



A-Gas Used Refrigerants and Refrigerant Blends

A-Gas (U.S. Headquarters)

Chemwatch: 5219-74

Version No: 2.1.1.1

Safety Data Sheet according to OSHA HazCom Standard (2012) requirements

Chemwatch Hazard Alert Code: 3

Issue Date: 08/08/2016

Print Date: 19/07/2019

L.GHS.USA.EN

SECTION 1 IDENTIFICATION

Product Identifier

Product name	A-Gas Used Refrigerants and Refrigerant Blends
Synonyms	USED REFRIGERANT R-22; USED REFRIGERANT R-134a; USED REFRIGERANT R-125; USED REFRIGERANT R-32; USED REFRIGERANT R-124; USED REFRIGERANT R-12; USED REFRIGERANT R-13; USED REFRIGERANT R-14; USED REFRIGERANT R-11; USED REFRIGERANT R-23; USED REFRIGERANT R-113; USED REFRIGERANT R-114; USED REFRIGERANT R-116; USED REFRIGERANT R-123; USED REFRIGERANT R-401A (Suva MP39); USED REFRIGERANT R-401B (Suva MP66); USED REFRIGERANT R-401C (Suva MP-52); USED REFRIGERANT R-402A (Suva HP80); USED REFRIGERANT R-402B (Suva HP81); USED REFRIGERANT R-404A (Suva HP62); USED REFRIGERANT R-407A; USED REFRIGERANT R-407C; USED REFRIGERANT R-408A; USED REFRIGERANT R-409A; USED REFRIGERANT R-410A; USED REFRIGERANT R-417A (ISCEON MO59); USED REFRIGERANT R-422A (ISCEON MO79); USED REFRIGERANT R-422D (ISCEON MO29); USED REFRIGERANT R-423A (ISCEON 39TC); USED REFRIGERANT R-437A (ISCEON MO49 Plus); USED REFRIGERANT R-438A (ISCEON MO99); USED REFRIGERANT R-500; USED REFRIGERANT R-502; USED REFRIGERANT R-503; USED REFRIGERANT R-507; USED REFRIGERANT R-508B (Suva 95); USED REFRIGERANT R-236fa
Proper shipping name	Refrigerant gases, n.o.s. (contains Fluorinated Hydrocarbons)
Other means of identification	Not Available

Recommended use of the chemical and restrictions on use

Relevant identified uses	Use according to manufacturer's directions. 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.
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Name, address, and telephone number of the chemical manufacturer, importer, or other responsible party

Registered company name	A-Gas (U.S. Headquarters)
Address	1100 Haskins Rd OH 43402 United States
Telephone	14198678990
Fax	1-419-867-3279
Website	www.agasamericas.com
Email	tammy.myers@agas.com

Emergency phone number

Association / Organisation	PERS
Emergency telephone numbers	1-800-633-8253
Other emergency telephone numbers	International 1-801-629-0667

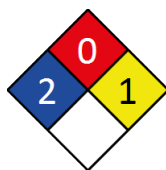
SECTION 2 HAZARD(S) IDENTIFICATION

Classification of the substance or mixture

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NFPA 704 diamond



Note: The hazard category numbers found in GHS classification in section 2 of this SDSs are NOT to be used to fill in the NFPA 704 diamond. Blue = Health Red = Fire Yellow = Reactivity White = Special (Oxidizer or water reactive substances)

Classification	Simple Asphyxiant, Gas under Pressure (Liquefied gas), Acute Toxicity (Oral) Category 4, Acute Toxicity (Dermal) Category 4, Acute Toxicity (Inhalation) Category 4, Eye Irritation Category 2A, Carcinogenicity Category 1B, Lactation Effects, Specific target organ toxicity - single exposure Category 3 (narcotic effects), Specific target organ toxicity - repeated exposure Category 2, Chronic Aquatic Hazard Category 1, Hazardous to the Ozone Layer Category 1
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Label elements

Hazard pictogram(s)	
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SIGNAL WORD	DANGER
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Hazard statement(s)

H280	Contains gas under pressure; may explode if heated.
H302	Harmful if swallowed.
H312	Harmful in contact with skin.
H332	Harmful if inhaled.
H319	Causes serious eye irritation.
H350	May cause cancer.
H362	May cause harm to breast-fed children.
H336	May cause drowsiness or dizziness.
H373	May cause damage to organs through prolonged or repeated exposure.
H410	Very toxic to aquatic life with long lasting effects.
H420	Harms public health and the environment by destroying ozone in the upper atmosphere.
	May displace oxygen and cause rapid suffocation

Hazard(s) not otherwise classified

Not Applicable

Precautionary statement(s) Prevention

P201	Obtain special instructions before use.
P260	Do not breathe dust/fume/gas/mist/vapours/spray.
P263	Avoid contact during pregnancy/while nursing.
P271	Use only outdoors or in a well-ventilated area.

Precautionary statement(s) Response

P308+P313	IF exposed or concerned: Get medical advice/attention.
P322	Specific measures (see advice on this label).
P363	Wash contaminated clothing before reuse.
P305+P351+P338	IF IN EYES: Rinse cautiously with water for several minutes. Remove contact lenses, if present and easy to do. Continue rinsing.

Precautionary statement(s) Storage

P405	Store locked up.
P410+P403	Protect from sunlight. Store in a well-ventilated place.
P403+P233	Store in a well-ventilated place. Keep container tightly closed.

Precautionary statement(s) Disposal

P501	Dispose of contents/container in accordance with local regulations.
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A-Gas Used Refrigerants and Refrigerant Blends

P502 Refer to manufacturer/supplier for information on recovery/recycling.

SECTION 3 COMPOSITION / INFORMATION ON INGREDIENTS

Substances

See section below for composition of Mixtures

Mixtures

CAS No	%[weight]	Name
75-45-6	0-100	<u>F-22 HCFC22</u>
811-97-2	0-100	<u>R-134A</u>
354-33-6	0-70	<u>R125</u>
75-10-5	0-30	<u>R32</u>
2837-89-0	0-100	<u>R124</u>
75-46-7	0-100	<u>R23</u>
306-83-2	0-100	<u>R123</u>
75-68-3	0-100	<u>R142b</u>
690-39-1	0-100	<u>HFC-236fa (FE36)</u>
420-46-2	0-55	<u>R143a</u>
431-89-0	0-50	<u>R227ea</u>
75-37-6	0-30	<u>R152a</u>
76-19-7	0-10	<u>octafluoropropane</u>
75-69-4	0-60	<u>A-Gas R11</u>
75-72-9	0-60	<u>chlorotrifluoromethane</u>
75-73-0	0-60	<u>tetrafluoromethane</u>
76-13-1	0-60	<u>R-113</u>
76-14-2	0-60	<u>1,2-dichlorotetrafluoroethane</u>
76-15-3	0-60	<u>chloropentafluoroethane</u>
76-16-4	0-60	<u>R116</u>
74-98-6	0-6	<u>Propane</u>
106-97-8.	0-5	<u>n-Butane, 99.95%</u>
109-66-0	0-1	<u>n-pentane</u>
75-28-5.	0-5	<u>R600a (Isobutane)</u>
78-78-4	0-1	<u>Isopentane</u>
68648-86-2	0-30	<u>benzene, C4-16-alkyl derivatives</u>
9003-13-8	0-30	<u>polypropylene glycol monobutyl ether</u>
9038-95-3	0-30	<u>monobutyl ether ethoxylated, propoxylated</u>
64742-44-5	0-30	<u>naphthenic distillate, heavy, clay-treated</u>
64741-88-4	0-30	<u>paraffinic distillate, heavy, solvent-refined (mild)</u>
118685-22-6	0-30	<u>pentaerythritol ester of heptanoic, isononanoic acids</u>
Not Available	0-3	unspecified impurities

The specific chemical identity and/or exact percentage (concentration) of composition has been withheld as a trade secret.

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)
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	<ul style="list-style-type: none"> ▶ 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. <p>In case of cold burns (frost-bite):</p> <ul style="list-style-type: none"> ▶ Move casualty into warmth before thawing the affected part; if feet are affected carry if possible ▶ Bathe the affected area immediately in luke-warm water (not more than 35 deg C) for 10 to 15 minutes, immersing if possible and without rubbing ▶ DO NOT apply hot water or radiant heat. ▶ Apply a clean, dry, light dressing of "fluffed-up" dry gauze bandage ▶ If a limb is involved, raise and support this to reduce swelling ▶ If an adult is involved and where intense pain occurs provide pain killers such as paracetamol ▶ Transport to hospital, or doctor ▶ Subsequent blackening of the exposed tissue indicates potential of necrosis, which may require amputation.
Inhalation	<ul style="list-style-type: none"> ▶ 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	<ul style="list-style-type: none"> ▶ Avoid giving milk or oils. ▶ Avoid giving alcohol. ▶ Not considered a normal route of entry. ▶ For advice, contact a Poisons Information Centre or a doctor. ▶ If spontaneous vomiting appears imminent or occurs, hold patient's head down, lower than their hips to help avoid possible aspiration of vomitus.

Most important symptoms and effects, both acute and delayed

See Section 11

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:

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- ▶ 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]

- ▶ Heavy and persistent skin contamination over many years may lead to dysplastic changes. Pre-existing skin disorders may be aggravated by exposure to this product.
- ▶ In general, emesis induction is unnecessary with high viscosity, low volatility products, i.e. most oils and greases.
- ▶ High pressure accidental injection through the skin should be assessed for possible incision, irrigation and/or debridement.

NOTE: Injuries may not seem serious at first, but within a few hours tissue may become swollen, discoloured and extremely painful with extensive subcutaneous necrosis. Product may be forced through considerable distances along tissue planes.

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 FIRE-FIGHTING MEASURES

Extinguishing media

SMALL FIRE: Use extinguishing agent suitable for type of surrounding fire.

LARGE FIRE: Cool cylinder.

DO NOT direct water at source of leak or venting safety devices as icing may occur.

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

Special protective equipment and precautions for fire-fighters

Fire Fighting	<p>-----</p> <p>GENERAL</p> <p>-----</p> <ul style="list-style-type: none"> ▶ Alert Fire Brigade and tell them location and nature of hazard. ▶ Wear breathing apparatus and protective gloves. ▶ Fight fire from a safe distance, with adequate cover. ▶ Use water delivered as a fine spray to control fire and cool adjacent area.
Fire/Explosion Hazard	<ul style="list-style-type: none"> ▶ Containers may explode when heated - Ruptured cylinders may rocket ▶ Fire exposed containers may vent contents through pressure relief devices. ▶ High concentrations of gas may cause asphyxiation without warning. ▶ May decompose explosively when heated or involved in fire. ▶ Contact with gas may cause burns, severe injury and/ or frostbite. <p>Decomposition may produce toxic fumes of:</p> <p>carbon monoxide (CO)</p> <p>carbon dioxide (CO₂)</p> <p>hydrogen chloride</p> <p>phosgene</p> <p>hydrogen fluoride</p> <p>sulfur oxides (SO_x)</p> <p>other pyrolysis products typical of burning organic material.</p>

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A-Gas Used Refrigerants and Refrigerant Blends

Contains low boiling substance: Closed containers may rupture due to pressure buildup under fire conditions.

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	<p>Environmental hazard - contain spillage.</p> <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. ▶ Increase ventilation.
Major Spills	<p>Environmental hazard - contain spillage.</p> <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. ▶ Wear breathing apparatus and protective gloves. ▶ Prevent by any means available, spillage from entering drains and water-courses. ▶ Remove leaking cylinders to a safe place. ▶ Fit vent pipes. Release pressure under safe, controlled conditions ▶ Burn issuing gas at vent pipes. ▶ DO NOT exert excessive pressure on valve; DO NOT attempt to operate damaged valve.

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

SECTION 7 HANDLING AND STORAGE

Precautions for safe handling

Safe handling	<p>Natural gases contain a contaminant, radon-222, a naturally occurring radioactive gas. During subsequent processing, radon tends to concentrate in liquefied petroleum streams and in product streams having similar boiling points. Industry experience indicates that the commercial product may contain small amounts of radon-222 and its radioactive decay products (radon daughters). The actual concentration of radon-222 and radioactive daughters in process equipment (IE lines, filters, pumps and reactor units) may reach significant levels and produce potentially damaging levels of gamma radiation.</p> <p>The conductivity of this material may make it a static accumulator., A liquid is typically considered nonconductive if its conductivity is below 100 pS/m and is considered semi-conductive if its conductivity is below 10 000 pS/m., Whether a liquid is nonconductive or semi-conductive, the precautions are the same., A number of factors, for example liquid temperature, presence of contaminants, and anti-static additives can greatly influence the conductivity of a liquid.</p> <ul style="list-style-type: none"> ▶ Containers, even those that have been emptied, may contain explosive vapours. ▶ Do NOT cut, drill, grind, weld or perform similar operations on or near containers. ▶ Overheating of ethoxylates/ alkoxyates in air should be avoided. When some ethoxylates are heated vigorously in the presence of air or oxygen, at temperatures exceeding 160 C, they may undergo exothermic oxidative degeneration resulting in self-heating and autoignition. ▶ Nitrogen blanketing will minimise the potential for ethoxylate oxidation. Prolonged storage in the presence of air or oxygen may cause product degradation. ▶ Electrostatic discharge may be generated during pumping - this may result in fire. ▶ Ensure electrical continuity by bonding and grounding (earthing) all equipment. ▶ Restrict line velocity during pumping in order to avoid generation of electrostatic discharge (<=1 m/sec until fill pipe submerged to twice its diameter, then <= 7 m/sec). ▶ Avoid splash filling. ▶ Avoid generation of static electricity. Earth all lines and equipment. <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 ·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. ▶ DO NOT transfer gas from one cylinder to another.
Other information	<p>Ethoxylates/ alkoxyates react slowly with air or oxygen and may generate potentially sensitising intermediates (haptens).. Storage under heated conditions in the presence of air or oxygen increases reaction rate. For example, after storing at 95 F/ 35 C for 30 days in the presence of air, there is measurable oxidation of the ethoxylate. Lower temperatures will allow for longer storage time and higher temperatures will shorten the storage time if stored under an air or oxygen atmosphere.</p> <ul style="list-style-type: none"> ▶ Outside or detached storage is preferred. ▶ Store below 38 deg. C. ▶ 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.

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- ▶ 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	<p>DO NOT repack. Use only containers as originally supplied by manufacturer</p> <ul style="list-style-type: none"> ▶ DO NOT use aluminium or galvanised containers ▶ Glass container is suitable for laboratory quantities ▶ Cylinder: <ul style="list-style-type: none"> ▶ 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	<ul style="list-style-type: none"> ▶ Avoid reaction with oxidising agents ▶ Contact with acids produces toxic fumes ▶ 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 <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 rage 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>BRETHERRICK 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.

SECTION 8 EXPOSURE CONTROLS / PERSONAL PROTECTION

Control parameters

OCCUPATIONAL EXPOSURE LIMITS (OEL)

INGREDIENT DATA

Source	Ingredient	Material name	TWA	STEL	Peak	Notes
US NIOSH Recommended Exposure Limits (RELs)	chlorodifluoromethane	Difluorochloromethane, Fluorocarbon-22, Freon® 22, Genetron® 22, Monochlorodifluoromethane, Refrigerant 22	1000 ppm / 3500 mg/m3	4375 mg/m3 / 1250 ppm	Not Available	Not Available
US ACGIH Threshold Limit Values (TLV)	chlorodifluoromethane	Chlorodifluoromethane	1000 ppm	Not Available	Not Available	TLV® Basis: CNS impair; asphyxia; card sens
US NIOSH Recommended Exposure Limits (RELs)	trichlorofluoromethane	Freon® 11, Monofluorotrichloromethane, Refrigerant 11, Trichlorofluoromethane, Trichloromonofluoromethane	Not Available	Not Available	1000 ppm / 5600 mg/m3	Not Available
US ACGIH Threshold Limit Values (TLV)	trichlorofluoromethane	Trichlorofluoromethane	Not Available	Not Available	1000 ppm	TLV® Basis: Card sens
US OSHA Permissible Exposure Levels (PELs) - Table Z1	trichlorofluoromethane	Fluorotrichloromethane (Trichlorofluoromethane)	1000 ppm / 5600 mg/m3	Not Available	Not Available	Not Available
US NIOSH Recommended Exposure Limits (RELs)	1,1,2-trichlorotrifluoroethane	Chlorofluorocarbon-113, CFC-113, Freon® 113, Genetron® 113, Halocarbon 113, Refrigerant 113, TTE	1000 ppm / 7600 mg/m3	9500 mg/m3 / 1250 ppm	Not Available	Not Available
US ACGIH Threshold Limit Values (TLV)	1,1,2-trichlorotrifluoroethane	1, 1, 2-Trichloro-1, 2, 2-trifluoroethane	1000 ppm	1250 ppm	Not Available	TLV® Basis: CNS impair
US OSHA Permissible Exposure Levels (PELs) - Table Z1	1,1,2-trichlorotrifluoroethane	1,1,2-Trichloro-1,2,2-trifluoroethane	1000 ppm / 7600 mg/m3	Not Available	Not Available	Not Available
US NIOSH Recommended Exposure Limits (RELs)	1,2-dichlorotetrafluoroethane	1,2-Dichlorotetrafluoroethane; Freon® 114; Genetron® 114; Halon® 242; Refrigerant 114	1000 ppm / 7000	Not Available	Not Available	Not Available

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			mg/m3			
US ACGIH Threshold Limit Values (TLV)	1,2-dichlorotetrafluoroethane	Dichlorotetrafluoroethane	1000 ppm	Not Available	Not Available	TLV® Basis: Pulm func
US OSHA Permissible Exposure Levels (PELs) - Table Z1	1,2-dichlorotetrafluoroethane	Dichlorotetrafluoroethane	1000 ppm / 7000 mg/m3	Not Available	Not Available	Not Available
US NIOSH Recommended Exposure Limits (RELs)	chloropentafluoroethane	Fluorocarbon-115, Freon® 115, Genetron® 115, Halocarbon 115, Monochloropentafluoroethane	1000 ppm / 6320 mg/m3	Not Available	Not Available	Not Available
US ACGIH Threshold Limit Values (TLV)	chloropentafluoroethane	Chloropentafluoroethane	1000 ppm	Not Available	Not Available	TLV® Basis: Card sens
US NIOSH Recommended Exposure Limits (RELs)	propane	Bottled gas, Dimethyl methane, n-Propane, Propyl hydride	1000 ppm / 1800 mg/m3	Not Available	Not Available	Not Available
US ACGIH Threshold Limit Values (TLV)	propane	* Propane	Not Available	Not Available	Not Available	TLV® Basis: Asphyxia; See Appendix F: Minimal Oxygen Content
US OSHA Permissible Exposure Levels (PELs) - Table Z1	propane	Propane	1000 ppm / 1800 mg/m3	Not Available	Not Available	Not Available
US NIOSH Recommended Exposure Limits (RELs)	butane	normal-Butane, Butyl hydride, Diethyl, Methylethylmethane [Note: Also see specific listing for Isobutane.]	800 ppm / 1900 mg/m3	Not Available	Not Available	Not Available
US ACGIH Threshold Limit Values (TLV)	butane	* Butane, all isomers	Not Available	1000 ppm	Not Available	TLV® Basis: CNS impair
US NIOSH Recommended Exposure Limits (RELs)	n-pentane	Pentane, normal-Pentane	120 ppm / 350 mg/m3	Not Available	610 ppm / 1800 mg/m3	[15-minute]
US ACGIH Threshold Limit Values (TLV)	n-pentane	Pentane, all isomers	1000 ppm	Not Available	Not Available	TLV® Basis: Narcosis; resp tract irr
US OSHA Permissible Exposure Levels (PELs) - Table Z1	n-pentane	Pentane	1000 ppm / 2950 mg/m3	Not Available	Not Available	Not Available
US NIOSH Recommended Exposure Limits (RELs)	iso-butane	2-Methylpropane [Note: Also see specific listing for n-Butane.]	800 ppm / 1900 mg/m3	Not Available	Not Available	Not Available
US ACGIH Threshold Limit Values (TLV)	iso-butane	* Butane, all isomers	Not Available	1000 ppm	Not Available	TLV® Basis: CNS impair
US NIOSH Recommended Exposure Limits (RELs)	isopentane	Pentane, normal-Pentane	120 ppm / 350 mg/m3	Not Available	610 ppm / 1800 mg/m3	[15-minute]
US ACGIH Threshold Limit Values (TLV)	isopentane	Pentane, all isomers	1000 ppm	Not Available	Not Available	TLV® Basis: Narcosis; resp tract irr

EMERGENCY LIMITS

Ingredient	Material name	TEEL-1	TEEL-2	TEEL-3
F-22 HCFC22	Chlorodifluoromethane; (Freon 22; CFC 22)	1,250 ppm	2,400 ppm	14,000 ppm
R-134A	HFC 134a; (Tetrafluoroethane, 1,1,1,2-)	Not Available	Not Available	Not Available
R32	Methylene fluoride; (Difluoromethane; HFC-32)	3,000 ppm	6,500 ppm	39,000 ppm
R124	Chloro-1,1,1,2-tetrafluoroethane, 2-	Not Available	Not Available	Not Available
R23	Carbon trifluoride; (Trifluoromethane; Fluoroform)	350 ppm	3,800 ppm	23,000 ppm
R123	HCFC-123; (Dichloro-1,1,1-trifluoroethane, 2,2-)	150 ppm	Not Available	Not Available
R142b	Chloro-1,1-difluoroethane, 1-; (HCFC-142b)	Not Available	Not Available	Not Available

A-Gas Used Refrigerants and Refrigerant Blends

R152a	Difluoroethane; (1,1-Difluoroethane; HFC 152a)	Not Available	Not Available	Not Available
A-Gas R11	Trichlorofluoromethane; (Fluorotrichloromethane; Freon 11)	140 ppm	1,500 ppm	10,000 ppm
chlorotrifluoromethane	Chlorotrifluoromethane; (CFC-113)	3,000 ppm	33,000 ppm	2.00E+05 ppm
tetrafluoromethane	Carbon tetrafluoride; (Tetrafluoromethane)	92 ppm	1,000 ppm	6,000 ppm
R-113	Trichlorotrifluoroethane; (Freon 113; CFC113)	1,250 ppm	1,500 ppm	4,500 ppm
1,2-dichlorotetrafluoroethane	Dichlorotetrafluoroethane	140 ppm	1,600 ppm	9,500 ppm
1,2-dichlorotetrafluoroethane	Dichlorotetrafluoroethane, 1,2-; (Freon 114, CFC 114)	3,000 ppm	10,000 ppm	50,000 ppm
chloropentafluoroethane	Monochloropentafluoroethane; (CFC-115)	3,000 ppm	5,700 ppm	34,000 ppm
R116	Hexafluoroethane; (Freon 116; Perfluoroethane)	100 ppm	1,100 ppm	6,800 ppm
Propane	Propane	Not Available	Not Available	Not Available
n-Butane, 99.95%	Butane	Not Available	Not Available	Not Available
n-pentane	Pentane, n-	3000 ppm	33000 ppm	200000 ppm
R600a (Isobutane)	Methylpropane, 2-; (Isobutane)	5500 ppm	17000 ppm	53000 ppm
Isopentane	Isopentane; (Ethylidimethylmethane; 2-Methylbutane)	3000 ppm	33000 ppm	200000 ppm
polypropylene glycol monobutyl ether	Butoxypolypropylene glycol	27 mg/m3	300 mg/m3	1,800 mg/m3

Ingredient	Original IDLH	Revised IDLH
F-22 HCFC22	Not Available	Not Available
R-134A	Not Available	Not Available
R125	Not Available	Not Available
R32	Not Available	Not Available
R124	Not Available	Not Available
R23	Not Available	Not Available
R123	Not Available	Not Available
R142b	Not Available	Not Available
HFC-236fa (FE36)	Not Available	Not Available
R143a	2,000 ppm	Not Available
R227ea	Not Available	Not Available
R152a	Not Available	Not Available
octafluoropropane	Not Available	Not Available
A-Gas R11	2,000 ppm	Not Available
chlorotrifluoromethane	Not Available	Not Available
tetrafluoromethane	Not Available	Not Available
R-113	2,000 ppm	Not Available
1,2-dichlorotetrafluoroethane	15,000 ppm	Not Available
chloropentafluoroethane	Not Available	Not Available
R116	Not Available	Not Available
Propane	2,100 ppm	Not Available
n-Butane, 99.95%	Not Available	1,600 ppm
n-pentane	1,500 ppm	Not Available
R600a (Isobutane)	Not Available	Not Available
Isopentane	Not Available	Not Available
benzene, C4-16-alkyl derivatives	Not Available	Not Available
polypropylene glycol monobutyl ether	Not Available	Not Available
monobutyl ether ethoxylated, propoxylated	Not Available	Not Available
naphthenic distillate, heavy, clay-treated	Not Available	Not Available
paraffinic distillate, heavy, solvent-refined (mild)	Not Available	Not Available

A-Gas Used Refrigerants and Refrigerant Blends


pentaerythritol ester of heptanoic, isononanoic acids

Not Available

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>
Personal protection	
Eye and face protection	<ul style="list-style-type: none"> ▶ Chemical goggles. ▶ Full face shield may be required for supplementary but never for primary protection of eyes. ▶ 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	<p>NOTE:</p> <ul style="list-style-type: none"> ▶ The material may produce skin sensitisation in predisposed individuals. Care must be taken, when removing gloves and other protective equipment, to avoid all possible skin contact. ▶ Contaminated leather items, such as shoes, belts and watch-bands should be removed and destroyed. ▶ Neoprene gloves ▶ Protective gloves eg. Leather gloves or gloves with Leather facing ▶ When handling sealed and suitably insulated cylinders wear cloth or leather gloves. ▶ Insulated gloves: <p>NOTE: Insulated gloves should be loose fitting so that may be removed quickly if liquid is spilled upon them. Insulated gloves are not made to permit hands to be placed in the liquid; they provide only short-term protection from accidental contact with the liquid.</p>
Body protection	See Other protection below
Other protection	<ul style="list-style-type: none"> ▶ Employees working with confirmed human carcinogens should be provided with, and be required to wear, clean, full body protective clothing (smocks, coveralls, or long-sleeved shirt and pants), shoe covers and gloves prior to entering the regulated area. [AS/NZS ISO 6529:2006 or national equivalent] ▶ Employees engaged in handling operations involving carcinogens should be provided with, and required to wear and use half-face filter-type respirators with filters for dusts, mists and fumes, or air purifying canisters or cartridges. A respirator affording higher levels of protection may be substituted. [AS/NZS 1715 or national equivalent] ▶ Emergency deluge showers and eyewash fountains, supplied with potable water, should be located near, within sight of, and on the same level with locations where direct exposure is likely. ▶ Prior to each exit from an area containing confirmed human carcinogens, employees should be required to remove and leave protective clothing and equipment at the point of exit and at the last exit of the day, to place used clothing and equipment in impervious containers at the point of exit for purposes of decontamination or disposal. The contents of such impervious containers must be identified with suitable labels. For maintenance and decontamination activities, authorized employees entering the area should be provided with and required to wear clean, impervious garments, including gloves, boots and continuous-air supplied hood. ▶ Prior to removing protective garments the employee should undergo decontamination and be required to shower upon removal of the garments and hood. ▶ Protective overalls, closely fitted at neck and wrist. ▶ Eye-wash unit. ▶ Ensure availability of lifeline in confined spaces. ▶ Staff should be trained in all aspects of rescue work.

Recommended material(s)

GLOVE SELECTION INDEX

Glove selection is based on a modified presentation of the: **"Forsberg Clothing Performance Index"**.

The effect(s) of the following substance(s) are taken into account in the **computer-generated** selection:

A-Gas Used Refrigerants and Refrigerant Blends

Material	CPI
NAT+NEOPR+NITRILE	C
NATURAL+NEOPRENE	C
NEOPRENE	C
NEOPRENE/NATURAL	C

Respiratory protection

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

Where the concentration of gas/particulates in the breathing zone, approaches or exceeds the "Exposure Standard" (or ES), respiratory protection is required.

Degree of protection varies with both face-piece and Class of filter; the nature of protection varies with Type of filter.

Required Minimum Protection Factor	Half-Face Respirator	Full-Face Respirator	Powered Air Respirator
up to 5 x ES	AX-AUS / Class 1 P2	-	AX-PAPR-AUS / Class 1 P2
up to 25 x ES	Air-line*	AX-2 P2	AX-PAPR-2 P2
up to 50 x ES	-	AX-3 P2	-

Continued...

A-Gas Used Refrigerants and Refrigerant Blends

NITRILE	C
NITRILE+PVC	C
PE	C
PE/EVAL/PE	C
PVA	C
PVC	C
TEFLON	C
VITON	C

* CPI - Chemwatch Performance Index

A: Best Selection

B: Satisfactory; may degrade after 4 hours continuous immersion

C: Poor to Dangerous Choice for other than short term immersion

NOTE: As a series of factors will influence the actual performance of the glove, a final selection must be based on detailed observation. -

* Where the glove is to be used on a short term, casual or infrequent basis, factors such as "feel" or convenience (e.g. disposability), may dictate a choice of gloves which might otherwise be unsuitable following long-term or frequent use. A qualified practitioner should be consulted.

50+ x ES	-	Air-line**	-
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* - Continuous-flow; ** - Continuous-flow or positive pressure demand

^ - Full-face

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.

SECTION 9 PHYSICAL AND CHEMICAL PROPERTIES

Information on basic physical and chemical properties

Appearance	Clear, colourless, or light yellow liquid, compressed gas, or liquefied gas with a slight, ether-like odour.		
Physical state	Liquified Gas	Relative density (Water = 1)	Not Applicable
Odour	Not Available	Partition coefficient n-octanol / water	Not Available
Odour threshold	Not Available	Auto-ignition temperature (°C)	Not Applicable
pH (as supplied)	Not Applicable	Decomposition temperature	Not Available
Melting point / freezing point (°C)	Not Applicable	Viscosity (cSt)	Not Applicable
Initial boiling point and boiling range (°C)	Not Applicable	Molecular weight (g/mol)	Not Applicable
Flash point (°C)	Not Applicable	Taste	Not Available
Evaporation rate	Not Applicable	Explosive properties	Not Available
Flammability	Not Applicable	Oxidising properties	Not Available
Upper Explosive Limit (%)	Not Applicable	Surface Tension (dyn/cm or mN/m)	Not Available
Lower Explosive Limit (%)	Not Applicable	Volatile Component (%vol)	Not Available
Vapour pressure (kPa)	Not Available	Gas group	Not Available
Solubility in water	Not Applicable	pH as a solution (1%)	Not Applicable
Vapour density (Air = 1)	Not Applicable	VOC g/L	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. ▶ Presence of heat source and direct sunlight ▶ Extremely high temperatures. ▶ Presence of elevated temperatures. ▶ Presence of heat source ▶ Presence of an ignition source
Possibility of hazardous reactions	See section 7

A-Gas Used Refrigerants and Refrigerant Blends

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

Inhaled	<p>Inhalation of vapours or aerosols (mists, fumes), generated by the material during the course of normal handling, may be harmful. 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>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>Inhalation hazard is increased at higher temperatures.</p> <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.</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>Acute effects from inhalation of high concentrations of vapour are pulmonary irritation, including coughing, with nausea; central nervous system depression - characterised by headache and dizziness, increased reaction time, fatigue and loss of co-ordination</p> <p>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>
Ingestion	<p>Accidental ingestion of the material may be harmful; animal experiments indicate that ingestion of less than 150 gram may be fatal or may produce serious damage to the health of the individual.</p> <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 with the material may be harmful; systemic effects may result following absorption.</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>Irritation and skin reactions are possible with sensitive skin</p> <p>Open cuts, abraded or irritated skin should not be exposed to this material</p> <p>Material on the skin evaporates rapidly and may cause tingling, chilling and even temporary numbness</p> <p>The material may accentuate any pre-existing dermatitis condition</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> <p>Vapourising liquid causes rapid cooling and contact may cause cold burns, frostbite, even through normal gloves. Frozen skin tissues are painless and appear waxy and yellow. Signs and symptoms of frost-bite may include "pins and needles", paleness followed by numbness, a hardening and stiffening of the skin, a progression of colour changes in the affected area, (first white, then mottled and blue and eventually black; on recovery, red, hot, painful and blistered).</p>
Eye	<p>Evidence exists, or practical experience predicts, that the material may cause eye irritation in a substantial number of individuals and/or may produce significant ocular lesions which are present twenty-four hours or more after instillation into the eye(s) of experimental animals. Repeated or prolonged eye contact may cause inflammation characterised by temporary redness (similar to windburn) of the conjunctiva (conjunctivitis); temporary impairment of vision and/or other transient eye damage/ulceration may occur.</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> <p>Petroleum hydrocarbons may produce pain after direct contact with the eyes. Slight, but transient disturbances of the corneal epithelium may also result. The aromatic fraction may produce irritation and lachrymation.</p>
Chronic	<p>On the basis, primarily, of animal experiments, the material may be regarded as carcinogenic to humans. There is sufficient evidence to provide a strong presumption that human exposure to the material may result in cancer on the basis of:</p> <ul style="list-style-type: none"> - appropriate long-term animal studies - other relevant information <p>Harmful: danger of serious damage to health by prolonged exposure through inhalation.</p> <p>Serious damage (clear functional disturbance or morphological change which may have toxicological significance) is likely to be caused by</p>

A-Gas Used Refrigerants and Refrigerant Blends

repeated or prolonged exposure. As a rule the material produces, or contains a substance which produces severe lesions. Such damage may become apparent following direct application in subchronic (90 day) toxicity studies or following sub-acute (28 day) or chronic (two-year) toxicity tests.

Limited evidence suggests that repeated or long-term occupational exposure may produce cumulative health effects involving organs or biochemical systems.

There exists limited evidence that shows that skin contact with the material is capable either of inducing a sensitisation reaction in a significant number of individuals, and/or of producing positive response in experimental animals.

Principal route of occupational exposure to the gas is by inhalation.

1,1,2-Trichlorotrifluoroethane showed no effect after 20 weeks of application to uncovered skin. By contrast trichloroethylene produced erythema and ulcerations at the end of the first week. Occluded contact of 5 gm/kg of the fluorocarbon produced local necrosis and sloughing plus conspicuous hepatomegaly (enlarged liver)

Prolonged or repeated skin contact may cause degreasing with drying, cracking and dermatitis following.

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.

A-Gas Used Refrigerants and Refrigerant Blends	TOXICITY	IRRITATION
	Not Available	Not Available
F-22 HCFC22	TOXICITY	IRRITATION
	Inhalation (rat) LC50: 2.1850040625 mg/l/15Md ^[2]	Not Available
R-134A	TOXICITY	IRRITATION
	Inhalation (rat) LC50: 1500 mg/l/4h ^[2]	Not Available
R125	TOXICITY	IRRITATION
	Inhalation (rat) LC50: 2910 mg/l/4H ^[2]	Not Available
R32	TOXICITY	IRRITATION
	Inhalation (rat) LC50: 1890 mg/l/4H ^[2]	Not Available
	Oral (rat) LD50: 1890 mg/kg ^[2]	
R124	TOXICITY	IRRITATION
	Inhalation (rat) LC50: 35584.351875 mg/l15md ^[2]	Not Available
R23	TOXICITY	IRRITATION
	Inhalation (rat) LC50: >662243.517 mg/l/4H ^[2]	Not Available
R123	TOXICITY	IRRITATION
	dermal (rat) LD50: >2000 mg/kg ^[1] Inhalation (rat) LC50: 225.7 mg/l/4H ^[2]	Not Available
R142b	TOXICITY	IRRITATION
	Inhalation (rat) LC50: 2050 mg/l/4h ^[2]	Not Available
HFC-236fa (FE36)	TOXICITY	IRRITATION
	Inhalation (rat) LC50: >456478.563 mg/l/4h* ^[2]	Not Available
R143a	TOXICITY	IRRITATION
	Inhalation (rat) LC50: >53.938386 mg/l/4H ^[2]	Not Available
R227ea	TOXICITY	IRRITATION
	Inhalation (rat) LC50: >787796.097864 mg/l/4h ^[2]	Not Available
R152a	TOXICITY	IRRITATION
	Inhalation (mouse) LC50: 488.5 mg/l/2h ^[2] Oral (rat) LD50: 484 mg/kg ^[2]	Not Available

A-Gas Used Refrigerants and Refrigerant Blends

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

F-22 HCFC22	The substance is classified by IARC as Group 3: NOT classifiable as to its carcinogenicity to humans. Evidence of carcinogenicity may be inadequate or limited in animal testing.
R-134A	* with added oxygen - ZhongHao New Chemical Materials MSDS Excessive concentration can have a narcotic effect; inhalation of high concentrations of decomposition products can cause lung oedema.
R125	Cardiac sensitisation threshold limit >245400 mg/m ³ Anaesthetic effects threshold limit 490800 mg/m ³ * DuPont SDS
R23	Repeated exposure of dogs to 5000 ppm and rats to 1000 ppm resulted in no toxic effects.
R142B	for chlorodifluoroethane (syn 1-chloro-1,1-difluoroethane): Acute toxicity of 1-chloro-1,1-difluoroethane is low (LC50/6h >1,640,000 mg/m ³ (400,000 ppm) in rats). Inhalation of high concentrations induced signs of lung irritation and Central Nervous System depressing effects of anesthetic type in rats and cardiac sensitisation in dogs. Consequently, 1-chloro 1,1 -difluoroethane may be hazardous to humans in case of accidental exposure to high concentrations occurring in confined area where replacement of air by the gas could at the same time reduce oxygen in the atmosphere. Repeat dose toxicity: In repeated inhalation exposure studies, 1-chloro -1,1-difluoroethane did not induce specific chronic toxicity in rats and dogs exposed 6 h/d, 5 d/week during several months (no target organs identified ; the no observed adverse effects were higher than 41 000 mg/m ³ (10,000 ppm) in dogs exposed during 3 months and higher than 82 000 mg/m ³ (20,000 ppm) in rats exposed for their lifetime). Inhalation (Mouse) LC50: 1758000 mg/m ³ /2h Nil reported - *(Toxicity data for approx. 45% gas, 55% air)
HFC-236FA (FE36)	Single exposure by inhalation caused narcosis and cardiac sensitisation, a potentially fatal disturbance of heart rhythm associated with a heightened sensitivity to the action of epinephrine; in a cardiac sensitisation screening test in dogs exposed to concentrations of 50,000 to 250,000 ppm evidence of sensitization occurred at 150,000 ppm. Repeated exposures caused a reduced startling response in rats. No other significant toxicological effects were observed. No-Observed-Adverse-Effect-Level (NOAEL): 20,000 ppm. Developmental studies conducted in rats and rabbits at dose levels of 5000, 20,000 or 50,000 ppm produced no evidence of developmental toxicity. HFC 236fa was not uniquely toxic to the rat or rabbit conceptus. Specific studies to evaluate the effect on female reproductive performance have not been conducted; however, limited information obtained from studies on developmental toxicity do not indicate adverse effects on female reproductive performance. Tests have shown that HFC 236fa does not cause genetic damage in bacterial or mammalian cell cultures. * DuPont MSDS
R143A	NOTE: Substance has been shown to be mutagenic in at least one assay, or belongs to a family of chemicals producing damage or change to cellular DNA.
R152A	For 1,1-difluoroethane: 1,1 -Difluoroethane is practically non-toxic following acute or chronic inhalation exposures. It is not a developmental or reproductive toxicant in rat studies and is negative for cancer in a two year rat inhalation study. It is not mutagenic in a <i>in vitro</i> bacterial reverse mutation assay and shows some weak clastogenicity in an <i>in vitro</i> human lymphocyte chromosome aberration test, but further evaluation of its ability to cause chromosome damage in and <i>in vivo</i> micronucleus test was negative. There is evidence that 1,1-difluoroethane can cause cardiac effects in some species, most notably heart arrhythmia in the dog.
CHLOROTRIFLUOROMETHANE	3na
N-PENTANE	[GENIUM and CCINFO, VW.&R.]
BENZENE, C4-16-ALKYL DERIVATIVES	for linear alkylbenzenes (LABs) Linear alkylbenzenes are not acutely toxic. Data from repeat exposure, reproductive and genotoxicity studies also indicate a low potential for toxic effects. The levels of both consumer and occupational exposure are expected to be very low based on their physical and chemical properties, use and handling patterns Linear alkyl benzenes do not present any significant acute or subchronic health effects by various exposure routes. LAB is not teratogenic and does not produce selective reproductive toxicity.
POLYPROPYLENE GLYCOL MONOBUTYL ETHER	for propylene glycol ethers (PGEs): Typical propylene glycol ethers include propylene glycol n-butyl ether (PnB); dipropylene glycol n-butyl ether (DPnB); dipropylene glycol methyl ether acetate (DPMA); tripropylene glycol methyl ether (TPM). Testing of a wide variety of propylene glycol ethers Testing of a wide variety of propylene glycol ethers has shown that propylene glycol-based ethers are less toxic than some ethers of the ethylene series. The common toxicities associated with the lower molecular weight homologues of the ethylene series, such as adverse effects on reproductive organs, the developing embryo and fetus, blood (haemolytic effects), or thymus, are not seen with the commercial-grade propylene glycol ethers. In the ethylene series, metabolism of the terminal hydroxyl group produces an alkoxyacetic acid.
MONOBUTYL ETHER ETHOXYLATED, PROPOXYLATED	Polyalkylene glycol monobutyl ether (PGME) polymers have a low degree of toxicity. Toxicity by ingestion is low, but highest for lower molecular weight products *(molecular weight <1500). Thus, the FDA has restricted the use of PGME in sanitizing solutions that may contact surfaces that contact foods to a 0.05% aqueous solution of polymers that have an average molecular weight of 2,400-3,300 and a cloud-point of 90-100 degrees C. In this application, large PGME polymers engulf (micellize) oils and smaller particulates that are subsequently precipitated at temperatures of 90-100 deg C. Toxicity by skin contact is low for all PGME species. Human beings have regular contact with alcohol ethoxylates through a variety of industrial and consumer products such as soaps, detergents, and other cleaning products . Exposure to these chemicals can occur through ingestion, inhalation, or contact with the skin or eyes. Studies of acute toxicity show that volumes well above a reasonable intake level would have to occur to produce any toxic response. Moreover, no fatal case of poisoning with alcohol ethoxylates has ever been reported. For high boiling ethylene glycol ethers (typically triethylene- and tetraethylene glycol ethers): Skin absorption: Available skin absorption data for triethylene glycol ether (TGBE), triethylene glycol methyl ether (TGME), and triethylene glycol ethylene ether (TGEE) suggest that the rate of absorption in skin of these three glycol ethers is 22 to 34

A-Gas Used Refrigerants and Refrigerant Blends

	<p>micrograms/cm²/hr, with the methyl ether having the highest permeation constant and the butyl ether having the lowest. The rates of absorption of TGBE, TGEE and TGME are at least 100-fold less than EGME, EGEE, and EGBE, their ethylene glycol monoalkyl ether counterparts, which have absorption rates that range from 214 to 2890 micrograms/cm²/hr. Therefore, an increase in either the chain length of the alkyl substituent or the number of ethylene glycol moieties appears to lead to a decreased rate of percutaneous absorption. However, since the ratio of the change in values of the ethylene glycol to the diethylene glycol series is larger than that of the diethylene glycol to triethylene glycol series, the effect of the length of the chain and number of ethylene glycol moieties on absorption diminishes with an increased number of ethylene glycol moieties.</p> <p>Alcohol ethoxylates are according to CESIO (2000) classified as Irritant or Harmful depending on the number of EO-units: EO < 5 gives Irritant (Xi) with R38 (Irritating to skin) and R41 (Risk of serious damage to eyes) EO > 5-15 gives Harmful (Xn) with R22 (Harmful if swallowed) - R38/41 EO > 15-20 gives Harmful (Xn) with R22-41 >20 EO is not classified (CESIO 2000)</p> <p>Oxo-AE, C13 EO10 and C13 EO15, are Irritating (Xi) with R36/38 (Irritating to eyes and skin). AE are not included in Annex 1 of the list of dangerous substances of the Council Directive 67/548/EEC</p> <p>In general, alcohol ethoxylates (AE) are readily absorbed through the skin of guinea pigs and rats and through the gastrointestinal mucosa of rats. AE are quickly eliminated from the body through the urine, faeces, and expired air (CO₂). Orally dosed AE was absorbed rapidly and extensively in rats, and more than 75% of the dose was absorbed. When applied to the skin of humans, the doses were absorbed slowly and incompletely (50% absorbed in 72 hours).</p>
NAPHTHENIC DISTILLATE, HEAVY, CLAY-TREATED	<p>Studies indicate that normal, branched and cyclic paraffins are absorbed from the mammalian gastrointestinal tract and that the absorption of n-paraffins is inversely proportional to the carbon chain length, with little absorption above C30. With respect to the carbon chain lengths likely to be present in mineral oil, n-paraffins may be absorbed to a greater extent than iso- or cyclo-paraffins. The major classes of hydrocarbons have been shown to be well absorbed by the gastrointestinal tract in various species. In many cases, the hydrophobic hydrocarbons are ingested in association with dietary lipids.</p> <p>*Calumet SDS C-4s Refrigeration Oil</p>
PARAFFINIC DISTILLATE, HEAVY, SOLVENT-REFINED (MILD)	WARNING: This substance has been classified by the IARC as Group 1: CARCINOGENIC TO HUMANS.
PENTAERYTHRITOL ESTER OF HEPTANOIC, ISONONANOIC ACIDS	<p>For Group E aliphatic esters (polyol esters):</p> <p>According to a classification scheme described by the American Chemistry Council's Aliphatic Esters Panel, Group E substances are esters of monoacids, mainly common fatty acids, and trihydroxy or polyhydroxyalcohols or polyols, such as pentaerythritol (PE), 2-ethyl-2-(hydroxymethyl)-1,3-propanediol or trimethylolpropane (TMP), and dipentaerythritol (diPE). The Group E substances often are referred to as "polyol esters". The polyol esters are unique in their chemical characteristics since they lack beta-tertiary hydrogen atoms, thus leading to stability against oxidation and elimination. The fatty acids often range from C5-C10 to as high as C18 (e.g., oleic, stearic, isostearic, tall oil fatty acids) in carbon number and generally are derived from naturally occurring sources. Group E esters may have multiple ester linkages and may include mixed esters derived from different carbon-length fatty acid mixtures.</p>
F-22 HCFC22 & R124 & R123 & R142B & A-GAS R11 & CHLOROTRIFLUOROMETHANE & R-113 & 1,2-DICHLOROTETRAFLUOROETHANE & CHLOROPENTAFLUOROETHANE	<p>Chlorofluorocarbons may enter the human organism by inhalation, ingestion, or dermal contact. Inhalation is the most common and important route of entry, and exhalation is the most significant route of elimination from the body. Controlled studies with volunteer subjects and experimental animals have provided substantial data from exposures to a number of the chlorofluorocarbons. CFCs and HCFCs are known to sensitise the heart to adrenalin-induced arrhythmias.</p>
F-22 HCFC22 & R-134A & R124 & R123 & R142B & R227EA & A-GAS R11	<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.</p>
R124 & R123 & R142B	<p>For dichlorotrifluoroethane (HCFC -123) and dichloropentafluoropropane (HCFC-225)</p> <p>Prolonged inhalation of high concentrations of HCFC-123 vapour may cause temporary nervous system depression with anesthetic effects such as dizziness, headache, confusion, incoordination, and loss of consciousness. With gross overexposure (greater than 20% concentration), a temporary alteration of the heart's electrical activity with irregular pulse, palpitations, or inadequate circulation may occur. Similar effects are observed in overexposure to CFC-11. Inhalation may cause liver effects with extended high-level exposures.</p>
R23 & HFC-236FA (FE36) & OCTAFLUOROPROPANE & R116 & PROPANE & PARAFFINIC DISTILLATE, HEAVY, SOLVENT-REFINED (MILD) & PENTAERYTHRITOL ESTER OF HEPTANOIC, ISONONANOIC ACIDS	No significant acute toxicological data identified in literature search.
OCTAFLUOROPROPANE & TETRAFLUOROMETHANE & R116	<p>For perfluoropropane (PF3) and other aliphatic perfluoroalkanes (PFAs)</p> <p>Perfluoroalkanes (PFAs) are very stable. They are not oxidized even by ozone to any appreciable extent; their atmospheric half-life greater than 5000 y</p> <p>PFAs are chemically inert; included in this family is Teflon (a polymeric, high-molecular-weight PFA). The major concern from exposure to high concentrations of gaseous PFAs is their potential for cardiac toxicity. Cardiac effects are known to occur when humans or animals are exposed to high concentrations of other fluorinated hydrocarbons (FCs), including Freons FCs, such as chlorofluorocarbons, could induce cardiac arrhythmias by sensitising the heart to epinephrine.</p> <p>For perfluorinated carbons (PFCs):</p> <p>PFCs are inert fluids composed of a complex combination of organic compounds resulting from the distillation of electrochemically fluorinated (ECF) compounds. This class consists of branched, linear and cyclic perfluorinated hydrocarbons having carbon numbers predominantly in the range of C5-C18 and boiling in the range of approximately 25 C-255 C (77 F-491 F). Perfluorinated amine and ether compounds may also be present</p>

A-Gas Used Refrigerants and Refrigerant Blends

	<p>Acute oral and inhalation toxicity tests with perfluoroalkanes show no toxicity at any dose tested, and even extremely high-dose intraperitoneal injection resulted in no lethality. In contrast, perfluoroalkenes (such as octafluorocyclopentene, perfluoroisobutylene, hexafluoropropene) have shown evidence of inhalation toxicity, in some cases, extreme.</p> <p>The material may produce peroxisome proliferation. Peroxisomes are single, membrane limited, cytoplasmic organelles that are found in the cells of animals, plants, fungi and protozoa. Peroxisome proliferators include certain hypolipidaemic drugs, phthalate ester plasticisers, industrial solvents, herbicides, food flavours, leukotriene D4 antagonists and hormones. Numerous studies in rats and mice have demonstrated the hepatocarcinogenic effects of peroxisome proliferators, and these compounds have been unequivocally established as carcinogens.</p>
A-GAS R11 & R-113	<p>Asthma-like symptoms may continue for months or even years after exposure to the material ceases. This may be due to a non-allergic condition known as reactive airways dysfunction syndrome (RADS) which can occur following exposure to high levels of highly irritating compound. Key criteria for the diagnosis of RADS include the absence of preceding respiratory disease, in a non-atopic individual, with abrupt onset of persistent asthma-like symptoms within minutes to hours of a documented exposure to the irritant. A reversible airflow pattern, on spirometry, with the presence of moderate to severe bronchial hyperreactivity on methacholine challenge testing and the lack of minimal lymphocytic inflammation, without eosinophilia, have also been included in the criteria for diagnosis of RADS.</p>
R-113 & POLYPROPYLENE GLYCOL MONOBUTYL ETHER	<p>The material may cause skin irritation after prolonged or repeated exposure and may produce a contact dermatitis (nonallergic). This form of dermatitis is often characterised by skin redness (erythema) and swelling epidermis. Histologically there may be intercellular oedema of the spongy layer (spongiosis) and intracellular oedema of the epidermis.</p>
NAPHTHENIC DISTILLATE, HEAVY, CLAY-TREATED & PARAFFINIC DISTILLATE, HEAVY, SOLVENT-REFINED (MILD)	<p>The materials included in the Lubricating Base Oils category are related from both process and physical-chemical perspectives; The potential toxicity of a specific distillate base oil is inversely related to the severity or extent of processing the oil has undergone, since:</p> <ul style="list-style-type: none"> ·The adverse effects of these materials are associated with undesirable components, and ·The levels of the undesirable components are inversely related to the degree of processing; ·Distillate base oils receiving the same degree or extent of processing will have similar toxicities; ·The potential toxicity of <i>residual base oils</i> is independent of the degree of processing the oil receives. ·The reproductive and developmental toxicity of the distillate base oils is inversely related to the degree of processing. <p>The degree of refining influences the carcinogenic potential of the oils. Whereas mild acid / earth refining processes are inadequate to substantially reduce the carcinogenic potential of lubricant base oils, hydrotreatment and / or solvent extraction methods can yield oils with no carcinogenic potential.</p> <p>for Unrefined and Mildly Refined Distillate Base Oils</p> <p>Acute toxicity: LD50s of >5000 mg/kg (bw) and >2g/kg (bw) for the oral and dermal routes of exposure, respectively, have been observed in rats dosed with an unrefined light paraffinic distillate. The same material was also reported to be “moderately irritating” to the skin of rabbits. When tested for eye irritation in rabbits, the material produced Draize scores of 3.0 and 4.0 (unwashed/washed eyes) at 24 hours, with the scores returning to zero by 48 hours. The material was reported to be “not sensitising” when tested in guinea pigs</p> <p>Repeat dose toxicity: 200, 1000 and 2000 mg/kg (bw)/day of an unrefined base oil has been applied undiluted to the skin of male and female rabbit.. The test material was applied to the rabbits’ skins 3 times/week for 4 weeks.</p>

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

A-Gas Used Refrigerants and Refrigerant Blends	ENDPOINT	TEST DURATION (HR)	SPECIES	VALUE	SOURCE
	Not Available	Not Available	Not Available	Not Available	Not Available
F-22 HCFC22	ENDPOINT	TEST DURATION (HR)	SPECIES	VALUE	SOURCE
	LC50	96	Fish	94.877mg/L	3
	EC50	48	Crustacea	433mg/L	2
	EC50	96	Algae or other aquatic plants	250mg/L	2
R-134A	ENDPOINT	TEST DURATION (HR)	SPECIES	VALUE	SOURCE
	LC50	96	Fish	29.671mg/L	3

Continued...

A-Gas Used Refrigerants and Refrigerant Blends

	EC50	48	Crustacea	980mg/L	5
	EC50	96	Algae or other aquatic plants	97.260mg/L	3
	NOEC	72	Algae or other aquatic plants	ca.13.2mg/L	2
R125	ENDPOINT	TEST DURATION (HR)	SPECIES	VALUE	SOURCE
	LC50	96	Fish	43.427mg/L	3
	EC50	48	Crustacea	>97.9mg/L	2
	EC50	72	Algae or other aquatic plants	>114mg/L	2
	NOEC	96	Fish	10mg/L	2
R32	ENDPOINT	TEST DURATION (HR)	SPECIES	VALUE	SOURCE
	LC50	96	Fish	1-405mg/L	2
	EC50	48	Crustacea	1-573mg/L	2
	EC50	96	Algae or other aquatic plants	1-888mg/L	2
	NOEC	96	Fish	10mg/L	2
R124	ENDPOINT	TEST DURATION (HR)	SPECIES	VALUE	SOURCE
	LC50	96	Fish	29.326mg/L	3
	EC50	96	Algae or other aquatic plants	90.149mg/L	3
R23	ENDPOINT	TEST DURATION (HR)	SPECIES	VALUE	SOURCE
	LC50	96	Fish	129.356mg/L	3
	EC50	96	Algae or other aquatic plants	154.54mg/L	2
R123	ENDPOINT	TEST DURATION (HR)	SPECIES	VALUE	SOURCE
	LC50	96	Fish	19.516mg/L	3
	EC50	48	Crustacea	17mg/L	5
	EC50	96	Algae or other aquatic plants	53.709mg/L	3
	NOEC	48	Crustacea	<2.24mg/L	2
R142b	ENDPOINT	TEST DURATION (HR)	SPECIES	VALUE	SOURCE
	LC50	96	Fish	15.691mg/L	3
	EC50	48	Crustacea	160mg/L	2
	EC50	96	Algae or other aquatic plants	45.071mg/L	3
HFC-236fa (FE36)	ENDPOINT	TEST DURATION (HR)	SPECIES	VALUE	SOURCE
	LC50	96	Fish	8.659mg/L	3
	EC50	48	Crustacea	299mg/L	2
	EC50	96	Algae or other aquatic plants	20.077mg/L	3
	NOEC	72	Algae or other aquatic plants	>=186mg/L	2
R143a	ENDPOINT	TEST DURATION (HR)	SPECIES	VALUE	SOURCE
	LC50	96	Fish	22.095mg/L	3
	EC50	96	Algae or other aquatic plants	70.891mg/L	3
R227ea	ENDPOINT	TEST DURATION (HR)	SPECIES	VALUE	SOURCE
	LC50	96	Fish	12.253mg/L	3
	EC50	48	Crustacea	>97.9mg/L	2
	EC50	96	Algae or other aquatic plants	29.866mg/L	3
	NOEC	96	Fish	10mg/L	2
R152a	ENDPOINT	TEST DURATION (HR)	SPECIES	VALUE	SOURCE
	LC50	96	Fish	48.415mg/L	3
	EC50	48	Crustacea	146.695mg/L	2

Continued...

A-Gas Used Refrigerants and Refrigerant Blends

	EC50	96	Algae or other aquatic plants	47.755mg/L	2
octafluoropropane	ENDPOINT	TEST DURATION (HR)	SPECIES	VALUE	SOURCE
	LC50	96	Fish	4.860mg/L	3
	EC50	96	Algae or other aquatic plants	9.528mg/L	3
A-Gas R11	ENDPOINT	TEST DURATION (HR)	SPECIES	VALUE	SOURCE
	LC50	96	Fish	18.749mg/L	3
	EC50	48	Crustacea	=130mg/L	1
chlorotrifluoromethane	ENDPOINT	TEST DURATION (HR)	SPECIES	VALUE	SOURCE
	LC50	96	Fish	41.110mg/L	3
	EC50	96	Algae or other aquatic plants	143.697mg/L	3
tetrafluoromethane	ENDPOINT	TEST DURATION (HR)	SPECIES	VALUE	SOURCE
	LC50	96	Fish	58.318mg/L	3
	EC50	96	Algae or other aquatic plants	227.696mg/L	3
R-113	ENDPOINT	TEST DURATION (HR)	SPECIES	VALUE	SOURCE
	LC50	96	Fish	5.093mg/L	3
	EC50	48	Crustacea	=71mg/L	1
1,2-dichlorotetrafluoroethane	ENDPOINT	TEST DURATION (HR)	SPECIES	VALUE	SOURCE
	LC50	96	Fish	7.823mg/L	3
	EC50	96	Algae or other aquatic plants	17.318mg/L	3
chloropentafluoroethane	ENDPOINT	TEST DURATION (HR)	SPECIES	VALUE	SOURCE
	LC50	96	Fish	11.905mg/L	3
	EC50	96	Algae or other aquatic plants	29.437mg/L	3
R116	ENDPOINT	TEST DURATION (HR)	SPECIES	VALUE	SOURCE
	LC50	96	Fish	18.215mg/L	3
	EC50	96	Algae or other aquatic plants	37.5mg/L	2
Propane	ENDPOINT	TEST DURATION (HR)	SPECIES	VALUE	SOURCE
	LC50	96	Fish	10.307mg/L	3
	EC50	96	Algae or other aquatic plants	7.71mg/L	2
n-Butane, 99.95%	ENDPOINT	TEST DURATION (HR)	SPECIES	VALUE	SOURCE
	LC50	96	Fish	5.862mg/L	3
	EC50	96	Algae or other aquatic plants	7.71mg/L	2
n-pentane	ENDPOINT	TEST DURATION (HR)	SPECIES	VALUE	SOURCE
	LC50	96	Fish	3.193mg/L	3
	EC50	48	Crustacea	2.7mg/L	2
	EC50	72	Algae or other aquatic plants	1.26mg/L	2
R600a (Isobutane)	ENDPOINT	TEST DURATION (HR)	SPECIES	VALUE	SOURCE
	LC50	96	Fish	6.706mg/L	3
	EC50	96	Algae or other aquatic plants	7.71mg/L	2
Isopentane	ENDPOINT	TEST DURATION (HR)	SPECIES	VALUE	SOURCE
	LC50	96	Fish	3.653mg/L	3

Continued...

A-Gas Used Refrigerants and Refrigerant Blends

	EC50	48	Crustacea	2.3mg/L	2
	EC50	72	Algae or other aquatic plants	1.26mg/L	2
	NOEC	72	Algae or other aquatic plants	7.51mg/L	2
benzene, C4-16-alkyl derivatives	ENDPOINT	TEST DURATION (HR)	SPECIES	VALUE	SOURCE
	EC50	48	Crustacea	0.009mg/L	1
polypropylene glycol monobutyl ether	ENDPOINT	TEST DURATION (HR)	SPECIES	VALUE	SOURCE
	LC50	96	Fish	104mg/L	2
	EC50	48	Crustacea	>100mg/L	2
	EC50	72	Algae or other aquatic plants	ca.112mg/L	2
	EL10	72	Algae or other aquatic plants	ca.72.3mg/L	2
	NOEC	48	Crustacea	1-mg/L	2
monobutyl ether ethoxylated, propoxylated	ENDPOINT	TEST DURATION (HR)	SPECIES	VALUE	SOURCE
	Not Available	Not Available	Not Available	Not Available	Not Available
naphthenic distillate, heavy, clay-treated	ENDPOINT	TEST DURATION (HR)	SPECIES	VALUE	SOURCE
	LC50	96	Fish	>100mg/L	2
	EC50	48	Crustacea	>10-mg/L	2
paraffinic distillate, heavy, solvent-refined (mild)	ENDPOINT	TEST DURATION (HR)	SPECIES	VALUE	SOURCE
	LC50	96	Fish	>100mg/L	2
	EC50	48	Crustacea	>10-mg/L	2
	EC50	96	Algae or other aquatic plants	>1000mg/L	1
	NOEC	504	Crustacea	>1mg/L	1
pentaerythritol ester of heptanoic, isononoic acids	ENDPOINT	TEST DURATION (HR)	SPECIES	VALUE	SOURCE
	Not Available	Not Available	Not Available	Not Available	Not Available
Legend:	Extracted from 1. IUCLID Toxicity Data 2. Europe ECHA Registered Substances - Ecotoxicological Information - Aquatic Toxicity 3. EPIWIN Suite V3.12 (QSAR) - Aquatic Toxicity Data (Estimated) 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				

On the basis of the available evidence concerning properties and predicted or observed environmental fate and behavior, the material may present a danger to the structure and/or functioning of the stratospheric ozone layer.

Very toxic to aquatic organisms, may cause long-term adverse effects in the aquatic environment.

Do NOT allow product to come in contact with surface waters or to intertidal areas below the mean high water mark. Do not contaminate water when cleaning equipment or disposing of equipment wash-waters.

Wastes resulting from use of the product must be disposed of on site or at approved waste sites.

Surfactants are in general toxic to aquatic organisms due to their surface-active properties. Historically, synthetic surfactants were often composed of branched alkyl chains resulting in poor biodegradability which led to concerns about their environmental effects. Today however, many of them, for example those used in large amounts, globally, as detergents, are linear and therefore readily biodegradable and considered to be of rather low risk to the environment. A linear structure of the hydrophobic chain facilitates the approach of microorganism while branching, in particular at the terminal position, inhibits biodegradation.

Persistence and degradability

Ingredient	Persistence: Water/Soil	Persistence: Air
F-22 HCFC22	LOW	LOW
R-134A	HIGH	HIGH
R125	HIGH	HIGH
R32	LOW	LOW
R124	HIGH	HIGH
R23	LOW	LOW
R123	HIGH	HIGH
R142b	HIGH	HIGH
HFC-236fa (FE36)	HIGH	HIGH
R143a	HIGH	HIGH

Continued...

A-Gas Used Refrigerants and Refrigerant Blends

R227ea	HIGH	HIGH
R152a	LOW	LOW
octafluoropropane	HIGH	HIGH
A-Gas R11	HIGH (Half-life = 720 days)	HIGH (Half-life = 54166.67 days)
chlorotrifluoromethane	HIGH	HIGH
tetrafluoromethane	LOW	LOW
R-113	HIGH (Half-life = 720 days)	HIGH (Half-life = 366666.67 days)
1,2-dichlorotetrafluoroethane	HIGH	HIGH
chloropentafluoroethane	HIGH	HIGH
R116	HIGH	HIGH
Propane	LOW	LOW
n-Butane, 99.95%	LOW	LOW
n-pentane	LOW	LOW
R600a (Isobutane)	HIGH	HIGH
Isopentane	HIGH	HIGH
polypropylene glycol monobutyl ether	HIGH	HIGH

Bioaccumulative potential

Ingredient	Bioaccumulation
F-22 HCFC22	LOW (LogKOW = 1.08)
R-134A	LOW (LogKOW = 1.68)
R125	LOW (LogKOW = 1.5472)
R32	LOW (LogKOW = 0.2)
R124	LOW (LogKOW = 1.8605)
R23	LOW (LogKOW = 0.64)
R123	LOW (LogKOW = 2.1738)
R142b	LOW (LogKOW = 2.0526)
HFC-236fa (FE36)	LOW (LogKOW = 2.6461)
R143a	LOW (LogKOW = 1.7393)
R227ea	LOW (LogKOW = 2.5133)
R152a	LOW (LogKOW = 0.75)
octafluoropropane	LOW (LogKOW = 3.1211)
A-Gas R11	LOW (BCF = 26)
chlorotrifluoromethane	LOW (LogKOW = 1.65)
tetrafluoromethane	LOW (LogKOW = 1.18)
R-113	LOW (LogKOW = 3.16)
1,2-dichlorotetrafluoroethane	LOW (LogKOW = 2.82)
chloropentafluoroethane	LOW (LogKOW = 2.4683)
R116	LOW (LogKOW = 2)
Propane	LOW (LogKOW = 2.36)
n-Butane, 99.95%	LOW (LogKOW = 2.89)
n-pentane	LOW (BCF = 2.35)
R600a (Isobutane)	LOW (BCF = 1.97)
Isopentane	LOW (LogKOW = 2.7234)
benzene, C4-16-alkyl derivatives	LOW (BCF = 35)
polypropylene glycol monobutyl ether	LOW (LogKOW = 1.4138)

Mobility in soil

Ingredient	Mobility
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A-Gas Used Refrigerants and Refrigerant Blends

F-22 HCFC22	LOW (KOC = 23.74)
R-134A	LOW (KOC = 96.63)
R125	LOW (KOC = 154.4)
R32	LOW (KOC = 23.74)
R124	LOW (KOC = 154.4)
R23	LOW (KOC = 35.04)
R123	LOW (KOC = 154.4)
R142b	LOW (KOC = 48.64)
HFC-236fa (FE36)	LOW (KOC = 393.3)
R143a	LOW (KOC = 48.64)
R227ea	LOW (KOC = 680.2)
R152a	LOW (KOC = 35.04)
octafluoropropane	LOW (KOC = 1038)
A-Gas R11	LOW (KOC = 48.64)
chlorotrifluoromethane	LOW (KOC = 48.64)
tetrafluoromethane	LOW (KOC = 48.64)
R-113	LOW (KOC = 224.7)
1,2-dichlorotetrafluoroethane	LOW (KOC = 224.7)
chloropentafluoroethane	LOW (KOC = 224.7)
R116	LOW (KOC = 224.7)
Propane	LOW (KOC = 23.74)
n-Butane, 99.95%	LOW (KOC = 43.79)
n-pentane	LOW (KOC = 80.77)
R600a (Isobutane)	LOW (KOC = 35.04)
Isopentane	LOW (KOC = 67.7)
polypropylene glycol monobutyl ether	LOW (KOC = 10)



SECTION 13 DISPOSAL CONSIDERATIONS

Waste treatment methods

Product / Packaging disposal	<ul style="list-style-type: none"> ▶ DO NOT allow wash water from cleaning or process equipment to enter drains. ▶ It may be necessary to collect all wash water for treatment before disposal. ▶ In all cases disposal to sewer may be subject to local laws and regulations and these should be considered first. ▶ Where in doubt contact the responsible authority. ▶ Evaporate residue at an approved site. ▶ Return empty containers to supplier. If containers are marked non-returnable establish means of disposal with manufacturer prior to purchase. ▶ Ensure damaged or non-returnable cylinders are gas-free before disposal.
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SECTION 14 TRANSPORT INFORMATION

Labels Required

	
Marine Pollutant	

Land transport (DOT)

UN number	1078
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A-Gas Used Refrigerants and Refrigerant Blends

UN proper shipping name	Refrigerant gases, n.o.s. (contains Fluorinated Hydrocarbons)	
Transport hazard class(es)	Class	2.2
	Subrisk	Not Applicable
Packing group	Not Applicable	
Environmental hazard	Environmentally hazardous	
Special precautions for user	Hazard Label	2.2
	Special provisions	T50

Air transport (ICAO-IATA / DGR)

UN number	1078	
UN proper shipping name	Refrigerant gas, n.o.s. * (contains Fluorinated Hydrocarbons)	
Transport hazard class(es)	ICAO/IATA Class	2.2
	ICAO / IATA Subrisk	Not Applicable
	ERG Code	2L
Packing group	Not Applicable	
Environmental hazard	Environmentally hazardous	
Special precautions for user	Special provisions	Not Applicable
	Cargo Only Packing Instructions	200
	Cargo Only Maximum Qty / Pack	150 kg
	Passenger and Cargo Packing Instructions	200
	Passenger and Cargo Maximum Qty / Pack	75 kg
	Passenger and Cargo Limited Quantity Packing Instructions	Forbidden
	Passenger and Cargo Limited Maximum Qty / Pack	Forbidden

Sea transport (IMDG-Code / GGVSee)

UN number	1078	
UN proper shipping name	REFRIGERANT GAS, N.O.S. (contains Fluorinated Hydrocarbons)	
Transport hazard class(es)	IMDG Class	2.2
	IMDG Subrisk	Not Applicable
Packing group	Not Applicable	
Environmental hazard	Marine Pollutant	
Special precautions for user	EMS Number	F-C, S-V
	Special provisions	274
	Limited Quantities	120 mL

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

Not Applicable

The above shipping information applies to all the Used Refrigerants and Refrigerant Blends except Used Refrigerant 11, Used Refrigerant 113, and Used Refrigerant 123. These 3 blends are not classified as dangerous in the meaning of transport regulations.[Manufacturer]

SECTION 15 REGULATORY INFORMATION

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

F-22 HCFC22(75-45-6) IS FOUND ON THE FOLLOWING REGULATORY LISTS

A-Gas Used Refrigerants and Refrigerant Blends

International Agency for Research on Cancer (IARC) - Agents Classified by the IARC Monographs	US - Washington Toxic air pollutants and their ASIL, SQER and de minimis emission values
International Air Transport Association (IATA) Dangerous Goods Regulations	US ACGIH Threshold Limit Values (TLV)
International Maritime Dangerous Goods Requirements (IMDG Code)	US ACGIH Threshold Limit Values (TLV) - Carcinogens
United Nations Recommendations on the Transport of Dangerous Goods Model Regulations	US CWA (Clean Water Act) - Toxic Pollutants
US - Alaska Limits for Air Contaminants	US Department of Transportation (DOT) List of Hazardous Substances and Reportable Quantities - Hazardous Substances Other Than Radionuclides
US - California Permissible Exposure Limits for Chemical Contaminants	US Department of Transportation (DOT), Hazardous Material Table
US - Hawaii Air Contaminant Limits	US DOE Temporary Emergency Exposure Limits (TEELs)
US - Massachusetts - Right To Know Listed Chemicals	US EPCRA Section 313 Chemical List
US - Michigan Exposure Limits for Air Contaminants	US NIOSH Recommended Exposure Limits (RELs)
US - Minnesota Permissible Exposure Limits (PELs)	US Postal Service (USPS) Hazardous Materials Table: Postal Service Mailability Guide
US - Pennsylvania - Hazardous Substance List	US Postal Service (USPS) Numerical Listing of Proper Shipping Names by Identification (ID) Number
US - Rhode Island Hazardous Substance List	US Spacecraft Maximum Allowable Concentrations (SMACs) for Airborne Contaminants
US - Tennessee Occupational Exposure Limits - Limits For Air Contaminants	US Toxic Substances Control Act (TSCA) - Chemical Substance Inventory
US - Vermont Permissible Exposure Limits Table Z-1-A Final Rule Limits for Air Contaminants	US TSCA Chemical Substance Inventory - Interim List of Active Substances
US - Vermont Permissible Exposure Limits Table Z-1-A Transitional Limits for Air Contaminants	US TSCA New Chemical Exposure Limits (NCEL)
US - Washington Permissible exposure limits of air contaminants	US TSCA Section 12(b) - List of Chemical Substances Subject to Export Notification Requirements
R-134A(811-97-2) IS FOUND ON THE FOLLOWING REGULATORY LISTS	
International Air Transport Association (IATA) Dangerous Goods Regulations	US DOE Temporary Emergency Exposure Limits (TEELs)
International Maritime Dangerous Goods Requirements (IMDG Code)	US Postal Service (USPS) Hazardous Materials Table: Postal Service Mailability Guide
United Nations Recommendations on the Transport of Dangerous Goods Model Regulations	US Postal Service (USPS) Numerical Listing of Proper Shipping Names by Identification (ID) Number
US - Washington Toxic air pollutants and their ASIL, SQER and de minimis emission values	US Toxic Substances Control Act (TSCA) - Chemical Substance Inventory
US AIHA Workplace Environmental Exposure Levels (WEELs)	US Toxicology Excellence for Risk Assessment (TERA) Workplace Environmental Exposure Levels (WEEL)
US Department of Transportation (DOT), Hazardous Material Table	US TSCA Chemical Substance Inventory - Interim List of Active Substances
R125(354-33-6) IS FOUND ON THE FOLLOWING REGULATORY LISTS	
International Air Transport Association (IATA) Dangerous Goods Regulations	US Postal Service (USPS) Hazardous Materials Table: Postal Service Mailability Guide
International Maritime Dangerous Goods Requirements (IMDG Code)	US Postal Service (USPS) Numerical Listing of Proper Shipping Names by Identification (ID) Number
United Nations Recommendations on the Transport of Dangerous Goods Model Regulations	US Toxic Substances Control Act (TSCA) - Chemical Substance Inventory
US AIHA Workplace Environmental Exposure Levels (WEELs)	US Toxicology Excellence for Risk Assessment (TERA) Workplace Environmental Exposure Levels (WEEL)
US Department of Transportation (DOT), Hazardous Material Table	US TSCA Chemical Substance Inventory - Interim List of Active Substances
R32(75-10-5) IS FOUND ON THE FOLLOWING REGULATORY LISTS	
International Air Transport Association (IATA) Dangerous Goods Regulations	US DOE Temporary Emergency Exposure Limits (TEELs)
International Maritime Dangerous Goods Requirements (IMDG Code)	US Postal Service (USPS) Hazardous Materials Table: Postal Service Mailability Guide
United Nations Recommendations on the Transport of Dangerous Goods Model Regulations	US Postal Service (USPS) Numerical Listing of Proper Shipping Names by Identification (ID) Number
US - Pennsylvania - Hazardous Substance List	US Toxic Substances Control Act (TSCA) - Chemical Substance Inventory
US AIHA Workplace Environmental Exposure Levels (WEELs)	US Toxicology Excellence for Risk Assessment (TERA) Workplace Environmental Exposure Levels (WEEL)
US CWA (Clean Water Act) - Toxic Pollutants	US TSCA Chemical Substance Inventory - Interim List of Active Substances
US Department of Transportation (DOT) List of Hazardous Substances and Reportable Quantities - Hazardous Substances Other Than Radionuclides	US TSCA New Chemical Exposure Limits (NCEL)
US Department of Transportation (DOT), Hazardous Material Table	
R124(2837-89-0) IS FOUND ON THE FOLLOWING REGULATORY LISTS	
International Air Transport Association (IATA) Dangerous Goods Regulations	US Postal Service (USPS) Hazardous Materials Table: Postal Service Mailability Guide
International Maritime Dangerous Goods Requirements (IMDG Code)	US Postal Service (USPS) Numerical Listing of Proper Shipping Names by Identification (ID) Number
United Nations Recommendations on the Transport of Dangerous Goods Model Regulations	US Toxic Substances Control Act (TSCA) - Chemical Substance Inventory
US AIHA Workplace Environmental Exposure Levels (WEELs)	US Toxicology Excellence for Risk Assessment (TERA) Workplace Environmental Exposure Levels (WEEL)
US Department of Transportation (DOT) List of Hazardous Substances and Reportable Quantities - Hazardous Substances Other Than Radionuclides	US TSCA Chemical Substance Inventory - Interim List of Active Substances
US Department of Transportation (DOT), Hazardous Material Table	US TSCA New Chemical Exposure Limits (NCEL)
US DOE Temporary Emergency Exposure Limits (TEELs)	US TSCA Section 12(b) - List of Chemical Substances Subject to Export Notification Requirements
US EPCRA Section 313 Chemical List	
R23(75-46-7) IS FOUND ON THE FOLLOWING REGULATORY LISTS	

A-Gas Used Refrigerants and Refrigerant Blends

International Air Transport Association (IATA) Dangerous Goods Regulations

International Maritime Dangerous Goods Requirements (IMDG Code)

United Nations Recommendations on the Transport of Dangerous Goods Model Regulations

US - Pennsylvania - Hazardous Substance List

US CWA (Clean Water Act) - Toxic Pollutants

US Department of Transportation (DOT) List of Hazardous Substances and Reportable Quantities - Hazardous Substances Other Than Radionuclides

US Department of Transportation (DOT), Hazardous Material Table

R123(306-83-2) IS FOUND ON THE FOLLOWING REGULATORY LISTS

US AIHA Workplace Environmental Exposure Levels (WEELs)

US Department of Transportation (DOT) List of Hazardous Substances and Reportable Quantities - Hazardous Substances Other Than Radionuclides

US DOE Temporary Emergency Exposure Limits (TEELs)

US EPCRA Section 313 Chemical List

US Toxic Substances Control Act (TSCA) - Chemical Substance Inventory

US DOE Temporary Emergency Exposure Limits (TEELs)

US Postal Service (USPS) Hazardous Materials Table: Postal Service Mailability Guide

US Postal Service (USPS) Numerical Listing of Proper Shipping Names by Identification (ID) Number

US Toxic Substances Control Act (TSCA) - Chemical Substance Inventory

US TSCA Chemical Substance Inventory - Interim List of Active Substances

US TSCA New Chemical Exposure Limits (NCEL)

US Toxicology Excellence for Risk Assessment (TERA) Workplace Environmental Exposure Levels (WEEL)

US TSCA Chemical Substance Inventory - Interim List of Active Substances

US TSCA New Chemical Exposure Limits (NCEL)

US TSCA Section 12(b) - List of Chemical Substances Subject to Export Notification Requirements

R142B(75-68-3) IS FOUND ON THE FOLLOWING REGULATORY LISTS

International Air Transport Association (IATA) Dangerous Goods Regulations

International Maritime Dangerous Goods Requirements (IMDG Code)

United Nations Recommendations on the Transport of Dangerous Goods Model Regulations

US - Massachusetts - Right To Know Listed Chemicals

US - Pennsylvania - Hazardous Substance List

US - Washington Toxic air pollutants and their ASIL, SQER and de minimis emission values

US AIHA Workplace Environmental Exposure Levels (WEELs)

US Department of Transportation (DOT) List of Hazardous Substances and Reportable Quantities - Hazardous Substances Other Than Radionuclides

US Department of Transportation (DOT), Hazardous Material Table

US DOE Temporary Emergency Exposure Limits (TEELs)

US EPCRA Section 313 Chemical List

US Postal Service (USPS) Hazardous Materials Table: Postal Service Mailability Guide

US Postal Service (USPS) Numerical Listing of Proper Shipping Names by Identification (ID) Number

US Toxic Substances Control Act (TSCA) - Chemical Substance Inventory

US Toxicology Excellence for Risk Assessment (TERA) Workplace Environmental Exposure Levels (WEEL)

US TSCA Chemical Substance Inventory - Interim List of Active Substances

US TSCA New Chemical Exposure Limits (NCEL)

US TSCA Section 12(b) - List of Chemical Substances Subject to Export Notification Requirements

HFC-236FA (FE36)(690-39-1) IS FOUND ON THE FOLLOWING REGULATORY LISTS

International Air Transport Association (IATA) Dangerous Goods Regulations

International Maritime Dangerous Goods Requirements (IMDG Code)

United Nations Recommendations on the Transport of Dangerous Goods Model Regulations

US AIHA Workplace Environmental Exposure Levels (WEELs)

US Department of Transportation (DOT), Hazardous Material Table

US Postal Service (USPS) Hazardous Materials Table: Postal Service Mailability Guide

US Postal Service (USPS) Numerical Listing of Proper Shipping Names by Identification (ID) Number

US Toxic Substances Control Act (TSCA) - Chemical Substance Inventory

US Toxicology Excellence for Risk Assessment (TERA) Workplace Environmental Exposure Levels (WEEL)

US TSCA Chemical Substance Inventory - Interim List of Active Substances

US TSCA Section 12(b) - List of Chemical Substances Subject to Export Notification Requirements

R143A(420-46-2) IS FOUND ON THE FOLLOWING REGULATORY LISTS

International Air Transport Association (IATA) Dangerous Goods Regulations

International Maritime Dangerous Goods Requirements (IMDG Code)

United Nations Recommendations on the Transport of Dangerous Goods Model Regulations

US AIHA Workplace Environmental Exposure Levels (WEELs)

US Department of Transportation (DOT), Hazardous Material Table

US Postal Service (USPS) Hazardous Materials Table: Postal Service Mailability Guide

US Postal Service (USPS) Numerical Listing of Proper Shipping Names by Identification (ID) Number

US Toxic Substances Control Act (TSCA) - Chemical Substance Inventory

US Toxicology Excellence for Risk Assessment (TERA) Workplace Environmental Exposure Levels (WEEL)

US TSCA Chemical Substance Inventory - Interim List of Active Substances

US TSCA Section 12(b) - List of Chemical Substances Subject to Export Notification Requirements

R227EA(431-89-0) IS FOUND ON THE FOLLOWING REGULATORY LISTS

International Air Transport Association (IATA) Dangerous Goods Regulations

International Maritime Dangerous Goods Requirements (IMDG Code)

United Nations Recommendations on the Transport of Dangerous Goods Model Regulations

US Department of Transportation (DOT), Hazardous Material Table

US Postal Service (USPS) Hazardous Materials Table: Postal Service Mailability Guide

US Postal Service (USPS) Numerical Listing of Proper Shipping Names by Identification (ID) Number

US Toxic Substances Control Act (TSCA) - Chemical Substance Inventory

US TSCA Chemical Substance Inventory - Interim List of Active Substances

R152A(75-37-6) IS FOUND ON THE FOLLOWING REGULATORY LISTS

A-Gas Used Refrigerants and Refrigerant Blends

International Air Transport Association (IATA) Dangerous Goods Regulations	US Department of Transportation (DOT), Hazardous Material Table
International Maritime Dangerous Goods Requirements (IMDG Code)	US DOE Temporary Emergency Exposure Limits (TEELs)
United Nations Recommendations on the Transport of Dangerous Goods Model Regulations	US Postal Service (USPS) Hazardous Materials Table: Postal Service Mailability Guide
US - Massachusetts - Right To Know Listed Chemicals	US Postal Service (USPS) Numerical Listing of Proper Shipping Names by Identification (ID) Number
US - Washington Toxic air pollutants and their ASIL, SQER and de minimis emission values	US Toxic Substances Control Act (TSCA) - Chemical Substance Inventory
US AIHA Workplace Environmental Exposure Levels (WEELs)	US Toxicology Excellence for Risk Assessment (TERA) Workplace Environmental Exposure Levels (WEEL)
US Department of Homeland Security (DHS) - Chemical Facility Anti-Terrorism Standards (CFATS) - Chemicals of Interest	US TSCA Chemical Substance Inventory - Interim List of Active Substances

OCFLUOROPROPANE(76-19-7) IS FOUND ON THE FOLLOWING REGULATORY LISTS

International Air Transport Association (IATA) Dangerous Goods Regulations	US Postal Service (USPS) Numerical Listing of Proper Shipping Names by Identification (ID) Number
International Maritime Dangerous Goods Requirements (IMDG Code)	US Spacecraft Maximum Allowable Concentrations (SMACs) for Airborne Contaminants
United Nations Recommendations on the Transport of Dangerous Goods Model Regulations	US Toxic Substances Control Act (TSCA) - Chemical Substance Inventory
US Department of Transportation (DOT), Hazardous Material Table	US TSCA Chemical Substance Inventory - Interim List of Active Substances
US Postal Service (USPS) Hazardous Materials Table: Postal Service Mailability Guide	

A-GAS R11(75-69-4) IS FOUND ON THE FOLLOWING REGULATORY LISTS

International Air Transport Association (IATA) Dangerous Goods Regulations	US ACGIH Threshold Limit Values (Spanish)
International Maritime Dangerous Goods Requirements (IMDG Code)	US ACGIH Threshold Limit Values (TLV)
United Nations Recommendations on the Transport of Dangerous Goods Model Regulations	US ACGIH Threshold Limit Values (TLV) - Carcinogens
US - Alaska Limits for Air Contaminants	US CWA (Clean Water Act) - Toxic Pollutants
US - California Permissible Exposure Limits for Chemical Contaminants	US Department of Transportation (DOT) List of Hazardous Substances and Reportable Quantities - Hazardous Substances Other Than Radionuclides
US - Hawaii Air Contaminant Limits	US Department of Transportation (DOT), Hazardous Material Table
US - Idaho - Limits for Air Contaminants	US DOE Temporary Emergency Exposure Limits (TEELs)
US - Massachusetts - Right To Know Listed Chemicals	US EPCRA Section 313 Chemical List
US - Michigan Exposure Limits for Air Contaminants	US List of Active Substances Exempt from the TSCA Inventory Notifications (Active-Inactive) Rule
US - Minnesota Permissible Exposure Limits (PELs)	US NIOSH Recommended Exposure Limits (RELs)
US - Oregon Permissible Exposure Limits (Z-1)	US NIOSH Recommended Exposure Limits (RELs) (Spanish)
US - Pennsylvania - Hazardous Substance List	US OSHA Permissible Exposure Levels (PELs) - Table Z1
US - Rhode Island Hazardous Substance List	US OSHA Permissible Exposure Limits - Annotated Table Z-1 (Spanish)
US - Tennessee Occupational Exposure Limits - Limits For Air Contaminants	US Postal Service (USPS) Hazardous Materials Table: Postal Service Mailability Guide
US - Vermont Permissible Exposure Limits Table Z-1-A Final Rule Limits for Air Contaminants	US Postal Service (USPS) Numerical Listing of Proper Shipping Names by Identification (ID) Number
US - Vermont Permissible Exposure Limits Table Z-1-A Transitional Limits for Air Contaminants	US Spacecraft Maximum Allowable Concentrations (SMACs) for Airborne Contaminants
US - Washington Permissible exposure limits of air contaminants	US Toxic Substances Control Act (TSCA) - Chemical Substance Inventory
US - Wyoming Toxic and Hazardous Substances Table Z1 Limits for Air Contaminants	US TSCA New Chemical Exposure Limits (NCEL)

CHLOROTRIFLUOROMETHANE(75-72-9) IS FOUND ON THE FOLLOWING REGULATORY LISTS

International Air Transport Association (IATA) Dangerous Goods Regulations	US DOE Temporary Emergency Exposure Limits (TEELs)
International Maritime Dangerous Goods Requirements (IMDG Code)	US EPCRA Section 313 Chemical List
United Nations Recommendations on the Transport of Dangerous Goods Model Regulations	US List of Active Substances Exempt from the TSCA Inventory Notifications (Active-Inactive) Rule
US - Pennsylvania - Hazardous Substance List	US Postal Service (USPS) Hazardous Materials Table: Postal Service Mailability Guide
US CWA (Clean Water Act) - Toxic Pollutants	US Postal Service (USPS) Numerical Listing of Proper Shipping Names by Identification (ID) Number
US Department of Transportation (DOT) List of Hazardous Substances and Reportable Quantities - Hazardous Substances Other Than Radionuclides	US Toxic Substances Control Act (TSCA) - Chemical Substance Inventory
US Department of Transportation (DOT), Hazardous Material Table	US TSCA New Chemical Exposure Limits (NCEL)

TETRAFLUOROMETHANE(75-73-0) IS FOUND ON THE FOLLOWING REGULATORY LISTS

International Air Transport Association (IATA) Dangerous Goods Regulations	US DOE Temporary Emergency Exposure Limits (TEELs)
International Maritime Dangerous Goods Requirements (IMDG Code)	US Postal Service (USPS) Hazardous Materials Table: Postal Service Mailability Guide
United Nations Recommendations on the Transport of Dangerous Goods Model Regulations	US Postal Service (USPS) Numerical Listing of Proper Shipping Names by Identification (ID) Number
US - Pennsylvania - Hazardous Substance List	US Toxic Substances Control Act (TSCA) - Chemical Substance Inventory
US CWA (Clean Water Act) - Toxic Pollutants	US TSCA Chemical Substance Inventory - Interim List of Active Substances
US Department of Transportation (DOT), Hazardous Material Table	

R-113(76-13-1) IS FOUND ON THE FOLLOWING REGULATORY LISTS

A-Gas Used Refrigerants and Refrigerant Blends

GESAMP/EHS Composite List - GESAMP Hazard Profiles	US - Wyoming Toxic and Hazardous Substances Table Z1 Limits for Air Contaminants
IMO IBC Code Chapter 17: Summary of minimum requirements	US ACGIH Threshold Limit Values (Spanish)
IMO MARPOL (Annex II) - List of Noxious Liquid Substances Carried in Bulk	US ACGIH Threshold Limit Values (TLV)
International Air Transport Association (IATA) Dangerous Goods Regulations	US ACGIH Threshold Limit Values (TLV) - Carcinogens
International Maritime Dangerous Goods Requirements (IMDG Code)	US Coast Guard, Department of Homeland Security Part 153: Ships Carrying Bulk Liquid, Liquefied gas or compressed gas hazardous materials. Table 1 to Part 153 --Summary of Minimum Requirements
United Nations Recommendations on the Transport of Dangerous Goods Model Regulations	US Department of Transportation (DOT) List of Hazardous Substances and Reportable Quantities - Hazardous Substances Other Than Radionuclides
US - Alaska Limits for Air Contaminants	US Department of Transportation (DOT), Hazardous Material Table
US - California Permissible Exposure Limits for Chemical Contaminants	US DOE Temporary Emergency Exposure Limits (TEELs)
US - Hawaii Air Contaminant Limits	US EPCRA Section 313 Chemical List
US - Idaho - Limits for Air Contaminants	US NIOSH Recommended Exposure Limits (RELs)
US - Massachusetts - Right To Know Listed Chemicals	US NIOSH Recommended Exposure Limits (RELs) (Spanish)
US - Michigan Exposure Limits for Air Contaminants	US OSHA Permissible Exposure Levels (PELs) - Table Z1
US - Minnesota Permissible Exposure Limits (PELs)	US OSHA Permissible Exposure Limits - Annotated Table Z-1 (Spanish)
US - Oregon Permissible Exposure Limits (Z-1)	US Postal Service (USPS) Hazardous Materials Table: Postal Service Mailability Guide
US - Pennsylvania - Hazardous Substance List	US Postal Service (USPS) Numerical Listing of Proper Shipping Names by Identification (ID) Number
US - Rhode Island Hazardous Substance List	US Spacecraft Maximum Allowable Concentrations (SMACs) for Airborne Contaminants
US - Tennessee Occupational Exposure Limits - Limits For Air Contaminants	US Toxic Substances Control Act (TSCA) - Chemical Substance Inventory
US - Vermont Permissible Exposure Limits Table Z-1-A Final Rule Limits for Air Contaminants	US TSCA Chemical Substance Inventory - Interim List of Active Substances
US - Vermont Permissible Exposure Limits Table Z-1-A Transitional Limits for Air Contaminants	US TSCA New Chemical Exposure Limits (NCEL)
US - Washington Permissible exposure limits of air contaminants	

1,2-DICHLOROTETRAFLUROETHANE(76-14-2) IS FOUND ON THE FOLLOWING REGULATORY LISTS

International Air Transport Association (IATA) Dangerous Goods Regulations	US - Wyoming Toxic and Hazardous Substances Table Z1 Limits for Air Contaminants
International Maritime Dangerous Goods Requirements (IMDG Code)	US ACGIH Threshold Limit Values (Spanish)
United Nations Recommendations on the Transport of Dangerous Goods Model Regulations	US ACGIH Threshold Limit Values (TLV)
US - Alaska Limits for Air Contaminants	US ACGIH Threshold Limit Values (TLV) - Carcinogens
US - California Permissible Exposure Limits for Chemical Contaminants	US Department of Transportation (DOT) List of Hazardous Substances and Reportable Quantities - Hazardous Substances Other Than Radionuclides
US - Hawaii Air Contaminant Limits	US Department of Transportation (DOT), Hazardous Material Table
US - Idaho - Limits for Air Contaminants	US DOE Temporary Emergency Exposure Limits (TEELs)
US - Massachusetts - Right To Know Listed Chemicals	US EPCRA Section 313 Chemical List
US - Michigan Exposure Limits for Air Contaminants	US NIOSH Recommended Exposure Limits (RELs)
US - Minnesota Permissible Exposure Limits (PELs)	US NIOSH Recommended Exposure Limits (RELs) (Spanish)
US - Oregon Permissible Exposure Limits (Z-1)	US OSHA Permissible Exposure Levels (PELs) - Table Z1
US - Pennsylvania - Hazardous Substance List	US OSHA Permissible Exposure Limits - Annotated Table Z-1 (Spanish)
US - Rhode Island Hazardous Substance List	US Postal Service (USPS) Hazardous Materials Table: Postal Service Mailability Guide
US - Tennessee Occupational Exposure Limits - Limits For Air Contaminants	US Postal Service (USPS) Numerical Listing of Proper Shipping Names by Identification (ID) Number
US - Vermont Permissible Exposure Limits Table Z-1-A Final Rule Limits for Air Contaminants	US Toxic Substances Control Act (TSCA) - Chemical Substance Inventory
US - Vermont Permissible Exposure Limits Table Z-1-A Transitional Limits for Air Contaminants	US TSCA Chemical Substance Inventory - Interim List of Active Substances
US - Washington Permissible exposure limits of air contaminants	US TSCA New Chemical Exposure Limits (NCEL)

CHLOROPENTAFLUROETHANE(76-15-3) IS FOUND ON THE FOLLOWING REGULATORY LISTS

International Air Transport Association (IATA) Dangerous Goods Regulations	US - Vermont Permissible Exposure Limits Table Z-1-A Transitional Limits for Air Contaminants
International Maritime Dangerous Goods Requirements (IMDG Code)	US - Washington Permissible exposure limits of air contaminants
United Nations Recommendations on the Transport of Dangerous Goods Model Regulations	US ACGIH Threshold Limit Values (TLV)
US - Alaska Limits for Air Contaminants	US Department of Transportation (DOT) List of Hazardous Substances and Reportable Quantities - Hazardous Substances Other Than Radionuclides
US - California Permissible Exposure Limits for Chemical Contaminants	US Department of Transportation (DOT), Hazardous Material Table
US - Hawaii Air Contaminant Limits	US DOE Temporary Emergency Exposure Limits (TEELs)
US - Massachusetts - Right To Know Listed Chemicals	US EPCRA Section 313 Chemical List
US - Michigan Exposure Limits for Air Contaminants	US List of Active Substances Exempt from the TSCA Inventory Notifications (Active-Inactive) Rule
US - Minnesota Permissible Exposure Limits (PELs)	US NIOSH Recommended Exposure Limits (RELs)
US - Pennsylvania - Hazardous Substance List	US Postal Service (USPS) Hazardous Materials Table: Postal Service Mailability Guide
US - Rhode Island Hazardous Substance List	US Postal Service (USPS) Numerical Listing of Proper Shipping Names by Identification (ID) Number
US - Tennessee Occupational Exposure Limits - Limits For Air Contaminants	US Toxic Substances Control Act (TSCA) - Chemical Substance Inventory
US - Vermont Permissible Exposure Limits Table Z-1-A Final Rule Limits for Air Contaminants	US TSCA New Chemical Exposure Limits (NCEL)

A-Gas Used Refrigerants and Refrigerant Blends

R116(76-16-4) IS FOUND ON THE FOLLOWING REGULATORY LISTS

International Air Transport Association (IATA) Dangerous Goods Regulations
 International Maritime Dangerous Goods Requirements (IMDG Code)
 United Nations Recommendations on the Transport of Dangerous Goods Model Regulations
 US Department of Transportation (DOT), Hazardous Material Table
 US DOE Temporary Emergency Exposure Limits (TEELs)

US Postal Service (USPS) Hazardous Materials Table: Postal Service Mailability Guide
 US Postal Service (USPS) Numerical Listing of Proper Shipping Names by Identification (ID) Number
 US Toxic Substances Control Act (TSCA) - Chemical Substance Inventory
 US TSCA Chemical Substance Inventory - Interim List of Active Substances

PROPANE(74-98-6) IS FOUND ON THE FOLLOWING REGULATORY LISTS

International Air Transport Association (IATA) Dangerous Goods Regulations
 International Maritime Dangerous Goods Requirements (IMDG Code)
 United Nations Recommendations on the Transport of Dangerous Goods Model Regulations
 US - Alaska Limits for Air Contaminants
 US - California Permissible Exposure Limits for Chemical Contaminants
 US - Hawaii Air Contaminant Limits
 US - Idaho - Limits for Air Contaminants
 US - Massachusetts - Right To Know Listed Chemicals
 US - Michigan Exposure Limits for Air Contaminants
 US - Minnesota Permissible Exposure Limits (PELs)
 US - Oregon Permissible Exposure Limits (Z-1)
 US - Pennsylvania - Hazardous Substance List
 US - Rhode Island Hazardous Substance List
 US - Tennessee Occupational Exposure Limits - Limits For Air Contaminants
 US - Vermont Permissible Exposure Limits Table Z-1-A Final Rule Limits for Air Contaminants
 US - Vermont Permissible Exposure Limits Table Z-1-A Transitional Limits for Air Contaminants

US - Washington Permissible exposure limits of air contaminants
 US - Wyoming Toxic and Hazardous Substances Table Z1 Limits for Air Contaminants
 US ACGIH Threshold Limit Values (Spanish)
 US ACGIH Threshold Limit Values (TLV)
 US Department of Homeland Security (DHS) - Chemical Facility Anti-Terrorism Standards (CFATS) - Chemicals of Interest
 US Department of Transportation (DOT), Hazardous Material Table
 US DOE Temporary Emergency Exposure Limits (TEELs)
 US DOT Coast Guard Bulk Hazardous Materials - List of Flammable and Combustible Bulk Liquid Cargoes
 US NIOSH Recommended Exposure Limits (RELs)
 US NIOSH Recommended Exposure Limits (RELs) (Spanish)
 US OSHA Permissible Exposure Levels (PELs) - Table Z1
 US OSHA Permissible Exposure Limits - Annotated Table Z-1 (Spanish)
 US Postal Service (USPS) Hazardous Materials Table: Postal Service Mailability Guide
 US Spacecraft Maximum Allowable Concentrations (SMACs) for Airborne Contaminants
 US Toxic Substances Control Act (TSCA) - Chemical Substance Inventory
 US TSCA Chemical Substance Inventory - Interim List of Active Substances

N-BUTANE, 99.95%(106-97-8.) IS FOUND ON THE FOLLOWING REGULATORY LISTS

International Air Transport Association (IATA) Dangerous Goods Regulations
 International Maritime Dangerous Goods Requirements (IMDG Code)
 United Nations Recommendations on the Transport of Dangerous Goods Model Regulations
 US - Alaska Limits for Air Contaminants
 US - California Permissible Exposure Limits for Chemical Contaminants
 US - Hawaii Air Contaminant Limits
 US - Massachusetts - Right To Know Listed Chemicals
 US - Michigan Exposure Limits for Air Contaminants
 US - Minnesota Permissible Exposure Limits (PELs)
 US - Oregon Permissible Exposure Limits (Z-1)
 US - Pennsylvania - Hazardous Substance List
 US - Rhode Island Hazardous Substance List
 US - Tennessee Occupational Exposure Limits - Limits For Air Contaminants
 US - Vermont Permissible Exposure Limits Table Z-1-A Final Rule Limits for Air Contaminants

US - Vermont Permissible Exposure Limits Table Z-1-A Transitional Limits for Air Contaminants
 US - Washington Permissible exposure limits of air contaminants
 US ACGIH Threshold Limit Values (TLV)
 US Chemical Footprint Project - Chemicals of High Concern List
 US Department of Homeland Security (DHS) - Chemical Facility Anti-Terrorism Standards (CFATS) - Chemicals of Interest
 US Department of Transportation (DOT), Hazardous Material Table
 US DOE Temporary Emergency Exposure Limits (TEELs)
 US DOT Coast Guard Bulk Hazardous Materials - List of Flammable and Combustible Bulk Liquid Cargoes
 US NIOSH Recommended Exposure Limits (RELs)
 US Postal Service (USPS) Hazardous Materials Table: Postal Service Mailability Guide
 US Postal Service (USPS) Numerical Listing of Proper Shipping Names by Identification (ID) Number
 US Spacecraft Maximum Allowable Concentrations (SMACs) for Airborne Contaminants
 US Toxic Substances Control Act (TSCA) - Chemical Substance Inventory
 US TSCA Chemical Substance Inventory - Interim List of Active Substances

N-PENTANE(109-66-0) IS FOUND ON THE FOLLOWING REGULATORY LISTS

A-Gas Used Refrigerants and Refrigerant Blends

GESAMP/EHS Composite List - GESAMP Hazard Profiles

IMO IBC Code Chapter 17: Summary of minimum requirements

IMO MARPOL (Annex II) - List of Noxious Liquid Substances Carried in Bulk

IMO Provisional Categorization of Liquid Substances - List 2: Pollutant only mixtures containing at least 99% by weight of components already assessed by IMO

International Air Transport Association (IATA) Dangerous Goods Regulations

International Maritime Dangerous Goods Requirements (IMDG Code)

United Nations Recommendations on the Transport of Dangerous Goods Model Regulations

US - Alaska Limits for Air Contaminants

US - California Permissible Exposure Limits for Chemical Contaminants

US - Hawaii Air Contaminant Limits

US - Idaho - Limits for Air Contaminants

US - Idaho Toxic Air Pollutants Non- Carcinogenic Increments - Occupational Exposure Limits

US - Massachusetts - Right To Know Listed Chemicals

US - Michigan Exposure Limits for Air Contaminants

US - Minnesota Permissible Exposure Limits (PELs)

US - Oregon Permissible Exposure Limits (Z-1)

US - Pennsylvania - Hazardous Substance List

US - Rhode Island Hazardous Substance List

US - Tennessee Occupational Exposure Limits - Limits For Air Contaminants

US - Vermont Permissible Exposure Limits Table Z-1-A Final Rule Limits for Air Contaminants

US - Vermont Permissible Exposure Limits Table Z-1-A Transitional Limits for Air Contaminants

US - Washington Permissible exposure limits of air contaminants

US - Wyoming Toxic and Hazardous Substances Table Z1 Limits for Air Contaminants

US ACGIH Threshold Limit Values (Spanish)

US ACGIH Threshold Limit Values (TLV)

US Coast Guard, Department of Homeland Security Part 153: Ships Carrying Bulk Liquid, Liquefied gas or compressed gas hazardous materials. Table 1 to Part 153 --Summary of Minimum Requirements

US Department of Homeland Security (DHS) - Chemical Facility Anti-Terrorism Standards (CFATS) - Chemicals of Interest

US Department of Transportation (DOT), Hazardous Material Table

US DOE Temporary Emergency Exposure Limits (TEELs)

US DOT Coast Guard Bulk Hazardous Materials - List of Flammable and Combustible Bulk Liquid Cargoes

US NIOSH Recommended Exposure Limits (RELs)

US NIOSH Recommended Exposure Limits (RELs) (Spanish)

US OSHA Permissible Exposure Levels (PELs) - Table Z1

US OSHA Permissible Exposure Limits - Annotated Table Z-1 (Spanish)

US Postal Service (USPS) Hazardous Materials Table: Postal Service Mailability Guide

US Postal Service (USPS) Numerical Listing of Proper Shipping Names by Identification (ID) Number

US Spacecraft Maximum Allowable Concentrations (SMACs) for Airborne Contaminants

US Toxic Substances Control Act (TSCA) - Chemical Substance Inventory

US TSCA Chemical Substance Inventory - Interim List of Active Substances

US TSCA Section 4/12 (b) - Sunset Dates/Status

R600A (ISOBUTANE)(75-28-5.) IS FOUND ON THE FOLLOWING REGULATORY LISTS

International Air Transport Association (IATA) Dangerous Goods Regulations

International Maritime Dangerous Goods Requirements (IMDG Code)

United Nations Recommendations on the Transport of Dangerous Goods Model Regulations

US - Alaska Limits for Air Contaminants

US - Massachusetts - Right To Know Listed Chemicals

US - Minnesota Permissible Exposure Limits (PELs)

US - Pennsylvania - Hazardous Substance List

US - Vermont Permissible Exposure Limits Table Z-1-A Final Rule Limits for Air Contaminants

US - Vermont Permissible Exposure Limits Table Z-1-A Transitional Limits for Air Contaminants

US ACGIH Threshold Limit Values (TLV)

US Chemical Footprint Project - Chemicals of High Concern List

US Department of Homeland Security (DHS) - Chemical Facility Anti-Terrorism Standards (CFATS) - Chemicals of Interest

US Department of Transportation (DOT), Hazardous Material Table

US DOE Temporary Emergency Exposure Limits (TEELs)

US DOT Coast Guard Bulk Hazardous Materials - List of Flammable and Combustible Bulk Liquid Cargoes

US NIOSH Recommended Exposure Limits (RELs)

US Postal Service (USPS) Hazardous Materials Table: Postal Service Mailability Guide

US Postal Service (USPS) Numerical Listing of Proper Shipping Names by Identification (ID) Number

US Spacecraft Maximum Allowable Concentrations (SMACs) for Airborne Contaminants

US Toxic Substances Control Act (TSCA) - Chemical Substance Inventory

US TSCA Chemical Substance Inventory - Interim List of Active Substances

ISOPENTANE(78-78-4) IS FOUND ON THE FOLLOWING REGULATORY LISTS

IMO IBC Code Chapter 17: Summary of minimum requirements

IMO MARPOL (Annex II) - List of Noxious Liquid Substances Carried in Bulk

IMO Provisional Categorization of Liquid Substances - List 2: Pollutant only mixtures containing at least 99% by weight of components already assessed by IMO

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International Maritime Dangerous Goods Requirements (IMDG Code)

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US - Idaho - Limits for Air Contaminants

US - Massachusetts - Right To Know Listed Chemicals

US - Minnesota Permissible Exposure Limits (PELs)

US - Pennsylvania - Hazardous Substance List

US - Rhode Island Hazardous Substance List

US - Vermont Permissible Exposure Limits Table Z-1-A Final Rule Limits for Air Contaminants

US - Vermont Permissible Exposure Limits Table Z-1-A Transitional Limits for Air Contaminants

US ACGIH Threshold Limit Values (TLV)

US Coast Guard, Department of Homeland Security Part 153: Ships Carrying Bulk Liquid, Liquefied gas or compressed gas hazardous materials. Table 1 to Part 153 --Summary of Minimum Requirements

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US Postal Service (USPS) Numerical Listing of Proper Shipping Names by Identification (ID) Number

US Spacecraft Maximum Allowable Concentrations (SMACs) for Airborne Contaminants

US Toxic Substances Control Act (TSCA) - Chemical Substance Inventory

US TSCA Chemical Substance Inventory - Interim List of Active Substances

BENZENE, C4-16-ALKYL DERIVATIVES(68648-86-2) IS FOUND ON THE FOLLOWING REGULATORY LISTS

Continued...

A-Gas Used Refrigerants and Refrigerant Blends

International Air Transport Association (IATA) Dangerous Goods Regulations

International Maritime Dangerous Goods Requirements (IMDG Code)

United Nations Recommendations on the Transport of Dangerous Goods Model Regulations

US Department of Transportation (DOT), Hazardous Material Table

US List of Active Substances Exempt from the TSCA Inventory Notifications (Active-Inactive) Rule

US Postal Service (USPS) Hazardous Materials Table: Postal Service Mailability Guide

US Postal Service (USPS) Numerical Listing of Proper Shipping Names by Identification (ID) Number

US Toxic Substances Control Act (TSCA) - Chemical Substance Inventory

POLYPROPYLENE GLYCOL MONOBUTYL ETHER(9003-13-8) IS FOUND ON THE FOLLOWING REGULATORY LISTS

US - California OEHHA/ARB - Acute Reference Exposure Levels and Target Organs (RELS)

US - California OEHHA/ARB - Chronic Reference Exposure Levels and Target Organs (CRELs)

US - Pennsylvania - Hazardous Substance List

US Chemical Footprint Project - Chemicals of High Concern List

US Clean Air Act - Hazardous Air Pollutants

US DOE Temporary Emergency Exposure Limits (TEELs)

US EPCRA Section 313 Chemical List

US Toxic Substances Control Act (TSCA) - Chemical Substance Inventory

US TSCA Chemical Substance Inventory - Interim List of Active Substances

MONOBUTYL ETHER ETHOXYLATED, PROPOXYLATED(9038-95-3) IS FOUND ON THE FOLLOWING REGULATORY LISTS

US - Idaho Toxic Air Pollutants Non- Carcinogenic Increments - Occupational Exposure Limits

US - Vermont Permissible Exposure Limits Table Z-1-A Transitional Limits for Air Contaminants

US Toxic Substances Control Act (TSCA) - Chemical Substance Inventory

US TSCA Chemical Substance Inventory - Interim List of Active Substances

NAPHTHENIC DISTILLATE, HEAVY, CLAY-TREATED(64742-44-5) IS FOUND ON THE FOLLOWING REGULATORY LISTS

US Chemical Footprint Project - Chemicals of High Concern List

US List of Active Substances Exempt from the TSCA Inventory Notifications (Active-Inactive) Rule

US Postal Service (USPS) Numerical Listing of Proper Shipping Names by Identification (ID) Number

US Toxic Substances Control Act (TSCA) - Chemical Substance Inventory

PARAFFINIC DISTILLATE, HEAVY, SOLVENT-REFINED (MILD)(64741-88-4) IS FOUND ON THE FOLLOWING REGULATORY LISTS

US Chemical Footprint Project - Chemicals of High Concern List

US Postal Service (USPS) Numerical Listing of Proper Shipping Names by Identification (ID) Number

US Toxic Substances Control Act (TSCA) - Chemical Substance Inventory

US TSCA Chemical Substance Inventory - Interim List of Active Substances

PENTAERYTHRITOL ESTER OF HEPTANOIC, ISONONANOIC ACIDS(118685-22-6) IS FOUND ON THE FOLLOWING REGULATORY LISTS

US Toxic Substances Control Act (TSCA) - Chemical Substance Inventory

US TSCA Chemical Substance Inventory - Interim List of Active Substances

Federal Regulations

Superfund Amendments and Reauthorization Act of 1986 (SARA)

SECTION 311/312 HAZARD CATEGORIES

Flammable (Gases, Aerosols, Liquids, or Solids)	No
Gas under pressure	Yes
Explosive	No
Self-heating	No
Pyrophoric (Liquid or Solid)	No
Pyrophoric Gas	No
Corrosive to metal	No
Oxidizer (Liquid, Solid or Gas)	No
Organic Peroxide	No
Self-reactive	No
In contact with water emits flammable gas	No
Combustible Dust	No
Carcinogenicity	Yes
Acute toxicity (any route of exposure)	Yes
Reproductive toxicity	Yes
Skin Corrosion or Irritation	No
Respiratory or Skin Sensitization	No
Serious eye damage or eye irritation	Yes
Specific target organ toxicity (single or repeated exposure)	Yes
Aspiration Hazard	No
Germ cell mutagenicity	No
Simple Asphyxiant	Yes

Continued...

A-Gas Used Refrigerants and Refrigerant Blends

Hazards Not Otherwise Classified

No

US. EPA CERCLA HAZARDOUS SUBSTANCES AND REPORTABLE QUANTITIES (40 CFR 302.4)

Name	Reportable Quantity in Pounds (lb)	Reportable Quantity in kg
Methane, trichlorofluoro-	5000	2270

State Regulations

US. CALIFORNIA PROPOSITION 65

None Reported

National Inventory Status

National Inventory	Status
Australia - AICS	Yes
Canada - DSL	Yes
Canada - NDSL	No (R123; chloropentafluoroethane; Isopentane; paraffinic distillate, heavy, solvent-refined (mild); R124; R-113; R32; R125; n-Butane, 99.95%; polypropylene glycol monobutyl ether; R227ea; octafluoropropane; tetrafluoromethane; R-134A; A-Gas R11; R23; n-pentane; R142b; R116; benzene, C4-16-alkyl derivatives; Propane; F-22 HCFC22; 1,2-dichlorotetrafluoroethane; R600a (Isobutane); monobutyl ether ethoxylated, propoxylated; R143a; chlorotrifluoromethane; naphthenic distillate, heavy, clay-treated; R152a; HFC-236fa (FE36))
China - IECSC	No (R32)
Europe - EINEC / ELINCS / NLP	No (pentaerythritol ester of heptanoic, isononanoic acids; monobutyl ether ethoxylated, propoxylated)
Japan - ENCS	No (benzene, C4-16-alkyl derivatives; monobutyl ether ethoxylated, propoxylated; naphthenic distillate, heavy, clay-treated)
Korea - KECI	Yes
New Zealand - NZIoC	Yes
Philippines - PICCS	No (HFC-236fa (FE36))
USA - TSCA	Yes
Taiwan - TCSI	Yes
Mexico - INSQ	No (polypropylene glycol monobutyl ether; benzene, C4-16-alkyl derivatives; pentaerythritol ester of heptanoic, isononanoic acids; naphthenic distillate, heavy, clay-treated)
Vietnam - NCI	No (R123; R124; R-113; octafluoropropane; R116; 1,2-dichlorotetrafluoroethane; chlorotrifluoromethane; naphthenic distillate, heavy, clay-treated; HFC-236fa (FE36))
Russia - ARIPS	No (paraffinic distillate, heavy, solvent-refined (mild); benzene, C4-16-alkyl derivatives; pentaerythritol ester of heptanoic, isononanoic acids; naphthenic distillate, heavy, clay-treated; HFC-236fa (FE36))
Thailand - TECl	No (chloropentafluoroethane; paraffinic distillate, heavy, solvent-refined (mild); R-113; polypropylene glycol monobutyl ether; tetrafluoromethane; A-Gas R11; R142b; benzene, C4-16-alkyl derivatives; pentaerythritol ester of heptanoic, isononanoic acids; 1,2-dichlorotetrafluoroethane; monobutyl ether ethoxylated, propoxylated; chlorotrifluoromethane; naphthenic distillate, heavy, clay-treated; HFC-236fa (FE36))
Legend:	<i>Yes = All CAS declared ingredients are on the inventory No = Not determined or one or more ingredients are not on the inventory and are not exempt from listing(see specific ingredients in brackets)</i>

SECTION 16 OTHER INFORMATION

Revision Date	08/08/2016
Initial Date	Not Available

SDS Version Summary

Version	Issue Date	Sections Updated
2.1.1.1	08/08/2016	Acute Health (eye), Acute Health (inhaled), Acute Health (skin), Acute Health (swallowed), Chronic Health, Classification, Environmental, Exposure Standard, Fire Fighter (fire/explosion hazard), Storage (storage incompatibility), Synonyms, Toxicity and Irritation (Other), Use

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.

Continued...

A-Gas Used Refrigerants and Refrigerant Blends

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

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

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TEL (+61 3) 9572 4700.