

R455A (L40X)

A-Gas (Australia) Pty Ltd

Version No: 8.1

Safety Data Sheet according to Work Health and Safety Regulations (Hazardous Chemicals) 2023 and ADG requirements

Issue Date: 29/04/2024

Print Date: 13/11/2024

L.GHS.AUS.EN

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

Product Identifier

Product name	R455A (L40X)
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

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

Relevant identified uses	Refrigerant. Not for consumer use. Use according to manufacturer's directions.
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Details of the manufacturer or supplier of the safety data sheet

Registered company name	A-Gas (Australia) Pty Ltd
Address	9-11 Oxford Rd, Laverton North Victoria 3026 Australia
Telephone	93689222
Fax	Not Available
Website	www.agas.com
Email	Not Available

Emergency telephone number

Association / Organisation	A-Gas (Australia) Pty Ltd	CHEMWATCH EMERGENCY RESPONSE (24/7)
Emergency telephone number(s)	1800737001	+61 1800 951 288
Other emergency telephone number(s)	Not Available	+61 3 9573 3188


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

SECTION 2 Hazards identification

Classification of the substance or mixture

Poisons Schedule	Not Applicable
Classification ^[1]	Flammable gases, Hazard Category 1B, Gases Under Pressure (Liquefied Gas)
Legend:	1. Classification by vendor; 2. Classification drawn from HCIS; 3. Classification drawn from Regulation (EU) No 1272/2008 - Annex VI

Label elements

Hazard pictogram(s)	 
Signal word	Danger

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Hazard statement(s)

H221	Flammable gas.
H280	Contains gas under pressure; may explode if heated.
AUH044	Risk of explosion if heated under confinement.

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

P210	Keep away from heat, hot surfaces, sparks, open flames and other ignition sources. No smoking.
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Precautionary statement(s) Response

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

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

SECTION 3 Composition / information on ingredients

Substances

See section below for composition of Mixtures

Mixtures

CAS No	%[weight]	Name
754-12-1	75.5	<u>2,3,3,3-tetrafluoropropene</u>
75-10-5	21.5	<u>difluoromethane</u>
124-38-9	3	<u>carbon dioxide</u>

Legend: 1. Classification by vendor; 2. Classification drawn from HCIS; 3. Classification drawn from Regulation (EU) No 1272/2008 - Annex VI; 4. Classification drawn from C&L; * EU IOELVs available

SECTION 4 First aid measures

Description of first aid measures

Eye Contact	<ul style="list-style-type: none"> ▶ 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 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. <p>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.</p>
Skin Contact	<p>If skin contact occurs:</p> <ul style="list-style-type: none"> ▶ 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	<ul style="list-style-type: none"> ▶ Following exposure to gas, remove the patient from the gas source or contaminated area.

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Ingestion	<ul style="list-style-type: none"> ▶ 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.
	<ul style="list-style-type: none"> ▶ Not considered a normal route of entry.

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

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SECTION 5 Firefighting measures

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.

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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Advice for firefighters

Fire Fighting	<p>FOR FIRES INVOLVING MANY GAS CYLINDERS:</p> <ul style="list-style-type: none"> ▶ 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. <p>-----</p> <p>GENERAL</p> <p>-----</p> <ul style="list-style-type: none"> ▶ 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	<ul style="list-style-type: none"> ▶ 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. <p>Combustion products include: carbon monoxide (CO) carbon dioxide (CO2) hydrogen fluoride other pyrolysis products typical of burning organic material.</p> <p>Contains low boiling substance: Closed containers may rupture due to pressure buildup under fire conditions.</p>
HAZCHEM	2YE

SECTION 6 Accidental release measures

Personal precautions, protective equipment and emergency procedures

See section 8

Environmental precautions

See section 12

Methods and material for containment and cleaning up

Minor Spills	<ul style="list-style-type: none"> ▶ 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	<ul style="list-style-type: none"> ▶ 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.

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

SECTION 7 Handling and storage

Precautions for safe handling

Safe handling	<ul style="list-style-type: none"> · 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
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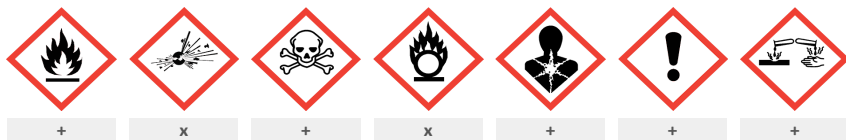
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	<ul style="list-style-type: none"> The tubing network design connecting gas cylinders to the delivery system should include appropriate pressure indicators and vacuum or suction lines. Fully-welded types of pressure gauges, where the bourdon tube sensing element is welded to the gauge body, are recommended. Before connecting gas cylinders, ensure manifold is mechanically secure and does not contain another gas. <ul style="list-style-type: none"> Avoid generation of static electricity. Earth all lines and equipment. DO NOT transfer gas from one cylinder to another.
Other information	<ul style="list-style-type: none"> Do NOT store halogenated aliphatics in areas containing alkali or alkaline earth metals such as powdered aluminum, zinc, or beryllium 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.

Conditions for safe storage, including any incompatibilities

Suitable container	<ul style="list-style-type: none"> 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	<p>Finely divided metals.</p> <p>Carbon dioxide:</p> <ul style="list-style-type: none"> reacts violently with strong bases and alkali metals (especially their dusts) may ignite or explode when heated or in suspended chemically active metals (and their hydrides) such as aluminium, chromium, manganese, magnesium (above 775 C), titanium (above 550 C), uranium (above 750 C) or zirconium, diethylmagnesium is incompatible with water, acrolein, acrylaldehyde, amines, anhydrous ammonia, aziridine, metal acetylides (such as lithium acetylide), caesium monoxide (moist), lithium, potassium, sodium, sodium carbide, sodium-potassium alloy, sodium peroxide, titanium may build up static electricity when discharged at high flow rates from storage cylinders or fire extinguishers - this may produce sparks resulting in ignition of flammables or explosives. may decompose to toxic carbon monoxide and flammable oxygen when exposed to electrical discharges or very high temperatures <p>As a general rule, hydrofluorocarbons tend to be flammable unless they contain more fluorine atoms than hydrogen atoms.</p> <p>Haloalkanes:</p> <ul style="list-style-type: none"> are highly reactive: some of the more lightly substituted lower members are highly flammable; the more highly substituted may be used as fire suppressants, not always with the anticipated results. may react with the lighter divalent metals to produce more reactive compounds analogous to Grignard reagents. may produce explosive compounds following prolonged contact with metallic or other azides may react on contact with potassium or its alloys - although apparently stable on contact with a wide range of halocarbons, reaction products may be shock-sensitive and may explode with great violence on light impact; severity generally increases with the degree of halocarbon substitution and potassium-sodium alloys give extremely sensitive mixtures. <p>BREITHERICK L.: Handbook of Reactive Chemical Hazards</p> <ul style="list-style-type: none"> react with metal halides and active metals, eg. sodium (Na), potassium (K), lithium (Li), calcium (Ca), zinc (Zn), powdered aluminium (Al) and aluminium alloys, magnesium (Mg) and magnesium alloys. Haloalkenes are highly reactive. Some of the more lightly substituted lower members are highly flammable; many members of the group are peroxidisable and polymerisable. Avoid reaction or contact with potassium or its alloys - although apparently stable on contact with a wide range of halocarbons, reaction products may be shock-sensitive and may explode with great violence on light impact. Severity generally increases with the degree of halocarbon substitution and potassium-sodium alloys give extremely sensitive mixtures. Compressed gases may contain a large amount of kinetic energy over and above that potentially available from the energy of reaction produced by the gas in chemical reaction with other substances



X — Must not be stored together

O — May be stored together with specific preventions

+ — May be stored together

Note: Depending on other risk factors, compatibility assessment based on the table above may not be relevant to storage situations, particularly where large volumes of dangerous goods are stored and handled. Reference should be made to the Safety Data Sheets for each substance or article and risks assessed accordingly.

SECTION 8 Exposure controls / personal protection**Control parameters****Occupational Exposure Limits (OEL)****INGREDIENT DATA**

Source	Ingredient	Material name	TWA	STEL	Peak	Notes
Australia Exposure Standards	carbon dioxide	Carbon dioxide in coal mines	12500 ppm / 22500 mg/m3	54000 mg/m3 / 30000 ppm	Not Available	Not Available


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Source	Ingredient	Material name	TWA	STEL	Peak	Notes
Australia Exposure Standards	carbon dioxide	Carbon dioxide	5000 ppm / 9000 mg/m3	54000 mg/m3 / 30000 ppm	Not Available	Not Available
Ingredient	Original IDLH		Revised IDLH			
2,3,3,3-tetrafluoropropene	Not Available		Not Available			
difluoromethane	Not Available		Not Available			
carbon dioxide	40,000 ppm		Not Available			

MATERIAL DATA

Exposure controls

Appropriate engineering controls	<p>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:</p> <p>Process controls which involve changing the way a job activity or process is done to reduce the risk.</p> <p>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.</p>
Individual protection measures, such as personal protective equipment	
Eye and face protection	<ul style="list-style-type: none"> ▶ Safety glasses with side shields. ▶ Chemical goggles. [AS/NZS 1337.1, EN166 or national equivalent] ▶ 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	<ul style="list-style-type: none"> ▶ Butyl rubber gloves <ul style="list-style-type: none"> · Butyl rubber gloves should be used when handling halogenated aliphatics . · Nitrile, PVC-coated nitrile, and PVC protective equipment are not recommended ▶ When handling sealed and suitably insulated cylinders wear cloth or leather gloves.
Body protection	See Other protection below
Other protection	<ul style="list-style-type: none"> · Halogen-selective detectors use a specialized sensor that allows the monitor to detect compounds containing fluorine, chlorine, bromine, and iodine with-out interference from other species. These detectors are typically easy to use, feature higher sensitivity than the nonselective detectors (detection limits are typically <5 ppm when used as an area monitor and <1.4 gm/yr [<0.05 oz/yr] when used as a leak pinpointer). · Compound-Specific Detectors are typically capable of detecting the presence of a single compound without interference from other compounds. ▶ The clothing worn by process operators insulated from earth may develop static charges far higher (up to 100 times) than the minimum ignition energies for various flammable gas-air mixtures. This holds true for a wide range of clothing materials including cotton. ▶ Avoid dangerous levels of charge by ensuring a low resistivity of the surface material worn outermost. <p>BREThERICK: Handbook of Reactive Chemical Hazards.</p> <ul style="list-style-type: none"> ▶ Protective overalls, closely fitted at neck and wrist. ▶ Eye-wash unit. <p>IN CONFINED SPACES:</p> <ul style="list-style-type: none"> ▶ Non-sparking protective boots ▶ Static-free clothing. ▶ Ensure availability of lifeline. ▶ Some plastic personal protective equipment (PPE) (e.g. gloves, aprons, overshoes) are not recommended as they may produce static electricity. ▶ For large scale or continuous use wear tight-weave non-static clothing (no metallic fasteners, cuffs or pockets). ▶ Non sparking safety or conductive footwear should be considered. Conductive footwear describes a boot or shoe with a sole made from a conductive compound chemically bound to the bottom components, for permanent control to electrically ground the foot an shall dissipate static electricity from the body to reduce the possibility of ignition of volatile compounds.

Respiratory protection

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

- ▶ 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.

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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 / Class 1	-
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 or positive pressure demand.

A(All classes) = Organic vapours, B AUS or B1 = Acid gases, 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 deg C)

SECTION 9 Physical and chemical properties

Information on basic physical and chemical properties

Appearance	Clear extremely flammable liquefied gas with a slight characteristic odour.		
Physical state	Liquefied Gas	Relative density (Water = 1)	Not Available
Odour	Not Available	Partition coefficient n-octanol / water	Not Available
Odour threshold	Not Available	Auto-ignition temperature (°C)	473-477
pH (as supplied)	Not Available	Decomposition temperature (°C)	Not Available
Melting point / freezing point (°C)	Not Available	Viscosity (cSt)	Not Available
Initial boiling point and boiling range (°C)	-52.1	Molecular weight (g/mol)	Not Applicable
Flash point (°C)	Not Available	Taste	Not Available
Evaporation rate	Not Available	Explosive properties	Not Available
Flammability	Not Available	Oxidising properties	Not Available
Upper Explosive Limit (%)	12.9	Surface Tension (dyn/cm or mN/m)	Not Available
Lower Explosive Limit (%)	11.8	Volatile Component (%vol)	Not Available
Vapour pressure (kPa)	1.235 @ 21.1C	Gas group	Not Available
Solubility in water	Not Available	pH as a solution (1%)	Not Available
Vapour density (Air = 1)	Not Available	VOC g/L	Not Available
Heat of Combustion (kJ/g)	Not Available	Ignition Distance (cm)	Not Available
Flame Height (cm)	Not Available	Flame Duration (s)	Not Available
Enclosed Space Ignition Time Equivalent (s/m3)	Not Available	Enclosed Space Ignition Deflagration Density (g/m3)	Not Available

SECTION 10 Stability and reactivity

Reactivity	See section 7
Chemical stability	<ul style="list-style-type: none"> ▶ Unstable in the presence of incompatible materials. ▶ Product is considered stable. ▶ Hazardous polymerisation will not occur.
Possibility of hazardous reactions	See section 7
Conditions to avoid	See section 7
Incompatible materials	See section 7
Hazardous decomposition products	See section 5

SECTION 11 Toxicological information

Information on toxicological effects

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Inhaled	<p>Inhalation of vapours may cause drowsiness and dizziness. This may be accompanied by narcosis, reduced alertness, loss of reflexes, lack of coordination and vertigo.</p> <p>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.</p> <p>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.</p> <p>Exposure to high concentrations of fluorocarbons may produce cardiac arrhythmias or cardiac arrest due sensitisation of the heart to adrenalin or noradrenalin. Deaths associated with exposures to fluorocarbons (specifically halogenated aliphatics) have occurred in occupational settings and in inhalation of bronchodilator drugs.</p> <p>Bronchospasm consistently occurs in human subjects inhaling fluorocarbons. At a measured concentration of 1700 ppm of one of the commercially available aerosols there is a biphasic change in ventilatory capacity, the first reduction occurring within a few minutes and the second delayed up to 30 minutes.</p> <p>Common, generalised symptoms associated with non-toxic gas inhalation include :</p> <ul style="list-style-type: none"> ▶ central nervous system effects such as headache, confusion, dizziness, progressive stupor, coma and seizures; ▶ respiratory system complications may include tachypnoea and dyspnoea; ▶ cardiovascular effects may include circulatory collapse and arrhythmias; ▶ gastrointestinal effects may also be present and may include mucous membrane irritation and nausea and vomiting. <p>Acute intoxication by halogenated aliphatic hydrocarbons appears to take place over two stages. Signs of a reversible narcosis are evident in the first stage and in the second stage signs of injury to organs may become evident, a single organ alone is (almost) never involved. Depression of the central nervous system is the most outstanding effect of most halogenated aliphatic hydrocarbons. Inebriation and excitation, passing into narcosis, is a typical reaction. In severe acute exposures there is always a danger of death from respiratory failure or cardiac arrest due to a tendency to make the heart more susceptible to catecholamines (adrenalin)</p> <p>Material is highly volatile and may quickly form a concentrated atmosphere in confined or unventilated areas. The vapour may displace and replace air in breathing zone, acting as a simple asphyxiant. This may happen with little warning of overexposure.</p> <p>The use of a quantity of material in an unventilated or confined space may result in increased exposure and an irritating atmosphere developing. Before starting consider control of exposure by mechanical ventilation.</p>
Ingestion	<p>Overexposure is unlikely in this form.</p> <p>Not normally a hazard due to physical form of product.</p> <p>Considered an unlikely route of entry in commercial/industrial environments</p>
Skin Contact	<p>Skin contact is not thought to have harmful health effects (as classified under EC Directives); the material may still produce health damage following entry through wounds, lesions or abrasions.</p> <p>Repeated exposure may cause skin cracking, flaking or drying following normal handling and use.</p> <p>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.</p> <p>In common with other halogenated aliphatics, fluorocarbons may cause dermal problems due to a tendency to remove natural oils from the skin causing irritation and the development of dry, sensitive skin. They do not appear to be appreciably absorbed.</p> <p>Open cuts, abraded or irritated skin should not be exposed to this material</p> <p>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.</p>
Eye	<p>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).</p> <p>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..</p>
Chronic	<p>Limited evidence suggests that repeated or long-term occupational exposure may produce cumulative health effects involving organs or biochemical systems.</p> <p>Halogenated oxiranes may arise following epoxidation of haloalkenes.</p> <p>The metabolism of haloethylenes by microsomal oxidation leading to epoxide formation across the double bond has been proposed. The resulting oxiranes are highly reactive and may covalently bind to nucleic acids leading to mutations and possible cancers A measure of such potential carcinogenicity is the development of significant preneoplastic foci in livers of treated rats.</p> <p>The carcinogenicity of halogenated oxiranes may lie in the reactivity of an epoxide intermediate.</p> <p>Principal route of occupational exposure to the gas is by inhalation.</p> <p>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.</p> <p>It is generally accepted that the fluorocarbons are less toxic than the corresponding halogenated aliphatic based on chlorine. Repeated inhalation exposure to the fluorocarbon FC-11 does not produce pathologic lesions of the liver and other visceral organs in experimental animals. There has been conjecture in non-scientific publications that fluorocarbons may cause leukemia, cancer, sterility and birth defects; these have not been verified by current research. The high incidence of cancer, spontaneous abortion and congenital anomalies amongst hospital personnel, repeatedly exposed to fluorine-containing general anaesthetics, has caused some scientists to call for a lowering of the fluorocarbon exposure standard to 5 ppm since some are mutagens.</p>

R455A (L40X)

R455A (L40X)	TOXICITY	IRRITATION
	Not Available	Not Available
2,3,3,3-tetrafluoropropene	TOXICITY	IRRITATION
	Inhalation (Rat) LC50: >86.831 ppm4h ^[2]	Not Available
difluoromethane	TOXICITY	IRRITATION
	Inhalation (Rat) LC50: >760000 ppm4h ^[2] Oral (Mouse) LD50; 1810 mg/kg ^[2]	Not Available
carbon dioxide	TOXICITY	IRRITATION
	Not Available	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	<p>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</p> <p>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.</p> <p>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.</p> <p>Numerous haloalkanes and haloalkenes have been tested for carcinogenic and mutagenic activities. In general, the genotoxic potential is dependent on the nature, number, and position of halogen(s) and the molecular size of the compound.</p>
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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

SECTION 12 Ecological information

Toxicity

R455A (L40X)	Endpoint	Test Duration (hr)	Species	Value	Source
	Not Available	Not Available	Not Available	Not Available	Not Available
2,3,3,3-tetrafluoropropene	Endpoint	Test Duration (hr)	Species	Value	Source
	EC50	72h	Algae or other aquatic plants	>2.5mg/l	2
	NOEC(ECx)	72h	Algae or other aquatic plants	>=2.5mg/l	2
	EC50	48h	Crustacea	65mg/l	2
	ErC50	72h	Algae or other aquatic plants	>100mg/l	2
difluoromethane	Endpoint	Test Duration (hr)	Species	Value	Source
	EC50	72h	Algae or other aquatic plants	>114mg/l	2
	EC50	96h	Algae or other aquatic plants	142mg/l	2
	NOEC(ECx)	96h	Fish	10mg/l	2

Continued...

R455A (L40X)

	EC50	48h	Crustacea	>97.9mg/l	2
	LC50	96h	Fish	>81.8mg/l	2
carbon dioxide	Endpoint	Test Duration (hr)	Species	Value	Source
	LC50	96h	Fish	35mg/l	1
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.

Persistence and degradability

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

Bioaccumulative potential

Ingredient	Bioaccumulation
2,3,3,3-tetrafluoropropene	LOW (LogKOW = 2.1485)
difluoromethane	LOW (LogKOW = 0.2)
carbon dioxide	LOW (LogKOW = 0.83)

Mobility in soil

Ingredient	Mobility
2,3,3,3-tetrafluoropropene	LOW (Log KOC = 154.4)
difluoromethane	LOW (Log KOC = 23.74)
carbon dioxide	HIGH (Log KOC = 1.498)

SECTION 13 Disposal considerations

Waste treatment methods

Product / Packaging disposal	<ul style="list-style-type: none"> ▶ Evaporate or incinerate residue at an approved site. ▶ Return empty containers to supplier. ▶ Ensure damaged or non-returnable cylinders are gas-free before disposal.
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SECTION 14 Transport information

Labels Required

	
Marine Pollutant	NO
HAZCHEM	2YE

Land transport (ADG)

14.1. UN number or ID 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)	<table border="1"> <tbody> <tr> <td>Class</td> <td>2.1</td> </tr> <tr> <td>Subsidiary Hazard</td> <td>Not Applicable</td> </tr> </tbody> </table>	Class	2.1	Subsidiary Hazard	Not Applicable
Class	2.1				
Subsidiary Hazard	Not Applicable				
14.4. Packing group	Not Applicable				
14.5. Environmental hazard	Not Applicable				

Continued...

R455A (L40X)

14.6. Special precautions for user	Special provisions	274
	Limited quantity	0

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 Subsidiary Hazard	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 Subsidiary Hazard	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

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

Not Applicable

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

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

14.7.3. Transport in bulk in accordance with the IGC Code

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

SECTION 15 Regulatory information

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

2,3,3,3-tetrafluoropropene is found on the following regulatory lists

Continued...

R455A (L40X)

Australian Inventory of Industrial Chemicals (AIIC)

difluoromethane is found on the following regulatory lists

Australian Inventory of Industrial Chemicals (AIIC)

UNEP (United Nations Environment Programme) Montreal Protocol Ozone Depletors - Annex F

carbon dioxide is found on the following regulatory lists

Australian Inventory of Industrial Chemicals (AIIC)

FEI Equine Prohibited Substances List - Controlled Medication

FEI Equine Prohibited Substances List (EPSL)

Additional Regulatory Information

Not Applicable

National Inventory Status

National Inventory	Status
Australia - AIIC / Australia Non-Industrial Use	Yes
Canada - DSL	Yes
Canada - NDSL	No (2,3,3,3-tetrafluoropropene; difluoromethane; carbon dioxide)
China - IECSC	No (2,3,3,3-tetrafluoropropene; difluoromethane)
Europe - EINEC / ELINCS / NLP	Yes
Japan - ENCS	Yes
Korea - KECI	Yes
New Zealand - NZIoC	Yes
Philippines - PICCS	Yes
USA - TSCA	All chemical substances in this product have been designated as TSCA Inventory 'Active'
Taiwan - TCSI	Yes
Mexico - INSQ	No (2,3,3,3-tetrafluoropropene)
Vietnam - NCI	Yes
Russia - FBEPH	No (2,3,3,3-tetrafluoropropene)
Legend:	<i>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.</i>

SECTION 16 Other information

Revision Date	29/04/2024
Initial Date	14/09/2017

SDS Version Summary

Version	Date of Update	Sections Updated
7.1	31/03/2023	Physical and chemical properties - Appearance
8.1	29/04/2024	Handling and storage - Storage (suitable container)

Other information

Classification of the preparation and its individual components has drawn on official and authoritative sources 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.

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

Continued...

R455A (L40X)

- ▶ TLV: Threshold Limit Value
- ▶ LOD: Limit Of Detection
- ▶ OTV: Odour Threshold Value
- ▶ BCF: BioConcentration Factors
- ▶ BEI: Biological Exposure Index
- ▶ DNEL: Derived No-Effect Level
- ▶ PNEC: Predicted no-effect concentration
- ▶ MARPOL: International Convention for the Prevention of Pollution from Ships
- ▶ IMSBC: International Maritime Solid Bulk Cargoes Code
- ▶ IGC: International Gas Carrier Code
- ▶ IBC: International Bulk Chemical Code

- ▶ AIIC: Australian Inventory of Industrial Chemicals
- ▶ DSL: Domestic Substances List
- ▶ NDSL: Non-Domestic Substances List
- ▶ IECS: 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