

Opteon XL41 (R-454B) Refrigerant

A-Gas (UK) Ltd

Chemwatch: 5402-41

Version No: 3.1

Safety Data Sheet (Conforms to Annex II of REACH (1907/2006) - Regulation 2020/878)

Chemwatch Hazard Alert Code: 4

Issue Date: 15/04/2021

Print Date: 24/02/2022

L.REACH.GBR.EN

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

1.1. Product Identifier

Product name	Opteon XL41 (R-454B) Refrigerant
Chemical Name	Not Applicable
Synonyms	Not Available
Proper shipping name	LIQUEFIED GAS, FLAMMABLE, N.O.S. (contains difluoromethane and 2,3,3,3-tetrafluoropropene)
Chemical formula	Not Applicable
Other means of identification	Not Available

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

Relevant identified uses	Refrigerant.
Uses advised against	Not Applicable

1.3. Details of the supplier of the safety data sheet

Registered company name	A-Gas (UK) Ltd
Address	Banyard Road, Portbury West Bristol BS20 7XH United Kingdom
Telephone	+44 (0) 1275 376600
Fax	[+44] (0) 1275 376601
Website	www.agas.com
Email	info.uk@agas.com

1.4. Emergency telephone number

Association / Organisation	A-Gas (UK) Ltd	CHEMWATCH EMERGENCY RESPONSE
Emergency telephone numbers	+44 (0) 1275 376600	+44 20 3901 3542
Other emergency telephone numbers	Not Available	+61 2 9186 1132

Once connected and if the message is not in your preferred language then please dial 01

SECTION 2 Hazards identification

2.1. Classification of the substance or mixture

Classification according to regulation (EC) No 1272/2008 [CLP] and amendments ^[1]	H280 - Gases Under Pressure (Compressed Gas)
Legend:	1. Classified by Chemwatch; 2. Classification drawn from Regulation (EU) No 1272/2008 - Annex VI

2.2. Label elements

Hazard pictogram(s)	
Signal word	Warning

Hazard statement(s)

H280	Contains gas under pressure; may explode if heated.
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Supplementary statement(s)

EUH044	Risk of explosion if heated under confinement.
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Precautionary statement(s) General

P101	If medical advice is needed, have product container or label at hand.
P102	Keep out of reach of children.
P103	Read carefully and follow all instructions.

Precautionary statement(s) Prevention

Not Applicable

Precautionary statement(s) Response

Not Applicable

Precautionary statement(s) Storage

P410+P403	Protect from sunlight. Store in a well-ventilated place.
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Precautionary statement(s) Disposal

Not Applicable

2.3. Other hazards

- Inhalation may produce health damage*.
- Cumulative effects may result following exposure*.
- May produce discomfort of the respiratory system and skin*.
- Limited evidence of a carcinogenic effect*.
- Repeated exposure potentially causes skin dryness and cracking*.
- Vapours potentially cause drowsiness and dizziness*.
- REACH - Art.57-59: The mixture does not contain Substances of Very High Concern (SVHC) at the SDS print date.

SECTION 3 Composition / information on ingredients

3.1.Substances

See 'Composition on ingredients' in Section 3.2

3.2.Mixtures

1.CAS No 2.EC No 3.Index No 4.REACH No	%[weight]	Name	Classification according to regulation (EC) No 1272/2008 [CLP] and amendments	SCL / M-Factor	Nanoform Particle Characteristics
1.75-10-5 2.200-839-4 3.Not Available 4.01-2119471312-47-XXXX	>60	<u>difluoromethane</u>	Flammable Gases Category 1A; H220 ^[1]	Not Available	Not Available
1.754-12-1 2.468-710-7 3.Not Available 4.01-0000019665-61-XXXX	30-60	<u>2,3,3,3-tetrafluoropropene</u>	Flammable Gases Category 1A, Gases Under Pressure (Liquefied Gas); H220, H280 ^[1]	Not Available	Not Available

Legend: 1. Classified by Chemwatch; 2. Classification drawn from Regulation (EU) No 1272/2008 - Annex VI; 3. Classification drawn from C&L; * EU IOELVs available; [e] Substance identified as having endocrine disrupting properties

SECTION 4 First aid measures

4.1. Description of first aid measures

Eye Contact	▶ If product comes in contact with eyes remove the patient from gas source or contaminated area. ▶ Take the patient to the nearest eye wash, shower or other source of clean water. ▶ Open the eyelid(s) wide to allow the material to evaporate. ▶ Gently rinse the affected eye(s) with clean, cool water for at least 15 minutes. Have the patient lie or sit down and tilt the head back. Hold the eyelid(s) open and pour water slowly over the eyeball(s) at the inner corners, letting the water run out of the outer corners. ▶ The patient may be in great pain and wish to keep the eyes closed. It is important that the material is rinsed from the eyes to prevent
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	further damage. ▶ Ensure that the patient looks up, and side to side as the eye is rinsed in order to better reach all parts of the eye(s) ▶ Transport to hospital or doctor. ▶ Even when no pain persists and vision is good, a doctor should examine the eye as delayed damage may occur. ▶ If the patient cannot tolerate light, protect the eyes with a clean, loosely tied bandage. ▶ Ensure verbal communication and physical contact with the patient. DO NOT allow the patient to rub the eyes DO NOT allow the patient to tightly shut the eyes DO NOT introduce oil or ointment into the eye(s) without medical advice DO NOT use hot or tepid water.
Skin Contact	If skin contact occurs: ▶ Immediately remove all contaminated clothing, including footwear. ▶ Flush skin and hair with running water (and soap if available). ▶ Seek medical attention in event of irritation.
Inhalation	▶ Following exposure to gas, remove the patient from the gas source or contaminated area. ▶ NOTE: Personal Protective Equipment (PPE), including positive pressure self-contained breathing apparatus may be required to assure the safety of the rescuer. ▶ Prostheses such as false teeth, which may block the airway, should be removed, where possible, prior to initiating first aid procedures. ▶ If the patient is not breathing spontaneously, administer rescue breathing. ▶ If the patient does not have a pulse, administer CPR. ▶ If medical oxygen and appropriately trained personnel are available, administer 100% oxygen. ▶ Summon an emergency ambulance. If an ambulance is not available, contact a physician, hospital, or Poison Control Centre for further instruction. ▶ Keep the patient warm, comfortable and at rest while awaiting medical care. ▶ MONITOR THE BREATHING AND PULSE, CONTINUOUSLY. ▶ Administer rescue breathing (preferably with a demand-valve resuscitator, bag-valve mask-device, or pocket mask as trained) or CPR if necessary.
Ingestion	▶ If swallowed do NOT induce vomiting. ▶ If vomiting occurs, lean patient forward or place on left side (head-down position, if possible) to maintain open airway and prevent aspiration. ▶ Observe the patient carefully. ▶ Never give liquid to a person showing signs of being sleepy or with reduced awareness; i.e. becoming unconscious. ▶ Give water to rinse out mouth, then provide liquid slowly and as much as casualty can comfortably drink. ▶ Seek medical advice.

4.2 Most important symptoms and effects, both acute and delayed

See Section 11

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

for intoxication due to Freons/ Halons;

A: Emergency and Supportive Measures

- ▶ Maintain an open airway and assist ventilation if necessary
- ▶ Treat coma and arrhythmias if they occur. Avoid (adrenaline) epinephrine or other sympathomimetic amines that may precipitate ventricular arrhythmias. Tachyarrhythmias caused by increased myocardial sensitisation may be treated with propranolol, 1-2 mg IV or esmolol 25-100 microgm/kg/min IV.
- ▶ Monitor the ECG for 4-6 hours

B: Specific drugs and antidotes:

- ▶ There is no specific antidote

C: Decontamination

- ▶ Inhalation; remove victim from exposure, and give supplemental oxygen if available.
- ▶ Ingestion; (a) Prehospital: Administer activated charcoal, if available. **DO NOT** induce vomiting because of rapid absorption and the risk of abrupt onset CNS depression. (b) Hospital: Administer activated charcoal, although the efficacy of charcoal is unknown. Perform gastric lavage only if the ingestion was very large and recent (less than 30 minutes)

D: Enhanced elimination:

- ▶ There is no documented efficacy for diuresis, haemodialysis, haemoperfusion, or repeat-dose charcoal.

POISONING and DRUG OVERDOSE, Californian Poison Control System Ed. Kent R Olson; 3rd Edition

- ▶ Do not administer sympathomimetic drugs unless absolutely necessary as material may increase myocardial irritability.
- ▶ No specific antidote.
- ▶ Because rapid absorption may occur through lungs if aspirated and cause systematic effects, the decision of whether to induce vomiting or not should be made by an attending physician.
- ▶ If lavage is performed, suggest endotracheal and/or esophageal control.
- ▶ Danger from lung aspiration must be weighed against toxicity when considering emptying the stomach.
- ▶ Treatment based on judgment of the physician in response to reactions of the patient

For frost-bite caused by liquefied petroleum gas:

- ▶ If part has not thawed, place in warm water bath (41-46 C) for 15-20 minutes, until the skin turns pink or red.
- ▶ Analgesia may be necessary while thawing.
- ▶ If there has been a massive exposure, the general body temperature must be depressed, and the patient must be immediately rewarmed by whole-body immersion, in a bath at the above temperature.
- ▶ Shock may occur during rewarming.
- ▶ Administer tetanus toxoid booster after hospitalization.
- ▶ Prophylactic antibiotics may be useful.
- ▶ The patient may require anticoagulants and oxygen.

[Shell Australia 22/12/87]

For gas exposures:

BASIC TREATMENT

- Establish a patent airway with suction where necessary.
- Watch for signs of respiratory insufficiency and assist ventilation as necessary.
- Administer oxygen by non-rebreather mask at 10 to 15 l/min.
- Monitor and treat, where necessary, for pulmonary oedema .
- Monitor and treat, where necessary, for shock.
- Anticipate seizures.

ADVANCED TREATMENT

- Consider orotracheal or nasotracheal intubation for airway control in unconscious patient or where respiratory arrest has occurred.
- Positive-pressure ventilation using a bag-valve mask might be of use.
- Monitor and treat, where necessary, for arrhythmias.
- Start an IV D5W TKO. If signs of hypovolaemia are present use lactated Ringers solution. Fluid overload might create complications.
- Drug therapy should be considered for pulmonary oedema.
- Hypotension with signs of hypovolaemia requires the cautious administration of fluids. Fluid overload might create complications.
- Treat seizures with diazepam.
- Proparacaine hydrochloride should be used to assist eye irrigation.

BRONSTEIN, A.C. and CURRANCE, P.L.

EMERGENCY CARE FOR HAZARDOUS MATERIALS EXPOSURE: 2nd Ed. 1994

SECTION 5 Firefighting measures

5.1. Extinguishing media

DO NOT EXTINGUISH BURNING GAS UNLESS LEAK CAN BE STOPPED SAFELY:

OTHERWISE: LEAVE GAS TO BURN.

FOR SMALL FIRE:

- Dry chemical, CO2 or water spray to extinguish gas (only if absolutely necessary and safe to do so).
- **DO NOT** use water jets.

FOR LARGE FIRE:

- Cool cylinder by direct flooding quantities of water onto upper surface until well after fire is out.

5.2. Special hazards arising from the substrate or mixture

Fire Incompatibility	▸ Avoid contamination with oxidising agents i.e. nitrates, oxidising acids, chlorine bleaches, pool chlorine etc. as ignition may result
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5.3. Advice for firefighters

Fire Fighting	FOR FIRES INVOLVING MANY GAS CYLINDERS: ▸ To stop the flow of gas, specifically trained personnel may inert the atmosphere to reduce oxygen levels thus allowing the capping of leaking container(s). ▸ Reduce the rate of flow and inject an inert gas, if possible, before completely stopping the flow to prevent flashback. ▸ DO NOT extinguish the fire until the supply is shut off otherwise an explosive re-ignition may occur. ▸ If the fire is extinguished and the flow of gas continues, used increased ventilation to prevent build-up, of explosive atmosphere. ----- GENERAL ----- ▸ Alert Fire Brigade and tell them location and nature of hazard. ▸ May be violently or explosively reactive. ▸ Wear breathing apparatus plus protective gloves. ▸ Consider evacuation ▸ Fight fire from a safe distance, with adequate cover.
Fire/Explosion Hazard	▸ HIGHLY FLAMMABLE: will be easily ignited by heat, sparks or flames. ▸ Will form explosive mixtures with air ▸ Fire exposed containers may vent contents through pressure relief valves thereby increasing fire intensity and/ or vapour concentration. ▸ Vapours may travel to source of ignition and flash back. ▸ Containers may explode when heated - Ruptured cylinders may rocket ▸ Fire may produce irritating, poisonous or corrosive gases. Combustion products include: carbon monoxide (CO) carbon dioxide (CO2) hydrogen fluoride other pyrolysis products typical of burning organic material.

SECTION 6 Accidental release measures

6.1. Personal precautions, protective equipment and emergency procedures

See section 8

6.2. Environmental precautions

6.3. Methods and material for containment and cleaning up

Minor Spills	- Avoid breathing vapour and any contact with liquid or gas. Protective equipment including respirator should be used. DO NOT enter confined spaces where gas may have accumulated. - Shut off all sources of possible ignition and increase ventilation.
Major Spills	- Clear area of all unprotected personnel and move upwind. - Alert Emergency Authority and advise them of the location and nature of hazard. - May be violently or explosively reactive. - Wear full body clothing with breathing apparatus.

6.4. Reference to other sections

Personal Protective Equipment advice is contained in Section 8 of the SDS.

SECTION 7 Handling and storage

7.1. Precautions for safe handling

Safe handling	- Consider use in closed pressurised systems, fitted with temperature, pressure and safety relief valves which are vented for safe dispersal. Use only properly specified equipment which is suitable for this product, its supply pressure and temperature - The tubing network design connecting gas cylinders to the delivery system should include appropriate pressure indicators and vacuum or suction lines. - Fully-welded types of pressure gauges, where the bourdon tube sensing element is welded to the gauge body, are recommended. - Before connecting gas cylinders, ensure manifold is mechanically secure and does not containing another gas. - Avoid generation of static electricity. Earth all lines and equipment. DO NOT transfer gas from one cylinder to another.
Fire and explosion protection	See section 5
Other information	- Polymerisation may occur slowly at room temperature. - Cylinders should be stored in a purpose-built compound with good ventilation, preferably in the open. - Such compounds should be sited and built in accordance with statutory requirements. - The storage compound should be kept clear and access restricted to authorised personnel only. - Cylinders stored in the open should be protected against rust and extremes of weather.

7.2. Conditions for safe storage, including any incompatibilities

Suitable container	DO NOT use aluminium or galvanised containers - Cylinder: - Ensure the use of equipment rated for cylinder pressure. - Ensure the use of compatible materials of construction. - Valve protection cap to be in place until cylinder is secured, connected. - Cylinder must be properly secured either in use or in storage.
Storage incompatibility	Avoid reaction with oxidising agents

7.3. Specific end use(s)

See section 1.2

SECTION 8 Exposure controls / personal protection

8.1. Control parameters

Ingredient	DNELs Exposure Pattern Worker	PNECs Compartment
difluoromethane	Inhalation 7 035 mg/m³ (Systemic, Chronic) <i>Inhalation 750 mg/m³ (Systemic, Chronic) *</i>	0.142 mg/L (Water (Fresh)) 1.42 mg/L (Water (Marine)) 0.534 mg/kg sediment dw (Sediment (Fresh Water))
2,3,3,3-tetrafluoropropene	Inhalation 950 mg/m³ (Systemic, Chronic)	0.1 mg/L (Water (Fresh)) 1 mg/L (Water (Marine))

* Values for General Population

Occupational Exposure Limits (OEL)

INGREDIENT DATA

Source	Ingredient	Material name	TWA	STEL	Peak	Notes
Not Available	Not Available	Not Available	Not Available	Not Available	Not Available	Not Available

Not Applicable

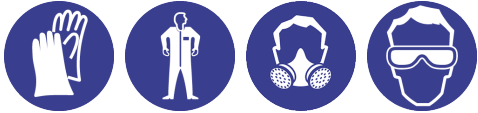
Emergency Limits

Ingredient	TEEL-1	TEEL-2	TEEL-3
difluoromethane	3,000 ppm	6,500 ppm	39,000 ppm
2,3,3,3-tetrafluoropropene	2,200 ppm	Not Available	1.40E+05 ppm

Ingredient	Original IDLH	Revised IDLH
difluoromethane	Not Available	Not Available
2,3,3,3-tetrafluoropropene	Not Available	Not Available

MATERIAL DATA

8.2. Exposure controls

8.2.1. Appropriate engineering controls	Engineering controls are used to remove a hazard or place a barrier between the worker and the hazard. Well-designed engineering controls can be highly effective in protecting workers and will typically be independent of worker interactions to provide this high level of protection. The basic types of engineering controls are: Process controls which involve changing the way a job activity or process is done to reduce the risk. Enclosure and/or isolation of emission source which keeps a selected hazard "physically" away from the worker and ventilation that strategically "adds" and "removes" air in the work environment.
8.2.2. Personal protection	
Eye and face protection	▸ Safety glasses with side shields. ▸ Chemical goggles. ▸ Contact lenses may pose a special hazard; soft contact lenses may absorb and concentrate irritants. A written policy document, describing the wearing of lenses or restrictions on use, should be created for each workplace or task.
Skin protection	See Hand protection below
Hands/feet protection	▸ When handling sealed and suitably insulated cylinders wear cloth or leather gloves.
Body protection	See Other protection below
Other protection	▸ Protective overalls, closely fitted at neck and wrist. ▸ Eye-wash unit. IN CONFINED SPACES: ▸ Non-sparking protective boots ▸ Static-free clothing. ▸ Ensure availability of lifeline.

Respiratory protection

Type AX Filter of sufficient capacity. (AS/NZS 1716 & 1715, EN 143:2000 & 149:2001, ANSI Z88 or national equivalent)

Selection of the Class and Type of respirator will depend upon the level of breathing zone contaminant and the chemical nature of the contaminant. Protection Factors (defined as the ratio of contaminant outside and inside the mask) may also be important.

Required minimum protection factor	Maximum gas/vapour concentration present in air p.p.m. (by volume)	Half-face Respirator	Full-Face Respirator
up to 10	1000	AX-AUS / Class1	-
up to 50	1000	-	AX-AUS / Class 1
up to 50	5000	Airline *	-
up to 100	5000	-	AX-2
up to 100	10000	-	AX-3
100+			Airline**

* - Continuous Flow ** - Continuous-flow or positive pressure demand

A(All classes) = Organic vapours, B AUS or B1 = Acid gasses, B2 = Acid gas or hydrogen cyanide(HCN), B3 = Acid gas or hydrogen cyanide(HCN), E = Sulfur dioxide(SO₂), G = Agricultural chemicals, K = Ammonia(NH₃), Hg = Mercury, NO = Oxides of nitrogen, MB = Methyl bromide, AX = Low boiling point organic compounds(below 65 degC)

- Cartridge respirators should never be used for emergency ingress or in areas of unknown vapour concentrations or oxygen content.
- The wearer must be warned to leave the contaminated area immediately on detecting any odours through the respirator. The odour may indicate that the mask is not functioning properly, that the vapour concentration is too high, or that the mask is not properly fitted. Because of these limitations, only restricted use of cartridge respirators is considered appropriate.
- Cartridge performance is affected by humidity. Cartridges should be changed after 2 hr of continuous use unless it is determined that the humidity is less than 75%, in which case, cartridges can be used for 4 hr. Used cartridges should be discarded daily, regardless of the length of time used
- Positive pressure, full face, air-supplied breathing apparatus should be used for work in enclosed spaces if a leak is suspected or the primary containment is to be opened (e.g. for a cylinder change)
- Air-supplied breathing apparatus is required where release of gas from primary containment is either suspected or demonstrated.

8.2.3. Environmental exposure controls

See section 12

SECTION 9 Physical and chemical properties

9.1. Information on basic physical and chemical properties

Appearance	Clear colourless highly flammable liquefied gas with slight ether like odour.		
Physical state	Liquified Gas	Relative density (Water = 1)	0.98 @25C
Odour	Not Available	Partition coefficient n-octanol / water	Not Available
Odour threshold	Not Available	Auto-ignition temperature (°C)	Not Available
pH (as supplied)	Not Available	Decomposition temperature	Not Available
Melting point / freezing point (°C)	Not Available	Viscosity (cSt)	Not Available
Initial boiling point and boiling range (°C)	-50.9	Molecular weight (g/mol)	Not Applicable
Flash point (°C)	Not Available	Taste	Not Available
Evaporation rate	>1	Explosive properties	Not Available
Flammability	Not Available	Oxidising properties	Not Available
Upper Explosive Limit (%)	22	Surface Tension (dyn/cm or mN/m)	Not Available
Lower Explosive Limit (%)	11.25	Volatile Component (%vol)	Not Available
Vapour pressure (kPa)	1.5856 @25C	Gas group	Not Available
Solubility in water	Not Available	pH as a solution (Not Available%)	Not Available
Vapour density (Air = 1)	2.2	VOC g/L	Not Available
Nanoform Solubility	Not Available	Nanoform Particle Characteristics	Not Available
Particle Size	Not Available		

9.2. Other information

Not Available

SECTION 10 Stability and reactivity

10.1.Reactivity	See section 7.2
10.2. Chemical stability	▶ Unstable in the presence of incompatible materials. ▶ Product is considered stable. ▶ Hazardous polymerisation will not occur.
10.3. Possibility of hazardous reactions	See section 7.2
10.4. Conditions to avoid	See section 7.2
10.5. Incompatible materials	See section 7.2
10.6. Hazardous decomposition products	See section 5.3

SECTION 11 Toxicological information

11.1. Information on toxicological effects

Inhaled	Inhalation of vapours may cause drowsiness and dizziness. This may be accompanied by narcosis, reduced alertness, loss of reflexes, lack of coordination and vertigo. Inhalation of vapours or aerosols (mists, fumes), generated by the material during the course of normal handling, may be damaging to the health of the individual. Limited evidence or practical experience suggests that the material may produce irritation of the respiratory system, in a significant number of individuals, following inhalation. In contrast to most organs, the lung is able to respond to a chemical insult by first removing or neutralising the irritant and then repairing the damage. The repair process, which initially evolved to protect mammalian lungs from foreign matter and antigens, may however, produce further lung damage resulting in the impairment of gas exchange, the primary function of the lungs. Respiratory tract irritation often results in an inflammatory response involving the recruitment and activation of many cell types, mainly derived from the vascular system.
Ingestion	Not normally a hazard due to physical form of product.
Skin Contact	Limited evidence suggests that repeated exposure may cause skin cracking, flaking or drying following normal handling and use. Limited evidence exists, or practical experience predicts, that the material either produces inflammation of the skin in a substantial number of individuals following direct contact, and/or produces significant inflammation when applied to the healthy intact skin of animals, for up to four hours, such inflammation being present twenty-four hours or more after the end of the exposure period. Skin irritation may also be present after prolonged or repeated exposure; this may result in a form of contact dermatitis (nonallergic). The dermatitis is often characterised by skin redness (erythema) and swelling (oedema) which may progress to blistering (vesiculation), scaling and thickening of the epidermis. At the microscopic level there may be intercellular oedema of the spongy layer of the skin (spongiosis) and intracellular oedema

	of the epidermis. Open cuts, abraded or irritated skin should not be exposed to this material Entry into the blood-stream through, for example, cuts, abrasions, puncture wounds or lesions, may produce systemic injury with harmful effects. Examine the skin prior to the use of the material and ensure that any external damage is suitably protected.
Eye	Although the material is not thought to be an irritant (as classified by EC Directives), direct contact with the eye may produce transient discomfort characterised by tearing or conjunctival redness (as with windburn). Direct contact with the eye may not cause irritation because of the extreme volatility of the gas; however concentrated atmospheres may produce irritation after brief exposures..
Chronic	On the basis, primarily, of animal experiments, concern has been expressed by at least one classification body that the material may produce carcinogenic or mutagenic effects; in respect of the available information, however, there presently exists inadequate data for making a satisfactory assessment. Limited evidence suggests that repeated or long-term occupational exposure may produce cumulative health effects involving organs or biochemical systems. Principal route of occupational exposure to the gas is by inhalation.

Opteon XL41 (R-454B) Refrigerant	TOXICITY	IRRITATION
	Not Available	Not Available
difluoromethane	TOXICITY	IRRITATION
	Inhalation(Rat) LC50; >760000 ppm4h ^[2]	Not Available
2,3,3,3-tetrafluoropropene	TOXICITY	IRRITATION
	Inhalation(Rat) LC50; >86.831 ppm4h ^[2]	Not Available
Legend:	1. Value obtained from Europe ECHA Registered Substances - Acute toxicity 2. * Value obtained from manufacturer's SDS. Unless otherwise specified data extracted from RTECS - Register of Toxic Effect of chemical Substances	

2,3,3,3-TETRAFLUOROPROPENE	Mutagenicity : Did not cause genetic damage in animals. Did not cause genetic damage in cultured mammalian cells. Experiments showed mutagenic effects in cultured bacterial cells. Reproductive toxicity : Animal testing showed no reproductive toxicity. Teratogenicity : Animal testing showed effects on embryo-fetal development at levels equal to or above those causing maternal toxicity. * Vendor For similar product, 1,3,3,3-tetrafluoropropene HFO-1234ze is not likely to accumulate in the bodies of humans or animals HFO-1234ze is practically non-toxic. Short-term exposures at levels higher than 10% have not induced cardiac sensitization to adrenalin nor induced serious toxic effects. Rats and rabbits did not exhibit any serious toxic, developmental or reproductive effects even with exposures to high levels of HFO-1234ze. Based on a series of mutagenicity and genomics studies, the cancer risk for HFO-1234ze is LOW The fluoroalkenes vary widely in acute inhalation toxicity. Those, such as perfluoroisobutylene, PFIB, the most highly toxic member, attacks the pulmonary epithelium of rats eventuating in edema and death after a delay of about one day. Other fluoroalkenes, such as hexafluoropropylene (HFP) or chlorotrifluoroethylene (CTFE), also cause pulmonary injury but at lower concentrations produce concentration dependent changes in the renal concentrating mechanism of the rat. Changes in the CNS of rats and rabbits have also been reported for CTFE. Disinfection by products (DBPs) re formed when disinfectants such as chlorine, chloramine, and ozone react with organic and inorganic matter in water. The observations that some DBPs such as trihalomethanes (THMs), di-/trichloroacetic acids, and 3-chloro-4-(dichloromethyl)-5-hydroxy-2(5H)-furanone (MX) are carcinogenic in animal studies have raised public concern over the possible adverse health effects of DBPs. To date, several hundred DBPs have been identified. Numerous haloalkanes and haloalkenes have been tested for carcinogenic and mutagenic activities. n general, the genotoxic potential is dependent on the nature, number, and position of halogen(s) and the molecular size of the compound.
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Acute Toxicity	✗	Carcinogenicity	✗
Skin Irritation/Corrosion	✗	Reproductivity	✗
Serious Eye Damage/Irritation	✗	STOT - Single Exposure	✗
Respiratory or Skin sensitisation	✗	STOT - Repeated Exposure	✗
Mutagenicity	✗	Aspiration Hazard	✗

Legend: ✗ – Data either not available or does not fill the criteria for classification
 ✔ – Data available to make classification

11.2.1. Endocrine Disruption Properties

Not Available

SECTION 12 Ecological information

12.1. Toxicity

Opteon XL41 (R-454B) Refrigerant	Endpoint	Test Duration (hr)	Species	Value	Source
	Not Available	Not Available	Not Available	Not Available	Not Available

difluoromethane	Endpoint	Test Duration (hr)	Species	Value	Source
	NOEC(ECx)	96h	Fish	10mg/l	2
	LC50	96h	Fish	>81.8mg/l	2
	EC50	72h	Algae or other aquatic plants	>114mg/l	2
	EC50	48h	Crustacea	>97.9mg/l	2
	EC50	96h	Algae or other aquatic plants	142mg/l	2
2,3,3,3-tetrafluoropropene	Endpoint	Test Duration (hr)	Species	Value	Source
	NOEC(ECx)	72h	Algae or other aquatic plants	>=2.5mg/l	2
	LC50	96h	Fish	33mg/l	2
	EC50	72h	Algae or other aquatic plants	>2.5mg/l	2
	EC50	48h	Crustacea	65mg/l	2
Legend:		Extracted from 1. IUCLID Toxicity Data 2. Europe ECHA Registered Substances - Ecotoxicological Information - Aquatic Toxicity 4. US EPA, Ecotox database - Aquatic Toxicity Data 5. ECETOC Aquatic Hazard Assessment Data 6. NITE (Japan) - Bioconcentration Data 7. METI (Japan) - Bioconcentration Data 8. Vendor Data			

DO NOT discharge into sewer or waterways.

12.2. Persistence and degradability

Ingredient	Persistence: Water/Soil	Persistence: Air
difluoromethane	LOW	LOW
2,3,3,3-tetrafluoropropene	HIGH	HIGH

12.3. Bioaccumulative potential

Ingredient	Bioaccumulation
difluoromethane	LOW (LogKOW = 0.2)
2,3,3,3-tetrafluoropropene	LOW (LogKOW = 2.1485)

12.4. Mobility in soil

Ingredient	Mobility
difluoromethane	LOW (KOC = 23.74)
2,3,3,3-tetrafluoropropene	LOW (KOC = 154.4)

12.5. Results of PBT and vPvB assessment

	P	B	T
Relevant available data	Not Available	Not Available	Not Available
PBT	✗	✗	✗
vPvB	✗	✗	✗
PBT Criteria fulfilled?			No
vPvB			No

12.6. Endocrine Disruption Properties

Not Available

12.7. Other adverse effects

Not Available

SECTION 13 Disposal considerations

13.1. Waste treatment methods

Product / Packaging disposal	▸ Evaporate or incinerate residue at an approved site. ▸ Return empty containers to supplier. ▸ Ensure damaged or non-returnable cylinders are gas-free before disposal.
Waste treatment options	Not Available
Sewage disposal options	Not Available

SECTION 14 Transport information

Labels Required

	
Marine Pollutant	NO
HAZCHEM	2YE

Land transport (ADR-RID)

14.1. UN number	3161		
14.2. UN proper shipping name	LIQUEFIED GAS, FLAMMABLE, N.O.S. (contains difluoromethane and 2,3,3,3-tetrafluoropropene)		
14.3. Transport hazard class(es)	Class	2.1	
	Subrisk	Not Applicable	
14.4. Packing group	Not Applicable		
14.5. Environmental hazard	Not Applicable		
14.6. Special precautions for user	Hazard identification (Kemler)		23
	Classification code		2F
	Hazard Label		2.1
	Special provisions		274 662
	Limited quantity		0
	Tunnel Restriction Code		2 (B/D)

Air transport (ICAO-IATA / DGR)

14.1. UN number	3161		
14.2. UN proper shipping name	Liquefied gas, flammable, n.o.s. * (contains difluoromethane and 2,3,3,3-tetrafluoropropene)		
14.3. Transport hazard class(es)	ICAO/IATA Class	2.1	
	ICAO / IATA Subrisk	Not Applicable	
	ERG Code	10L	
14.4. Packing group	Not Applicable		
14.5. Environmental hazard	Not Applicable		
14.6. Special precautions for user	Special provisions		A1 A807
	Cargo Only Packing Instructions		200
	Cargo Only Maximum Qty / Pack		150 kg
	Passenger and Cargo Packing Instructions		Forbidden
	Passenger and Cargo Maximum Qty / Pack		Forbidden
	Passenger and Cargo Limited Quantity Packing Instructions		Forbidden
	Passenger and Cargo Limited Maximum Qty / Pack		Forbidden

Sea transport (IMDG-Code / GGVSee)

14.1. UN number	3161		
14.2. UN proper shipping name	LIQUEFIED GAS, FLAMMABLE, N.O.S. (contains difluoromethane and 2,3,3,3-tetrafluoropropene)		
14.3. Transport hazard class(es)	IMDG Class	2.1	
	IMDG Subrisk	Not Applicable	
14.4. Packing group	Not Applicable		
14.5. Environmental hazard	Not Applicable		
14.6. Special precautions for user	EMS Number	F-D , S-U	
	Special provisions	274	
	Limited Quantities	0	

Inland waterways transport (ADN)

14.1. UN number	3161	
14.2. UN proper shipping name	LIQUEFIED GAS, FLAMMABLE, N.O.S. (contains difluoromethane and 2,3,3,3-tetrafluoropropene)	
14.3. Transport hazard class(es)	2.1	Not Applicable
14.4. Packing group	Not Applicable	
14.5. Environmental hazard	Not Applicable	
14.6. Special precautions for user	Classification code	2F
	Special provisions	274; 662
	Limited quantity	0
	Equipment required	PP, EX, A
	Fire cones number	1

14.7. Transport in bulk according to Annex II of MARPOL and the IBC code

Not Applicable

14.8. Transport in bulk in accordance with MARPOL Annex V and the IMSBC Code

Product name	Group
difluoromethane	Not Available
2,3,3,3-tetrafluoropropene	Not Available

14.9. Transport in bulk in accordance with the ICG Code

Product name	Ship Type
difluoromethane	Not Available
2,3,3,3-tetrafluoropropene	Not Available

SECTION 15 Regulatory information

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

difluoromethane is found on the following regulatory lists	
Europe EC Inventory	European Union - European Inventory of Existing Commercial Chemical Substances (EINECS)
2,3,3,3-tetrafluoropropene is found on the following regulatory lists	
EU European Chemicals Agency (ECHA) Community Rolling Action Plan (CoRAP) List of Substances	Europe EC Inventory

This safety data sheet is in compliance with the following EU legislation and its adaptations - as far as applicable - : Directives 98/24/EC, - 92/85/EEC, - 94/33/EC, - 2008/98/EC, - 2010/75/EU; Commission Regulation (EU) 2020/878; Regulation (EC) No 1272/2008 as updated through ATPs.

15.2. Chemical safety assessment

No Chemical Safety Assessment has been carried out for this substance/mixture by the supplier.

ECHA SUMMARY

Ingredient	CAS number	Index No	ECHA Dossier
difluoromethane	75-10-5	Not Available	01-2119471312-47-XXXX

Harmonisation (C&L Inventory)	Hazard Class and Category Code(s)	Pictograms Signal Word Code(s)	Hazard Statement Code(s)
1	Flam. Gas 1; Liq.	GHS02; GHS04; Dgr	H220; H280
2	Liq.; Flam. Gas 1; Comp.	GHS02; GHS04; Dgr	H280; H220; H312

Harmonisation Code 1 = The most prevalent classification. Harmonisation Code 2 = The most severe classification.

Ingredient	CAS number	Index No	ECHA Dossier
2,3,3,3-tetrafluoropropene	754-12-1	Not Available	01-0000019665-61-XXXX

Harmonisation (C&L Inventory)	Hazard Class and Category Code(s)	Pictograms Signal Word Code(s)	Hazard Statement Code(s)
1	Flam. Gas 1; Liq.	GHS02; GHS04; Dgr	H220; H280
2	Liq.; Flam. Gas 1; Comp.	GHS02; GHS04; Dgr	H280; H220

Harmonisation Code 1 = The most prevalent classification. Harmonisation Code 2 = The most severe classification.

National Inventory Status

National Inventory	Status
Australia - AIIC / Australia Non-Industrial Use	Yes
Canada - DSL	Yes
Canada - NDSL	No (difluoromethane; 2,3,3,3-tetrafluoropropene)
China - IECSC	No (difluoromethane; 2,3,3,3-tetrafluoropropene)
Europe - EINEC / ELINCS / NLP	No (2,3,3,3-tetrafluoropropene)
Japan - ENCS	Yes
Korea - KECI	Yes
New Zealand - NZIoC	Yes
Philippines - PICCS	Yes
USA - TSCA	Yes
Taiwan - TCSI	Yes
Mexico - INSQ	No (2,3,3,3-tetrafluoropropene)
Vietnam - NCI	Yes
Russia - FBEPH	No (2,3,3,3-tetrafluoropropene)
Legend:	Yes = All CAS declared ingredients are on the inventory No = One or more of the CAS listed ingredients are not on the inventory. These ingredients may be exempt or will require registration.

SECTION 16 Other information

Revision Date	15/04/2021
Initial Date	03/06/2020

Full text Risk and Hazard codes

H220	Extremely flammable gas.
H312	Harmful in contact with skin.

SDS Version Summary

Version	Date of Update	Sections Updated
2.1	03/06/2020	Classification
3.1	15/04/2021	Classification change due to full database hazard calculation/update.

Other information

Classification of the preparation and its individual components has drawn on official and authoritative sources as well as independent review by the Chemwatch Classification committee using available literature references.

The SDS is a Hazard Communication tool and should be used to assist in the Risk Assessment. Many factors determine whether the reported Hazards are Risks in the workplace or other settings. Risks may be determined by reference to Exposures Scenarios. Scale of use, frequency of use and current or available engineering controls must be considered.

For detailed advice on Personal Protective Equipment, refer to the following EU CEN Standards:
EN 166 Personal eye-protection
EN 340 Protective clothing
EN 374 Protective gloves against chemicals and micro-organisms
EN 13832 Footwear protecting against chemicals
EN 133 Respiratory protective devices

Definitions and abbreviations

PC—TWA: Permissible Concentration-Time Weighted Average
PC—STEL: Permissible Concentration-Short Term Exposure Limit
IARC: International Agency for Research on Cancer
ACGIH: American Conference of Governmental Industrial Hygienists
STEL: Short Term Exposure Limit
TEEL: Temporary Emergency Exposure Limit.
IDLH: Immediately Dangerous to Life or Health Concentrations
ES: Exposure Standard
OSF: Odour Safety Factor
NOAEL :No Observed Adverse Effect Level
LOAEL: Lowest Observed Adverse Effect Level
TLV: Threshold Limit Value
LOD: Limit Of Detection

OTV: Odour Threshold Value
BCF: BioConcentration Factors
BEI: Biological Exposure Index
AIIC: Australian Inventory of Industrial Chemicals
DSL: Domestic Substances List
NDSL: Non-Domestic Substances List
IECSC: Inventory of Existing Chemical Substance in China
EINECS: European INventory of Existing Commercial chemical Substances
ELINCS: European List of Notified Chemical Substances
NLP: No-Longer Polymers
ENCS: Existing and New Chemical Substances Inventory
KECI: Korea Existing Chemicals Inventory
NZIoC: New Zealand Inventory of Chemicals
PICCS: Philippine Inventory of Chemicals and Chemical Substances
TSCA: Toxic Substances Control Act
TCSI: Taiwan Chemical Substance Inventory
INSQ: Inventario Nacional de Sustancias Químicas
NCI: National Chemical Inventory
FBEPH: Russian Register of Potentially Hazardous Chemical and Biological Substances

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