Testing of Materials; bw - Body weight; CMR - Carcinogen, Mutagen or Reproductive Toxicant; DIN - Standard of the German Institute for Standardisation; DSL - Domestic Substances List (Canada); ECx - Concentration associated with x% response; 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; ERG - Emergency Response Guide; 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; 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; Nch - Chilean Norm; NO(A)EC - No Observed (Adverse) Effect Concentration; NO(A)EL - No Observed (Adverse) Effect Level; NOELR - No Observable Effect Loading Rate; NOM - Official Mexican Norm; NTP - National Toxicology Program; 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; SADT - Self-Accelerating Decomposition Temperature; SDS - Safety Data Sheet; TCSI - Taiwan Chemical Substance Inventory; TDG - Transportation of Dangerous Goods; TECI - Thailand Existing Chemicals Inventory; TSCA - Toxic Substances Control Act (United States); UN - United Nations; UNRTDG - United Nations Recommendations on the Transport of Dangerous Goods; vPvB - Very Persistent and Very Bioaccumulative; WHMIS - Workplace Hazardous Materials Information System

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 is designed only as a guidance for safe handling, use, processing, storage, transportation, disposal and release and shall not be considered a warranty or quality specification of any type. The information provided relates only to the specific material identified at the top of this SDS and may not be valid when the SDS material is used in combination with any other materials or in any process, unless specified in the text. Material users should review the information and recommendations in the specific context of their intended manner of handling, use, processing and storage, including an assessment of the appropriateness of the SDS material in the user's end product, if applicable.

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