

**Opteon™ YF**

Version 2.2

Revision Date 09/10/2015

Ref. 13000043292

This SDS adheres to the standards and regulatory requirements of the United States and may not meet the regulatory requirements in other countries.

**SECTION 1. PRODUCT AND COMPANY IDENTIFICATION**

Product name	:	Opteon™ YF
Tradename/Synonym	:	2,3,3,3-Tetrafluoropropene HFO-1234yf R-1234yf R-1234yf (2,3,3,3-tetrafluoroprop-1-ene)
Product Use	:	Heat transfer fluids - Refrigerants, coolants, Formulation of preparations, For professional and industrial installation and use only.
Restrictions on use	:	Do not use product for anything outside of the above specified uses
Manufacturer/Supplier	:	The Chemours Company FC, LLC 1007 Market Street Wilmington, DE 19899 United States of America
Product Information	:	1-844-773-CHEM (outside the U.S. 1-302-773-1000)
Medical Emergency	:	1-866-595-1473 (outside the U.S. 1-302-773-2000)
Transport Emergency	:	CHEMTREC: +1-800-424-9300 (outside the U.S. +1-703-527-3887)

**SECTION 2. HAZARDS IDENTIFICATION**

<b>Product hazard category</b>	
Flammable gases	Category 1
Gases under pressure	Liquefied gas



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**Label content**

Pictogram :



Signal word :

Danger

Hazardous warnings :

Extremely flammable gas.  
Contains gas under pressure; may explode if heated.

Hazardous prevention measures :

Keep away from heat/sparks/open flames/hot surfaces. No smoking.  
Leaking gas fire: Do not extinguish, unless leak can be stopped safely.  
Eliminate all ignition sources if safe to do so.  
Protect from sunlight. Store in a well-ventilated place.

**Other hazards**

Misuse or intentional inhalation abuse may cause death without warning symptoms, due to cardiac effects., Vapours are heavier than air and can cause suffocation by reducing oxygen available for breathing., Rapid evaporation of the liquid may cause frostbite.

**SECTION 3. COMPOSITION/INFORMATION ON INGREDIENTS**

Component	CAS-No.	Concentration
2,3,3,3-Tetrafluoropropene	754-12-1	>=99.5%wt



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**SECTION 4. FIRST AID MEASURES**

- General advice : Never give anything by mouth to an unconscious person. When symptoms persist or in all cases of doubt seek medical advice.
- Inhalation : Remove from exposure, lie down. Move to fresh air. Keep patient warm and at rest. Artificial respiration and/or oxygen may be necessary. Consult a physician.
- Skin contact : Take off all contaminated clothing immediately. Flush area with lukewarm water. Do not use hot water. If frostbite has occurred, call a physician.
- Eye contact : Hold eyelids apart and flush eyes with plenty of water for at least 15 minutes. Get medical attention.
- Ingestion : Is not considered a potential route of exposure.
- Most important symptoms/effects, acute and delayed : Contact with liquid or refrigerated gas can cause cold burns and frostbite.
- Protection of first-aiders : If potential for exposure exists refer to Section 8 for specific personal protective equipment.
- Notes to physician : Do not give adrenaline or similar drugs. Treat symptomatically.

**SECTION 5. FIREFIGHTING MEASURES**

- Suitable extinguishing media : Water spray, Alcohol-resistant foam, Dry chemical, Carbon dioxide (CO2)
- Unsuitable extinguishing media : No applicable data available.



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- Specific hazards : Vapours are heavier than air and may spread along floors. Vapours may form flammable mixture with air. Fire or intense heat may cause violent rupture of packages.  
Hazardous thermal decomposition products: Hydrogen fluoride Fluorinated compounds Carbon oxides
- Special protective equipment for firefighters : In the event of fire, wear self-contained breathing apparatus. Use personal protective equipment. Wear neoprene gloves during cleaning up work after a fire.
- Further information : Use extinguishing measures that are appropriate to local circumstances and the surrounding environment. Evacuate personnel to safe areas. Cool containers/tanks with water spray. Fire or intense heat may cause violent rupture of packages.

**SECTION 6. ACCIDENTAL RELEASE MEASURES**

NOTE: Review FIRE FIGHTING MEASURES and HANDLING (PERSONNEL) sections before proceeding with clean-up. Use appropriate PERSONAL PROTECTIVE EQUIPMENT during clean-up.

- Safeguards (Personnel) : Evacuate personnel to safe areas. Ventilate the area. Vapours are heavier than air and can cause suffocation by reducing oxygen available for breathing. Refer to protective measures listed in sections 7 and 8.
- Environmental precautions : Should not be released into the environment. In accordance with local and national regulations.
- Spill Cleanup : Evaporates.
- Accidental Release Measures : No applicable data available.

**SECTION 7. HANDLING AND STORAGE**

- Handling (Personnel) : Avoid breathing vapours or mist. Avoid contact with skin, eyes and clothing. Provide sufficient air exchange and/or exhaust in work rooms. For personal

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protection see section 8.  
Handle in accordance with good industrial hygiene and safety practice.

Handling (Physical Aspects) : Vapours are heavier than air and may spread along floors. Vapours may form flammable mixture with air. The product should only be used in areas from which all naked lights and effective sources of ignition have been excluded. Electrical equipment should be protected to the appropriate standard. May be ignited by open flame. Take measures to prevent the build up of electrostatic charge. Keep away from open flames, hot surfaces and effective sources of ignition. When using do not smoke.

Dust explosion class : No applicable data available.  
Storage : Do not drag, slide or roll cylinders. Never attempt to lift cylinder by its cap. Use a check valve or trap in the discharge line to prevent hazardous back flow into the cylinder. Keep containers tightly closed in a cool, well-ventilated place. Store in original container. Protect from contamination. The product has an indefinite shelf life when stored properly.

Storage period : > 10 yr

Storage temperature : < 52 °C (< 126 °F)

**SECTION 8. EXPOSURE CONTROLS/PERSONAL PROTECTION**

Engineering controls : Ensure adequate ventilation, especially in confined areas. Vapours are heavier than air and can cause suffocation by reducing oxygen available for breathing.

Personal protective equipment  
Respiratory protection : For rescue and maintenance work in storage tanks use self-contained breathing apparatus. Vapours are heavier than air and can cause suffocation by reducing oxygen available for breathing.

Hand protection : Material: Heat insulating gloves  
Additional protection: Protective gloves complying with EN 374., or, US OSHA guidelines

Eye protection : Wear safety glasses or coverall chemical splash goggles. Eye protection complying with EN 166. or ANSI Z87.1 Additionally wear a face shield where

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the possibility exists for face contact due to splashing, spraying or airborne contact with this material.

Skin and body protection : Wear suitable protective equipment.  
Wear as appropriate:  
Flame retardant antistatic protective clothing.

Protective measures : When using do not smoke.  
Self-contained breathing apparatus (SCBA) is required if a large release occurs.

Exposure Guidelines  
Exposure Limit Values

2,3,3,3-Tetrafluoropropene  
No applicable data available.

**SECTION 9. PHYSICAL AND CHEMICAL PROPERTIES**

Appearance

Physical state : gaseous  
Form : Liquefied gas  
Color : colourless

Odor : slight, ether-like

Odor threshold : No applicable data available.

pH : neutral

Melting point/freezing point : Melting point  
-152.2 °C (-242.0 °F)

Boiling point/boiling range : Boiling point  
-29.4 °C (-20.9 °F)

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Flash point	: No applicable data available.
Evaporation rate	: No applicable data available.
Flammability (solid, gas)	: No applicable data available.
Upper explosion limit	: 12.3 vol% (21 °C) (1013 hPa) Method: ASTM E681
Lower explosion limit	: 6.2 vol% (21 °C) Method: ASTM E681
Vapor pressure	: 5,917.2 hPa at 20 °C (68 °F)
Vapor density	: 4 (Air = 1.0)
Density	: 0.0048 g/cm <sup>3</sup> at 20 °C (68 °F) at (1,013 hPa) Vapour density
Specific gravity (Relative density)	: No applicable data available.
Water solubility	: 0.1982 g/l at 24 °C (75 °F)
Solubility(ies)	: No applicable data available.
Partition coefficient: n-octanol/water	: log Pow: 2 at 25 °C (77 °F) Method: High-performance liquid chromatography
Auto-ignition temperature	: 405 °C 1,013 hPa Method: Directive 67/548/EEC, Annex V, A.15. static test
Ignition temperature	: Actual Auto ignition Temperature (AIT) can be affected by the concentration of vapours and oxygen, vapour/air contact time, pressure, volume, catalytic impurities, etc.

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Decomposition temperature : No applicable data available.

Viscosity, kinematic : No applicable data available.

Viscosity, dynamic : No applicable data available.

**SECTION 10. STABILITY AND REACTIVITY**

Reactivity : No applicable data available.

Chemical stability : The product is chemically stable.

Possibility of hazardous reactions : Hazardous polymerisation does not occur. Vapours may form flammable mixture with air.

Conditions to avoid : Keep away from: Heat, flames and sparks. Do not spray on a naked flame or any incandescent material.  
Gas cylinder : Keep at temperature not exceeding 52°C. Pressurized container: Do not pierce or burn, even after use.

Incompatible materials : Strong bases Alkaline earth metals, finely divided metal powders, such as, Aluminium, Magnesium, Zinc, or, strong oxidizers

Hazardous decomposition products : Hazardous thermal decomposition products may include: Hydrogen fluoride, Fluorinated compounds, Carbon oxides

**SECTION 11. TOXICOLOGICAL INFORMATION**

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Further information : Cardiac sensitisation threshold limit : &gt; 559509 mg/m3

Further information : Liquefied gas

Further information : Avoid skin contact with leaking liquid (danger of frostbite).

2,3,3,3-Tetrafluoropropene

Inhalation 4 h LC50 : &gt; 405000 ppm , Rat

Inhalation Low Observed Adverse Effect : > 120000 ppm , Dog  
Cardiac sensitization

Concentration (LOAEC)

Inhalation No Observed : 120000 ppm , Dog



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Adverse Effect Concentration Skin irritation	: Cardiac sensitization  : No skin irritation, Not tested on animals Not expected to cause skin irritation based on expert review of the properties of the substance.
Eye irritation	: No eye irritation, Not tested on animals Not expected to cause eye irritation based on expert review of the properties of the substance.
Skin sensitization	: Not tested on animals Not expected to cause sensitization based on expert review of the properties of the substance.  There are no reports of human respiratory sensitization.
Repeated dose toxicity	: Inhalation Rat - gas NOAEL: 233 mg/l, 50,000 ppm, No toxicologically significant effects were found.  Inhalation Rabbit - gas NOAEL: 2.33 mg/l, 500 ppm, No toxicological effects warranting significant target organ toxicity classification were seen below the recommended guidance values for classification.  Inhalation Mini-pig - gas NOAEL: 50 mg/l, 10,000 ppm, No toxicologically significant effects were found.
Carcinogenicity	: Not classifiable as a human carcinogen.

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	Sufficient data are available to conclude that the substance is not expected to be carcinogenic.
Mutagenicity	: Animal testing did not show any mutagenic effects. Did not cause genetic damage in cultured mammalian cells. Experiments showed mutagenic effects in cultured bacterial cells.
Reproductive toxicity	: No toxicity to reproduction Animal testing showed no reproductive toxicity.
Teratogenicity	: Animal testing showed effects on embryo-fetal development at levels equal to or above those causing maternal toxicity.

**Carcinogenicity**

The carcinogenicity classifications for this product and/or its ingredients have been determined according to HazCom 2012, Appendix A.6. The classifications may differ from those listed in the National Toxicology Program (NTP) Report on Carcinogens (latest edition) or those found to be a potential carcinogen in the International Agency for Research on Cancer (IARC) Monographs (latest edition).

None of the components present in this material at concentrations equal to or greater than 0.1% are listed by IARC, NTP, or OSHA, as a carcinogen.

**SECTION 12. ECOLOGICAL INFORMATION****Aquatic Toxicity****2,3,3,3-Tetrafluoropropene**

96 h LC50	: Cyprinus carpio (Carp) > 197 mg/l
72 h NOEC	: Algae > 100 mg/l
48 h EC50	: Daphnia magna (Water flea) > 100 mg/l

**Environmental Fate****Opteon™ YF**

Biodegradability aerobic	: < 5 % OECD Test Guideline 301F According to the results of tests of biodegradability this product is not
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readily biodegradable.

Bioaccumulation : readily biodegradable.  
 No bioaccumulation is to be expected (log Pow <= 4).

**SECTION 13. DISPOSAL CONSIDERATIONS**

Waste disposal methods - Product : Can be used after re-conditioning. In accordance with local and national regulations.

Contaminated packaging : Empty pressure vessels should be returned to the supplier.

**SECTION 14. TRANSPORT INFORMATION**

DOT	UN number	: 3161
	Proper shipping name	: Liquefied gas, flammable, n.o.s. (2,3,3,3-Tetrafluoropropene)
	Class	: 2.1
	Labelling No.	: 2.1
IATA_C	UN number	: 3161
	Proper shipping name	: Liquefied gas, flammable, n.o.s. (2,3,3,3-Tetrafluoropropene)
	Class	: 2.1
	Labelling No.	: 2.1
IMDG	UN number	: 3161
	Proper shipping name	: LIQUEFIED GAS, FLAMMABLE, N.O.S. (2,3,3,3-Tetrafluoropropene)
	Class	: 2.1
	Labelling No.	: 2.1

ICAO / IATA cargo aircraft only



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**SECTION 15. REGULATORY INFORMATION**

TSCA : This material contains one or more substances which are subject to a TSCA Section 5 Consent Order or Significant New Use Rule (SNUR).

This material contains one or more substances which requires export notification under TSCA Section 12(b) and 40 CFR Part 707 Subpart D:

1-Propene, 2,3,3,3-tetrafluoro- (CAS No. 754-12-1)  
PMN Number: P-07-601

Processors and users of this substance must also comply with the applicable general SNUR requirements set forth in 40 CFR 721 subpart A, including export notification requirements if applicable (40 CFR 721.20), and the applicable record keeping requirements set forth at 40 CFR 721.125.

Contact your local Chemours sales or technical representative for more information.

SARA 313 Regulated Chemical(s) : This material does not contain any chemical components with known CAS numbers that exceed the threshold (De Minimis) reporting levels established by SARA Title III, Section 313.

California Prop. 65 : Chemicals known to the State of California to cause cancer, birth defects or any other harm: none known

**SECTION 16. OTHER INFORMATION**



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

Significant change from previous version is denoted with a double bar.

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Version 3.0

Revision Date 08/06/2015

Print Date 01/20/2017

**SECTION 1. PRODUCT AND COMPANY IDENTIFICATION**

Product name : Solstice® yf Refrigerant (R-1234yf)

Number : 00000011078

Product Use Description : Refrigerant

Manufacturer or supplier's details : Honeywell International Inc.  
115 Tabor Road  
Morris Plains, NJ 07950-2546

For more information call : 800-522-8001  
+1-973-455-6300  
(Monday-Friday, 9:00am-5:00pm)

In case of emergency call : **Medical: 1-800-498-5701 or +1-303-389-1414**  
: **Transportation (CHEMTREC): 1-800-424-9300 or +1-703-527-3887**  
:  
: (24 hours/day, 7 days/week)

**SECTION 2. HAZARDS IDENTIFICATION****Emergency Overview**

Form : Liquefied gas

Color : clear

Odor : slight

**Classification of the substance or mixture**

Classification of the substance or mixture : Flammable gases, Category 1  
Gases under pressure, Liquefied gas  
Simple Asphyxiant

**GHS Label elements, including precautionary statements**

Symbol(s) :



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Signal word : Danger

Hazard statements : Extremely flammable gas.  
Contains gas under pressure; may explode if heated.  
May displace oxygen and cause rapid suffocation.

Precautionary statements : **Prevention:**  
Keep away from heat/sparks/open flames/hot surfaces. - No smoking.

**Response:**  
Leaking gas fire: Do not extinguish, unless leak can be stopped safely.  
Eliminate all ignition sources if safe to do so.

**Storage:**  
Protect from sunlight. Store in a well-ventilated place.

Hazards not otherwise classified : May cause eye and skin irritation.  
May cause frostbite.

**Carcinogenicity**

No component of this product present at levels greater than or equal to 0.1% is identified as a known or anticipated carcinogen by NTP, IARC, or OSHA.

**SECTION 3. COMPOSITION/INFORMATION ON INGREDIENTS**

Chemical nature : Substance

Chemical Name	CAS-No.	Concentration
2,3,3,3-Tetrafluoroprop-1-ene	754-12-1	100.00 %

**SECTION 4. FIRST AID MEASURES**

General advice : First aider needs to protect himself. Take off all contaminated clothing immediately.

Inhalation : Remove to fresh air. If not breathing, give artificial respiration. If breathing is difficult, give oxygen. Use oxygen as required, provided a qualified operator is present. Call a physician.

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- Skin contact : After contact with skin, wash immediately with plenty of water. Rapid evaporation of the liquid may cause frostbite. If there is evidence of frostbite, bathe (do not rub) with lukewarm (not hot) water. If water is not available, cover with a clean, soft cloth or similar covering. Call a physician. Wash contaminated clothing before re-use.
- Eye contact : Rinse immediately with plenty of water, also under the eyelids, for at least 15 minutes. In case of frostbite water should be lukewarm, not hot. Call a physician.
- Ingestion : Unlikely route of exposure. As this product is a gas, refer to the inhalation section. Do not induce vomiting without medical advice. If conscious, drink plenty of water. Never give anything by mouth to an unconscious person. Call a physician immediately.

**Notes to physician**

- Treatment : Treat frost-bitten areas as needed. Treat symptomatically.

**SECTION 5. FIREFIGHTING MEASURES**

- Suitable extinguishing media : In case of fire, allow gas to burn if flow cannot be shut off immediately.  
Apply water from a safe distance to cool container and protect surrounding area.  
Use water spray, alcohol-resistant foam, dry chemical or carbon dioxide.
- Specific hazards during firefighting : Flammable gas.  
Contents under pressure.  
Vapours are heavier than air and can cause suffocation by reducing oxygen available for breathing.  
Vapors may travel to areas away from work site before igniting/flashback to vapor source.  
Fire or intense heat may cause violent rupture of packages.  
Cool closed containers exposed to fire with water spray.  
Do not allow run-off from fire fighting to enter drains or water courses.  
In case of fire hazardous decomposition products may be produced such as:  
Hydrogen fluoride  
Carbonyl halides  
Carbon monoxide  
Carbon dioxide (CO<sub>2</sub>)
- Special protective equipment : In the event of fire and/or explosion do not breathe fumes.



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for firefighters

Wear self-contained breathing apparatus and protective suit.  
No unprotected exposed skin areas.

Further information

: In case of fire: Evacuate area. Fight fire remotely due to the risk of explosion.

**SECTION 6. ACCIDENTAL RELEASE MEASURES**

Personal precautions

: Immediately evacuate personnel to safe areas.  
Keep people away from and upwind of spill/leak.  
Wear personal protective equipment. Unprotected persons must be kept away.  
Wear self-contained breathing apparatus and protective suit.  
Eliminate all ignition sources if safe to do so.  
Avoid skin contact with leaking liquid (danger of frostbite).  
Ventilate the area.  
Vapors may travel to areas away from work site before igniting/flashing back to vapor source.  
Vapours are heavier than air and can cause suffocation by reducing oxygen available for breathing.  
Avoid accumulation of vapours in low areas.  
Unprotected personnel should not return until air has been tested and determined safe.  
Ensure that the oxygen content is  $\geq 19.5\%$ .

Environmental precautions

: Prevent further leakage or spillage if safe to do so.  
The product evaporates readily.  
Discharge into the environment must be avoided.

Methods for cleaning up

: Use explosion-proof equipment.  
No sparking tools should be used.  
Ventilate the area.  
Allow to evaporate.

**SECTION 7. HANDLING AND STORAGE****Handling**

Handling

: Handle with care.  
Wear personal protective equipment.  
Do not breathe vapour.  
Avoid contact with skin, eyes and clothing.  
Use only in well-ventilated areas.  
Pressurized container. Protect from sunlight and do not expose to temperatures exceeding 50 °C.  
Follow all standard safety precautions for handling and use of

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compressed gas cylinders.  
Use authorized cylinders only.  
Protect cylinders from physical damage.  
Do not puncture or drop cylinders, expose them to open flame or excessive heat.  
Do not remove screw cap until immediately ready for use.  
Always replace cap after use.

Advice on protection against fire and explosion : Container hazardous when empty.  
Prevent the creation of flammable or explosive concentrations of vapour in air and avoid vapour concentration higher than the occupational exposure limits.  
Keep product and empty container away from heat and sources of ignition.  
Do not pressurize, cut, weld, braze, solder, drill, grind or expose containers to heat or sources of ignition.  
Take measures to prevent the build up of electrostatic charge.  
Electrical equipment should be protected to the appropriate standard.  
Use explosion-proof equipment.  
No sparking tools should be used.  
No smoking.

**Storage**

Requirements for storage areas and containers : Pressurized container: protect from sunlight and do not expose to temperatures exceeding 50 °C. Do not pierce or burn, even after use.  
Keep containers tightly closed in a dry, cool and well-ventilated place.  
Keep away from heat and sources of ignition.  
Storage rooms must be properly ventilated.  
Ensure adequate ventilation, especially in confined areas.  
Protect cylinders from physical damage.  
Store away from incompatible substances.  
Store in original container.

**SECTION 8. EXPOSURE CONTROLS/PERSONAL PROTECTION**

Protective measures : Ensure that eyewash stations and safety showers are close to the workstation location.  
Do not breathe vapour.  
Avoid contact with skin, eyes and clothing.

Engineering measures : Use with local exhaust ventilation.

Eye protection : Safety goggles

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- Hand protection : Protective gloves  
Gloves must be inspected prior to use.  
Replace when worn.
- Skin and body protection : Avoid skin contact with leaking liquid (danger of frostbite).  
Wear suitable protective equipment.
- Respiratory protection : No personal respiratory protective equipment normally required.  
When workers are facing concentrations above the exposure limit they must use appropriate certified respirators.  
Use NIOSH approved respiratory protection.
- Hygiene measures : Handle in accordance with good industrial hygiene and safety practice.  
Ensure adequate ventilation, especially in confined areas.  
When using do not eat, drink or smoke.  
Remove and wash contaminated clothing before re-use.  
Keep working clothes separately.  
Do not breathe vapour.  
Avoid contact with skin, eyes and clothing.

**Exposure Guidelines**

Components	CAS-No.	Value	Control parameters	Update	Basis
2,3,3,3-Tetrafluoroprop-1-ene	754-12-1	TWA : Time weighted average	(500 ppm)	2009	WEEL:US. OARS. WEELs Workplace Environmental Exposure Level Guide

2,3,3,3-Tetrafluoroprop-1-ene	754-12-1	TWA : Time weighted average	(500 ppm)	03 15 2010	Honeywell:Limit established by Honeywell International Inc.
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2,3,3,3-Tetrafluoroprop-1-ene	754-12-1	STEL : Short term exposure limit	(1,500 ppm)	03 15 2010	Honeywell:Limit established by Honeywell International Inc.
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**SECTION 9. PHYSICAL AND CHEMICAL PROPERTIES**

Physical state : Liquefied gas

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Color	:	clear
Odor	:	slight
pH	:	Note: Not applicable, as this product is a gas.
Melting point/range	:	Note: Not applicable, as this product is a gas.
Boiling point/boiling range	:	-29.4 °C
Flash point	:	Note: Not applicable, as this product is a gas.
Evaporation rate	:	Note: Not applicable, as this product is a gas.
lower flammability limit	:	6.2 %(V) Method: ASTM E681-04
upper flammability limit	:	12.3 %(V) Method: ASTM E681-04
Vapor pressure	:	6,067 hPa at 21.1 °C(70.0 °F) 14,203 hPa at 54.4 °C(129.9 °F)
Vapor density	:	4 Note: (Air = 1.0)
Density	:	1.1 g/cm <sup>3</sup> at 25 °C
Specific gravity	:	Note: Not applicable
Water solubility	:	198.2 mg/l at 24 °C  Method: 92/69/EEC, A.6
Partition coefficient: n-octanol/water	:	log Pow: 2.15 Method: 92/69/EEC, A.8
Ignition temperature	:	405 °C

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Method: Auto-ignition temperature

Viscosity, dynamic	: Note: Not applicable, as this product is a gas.
Viscosity, kinematic	: Note: Not applicable, as this product is a gas.
Particle size	: Note: Not applicable
Oxidizing properties	: Not applicable: Not expected to have oxidizing properties based on theoretical evaluation
Molecular weight	: 114 g/mol
Surface tension	: Note: Not applicable

**SECTION 10. STABILITY AND REACTIVITY**

Chemical stability	: Stable under normal conditions.
Possibility of hazardous reactions	: Hazardous polymerisation does not occur.
Conditions to avoid	: Keep away from heat and sources of ignition. Pressurized container. Protect from sunlight and do not expose to temperatures exceeding 50 °C. Do not pressurize, cut, weld, braze, solder, drill, grind or expose containers to heat or sources of ignition. Decomposes under high temperature. Some risk may be expected of corrosive and toxic decomposition products.

Incompatible materials to avoid	: <b>Alkali metals</b> <b>Oxidizers (e.g. peroxide residues present in insufficiently cured rubbers)</b> <b>Finely divided aluminium</b> <b>Finely divided magnesium</b> <b>Zinc</b>
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Hazardous decomposition products	: In case of fire hazardous decomposition products may be produced such as: Hydrogen fluoride Carbonyl halides Carbon monoxide Carbon dioxide (CO <sub>2</sub> )
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**SECTION 11. TOXICOLOGICAL INFORMATION**

Acute inhalation toxicity : LC50: > 400000 ppm  
Exposure time: 4 h  
Species: Rat  
Method: OECD Test Guideline 403

Skin irritation : Note: Not applicable Study technically not feasible.

Eye irritation : Note: Not applicable Study technically not feasible.

Sensitisation : **Dermal**  
Note: **Not applicable, as this product is a gas. Study technically not feasible.**

Repeated dose toxicity : Species: Rat  
Application Route: Inhalation  
Exposure time: 2 Weeks  
No-observed-effect level: 50000 ppm  
Method: OECD Test Guideline 412

: Species: Rat  
Application Route: Inhalation  
Exposure time: 4 Weeks  
NOAEL (No observed adverse effect level): 50000 ppm  
Method: OECD Test Guideline 412

: Species: Rat  
Application Route: Inhalation  
Exposure time: 13 Weeks  
NOAEL (No observed adverse effect level): 50000 ppm  
Method: OECD Test Guideline 413

: Species: **Rabbit, male**  
Application Route: **Inhalation**  
Exposure time: **28 d**  
**No-observed-effect level: 500 ppm**  
Method: **OECD Test Guideline 412**  
Note: **There are no observed toxicological effects, which result in classification as a specific target organ toxicant.**

: Species: **Rabbit, female**  
Application Route: **Inhalation**

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Exposure time: 28 d  
 No-observed-effect level: 1000 ppm  
 Method: OECD Test Guideline 412  
 Note: There are no observed toxicological effects, which result in classification as a specific target organ toxicant.

- : Species: Mini-pig  
 Application Route: Inhalation  
 Exposure time: 28 d  
 NOAEL (No observed adverse effect level): 10000 ppm  
 Note: highest exposure tested
- Genotoxicity in vitro : Test Method: Ames test  
 Result: 20% and higher, positive in TA 100 and e. coli WP2 uvrA, negative in TA98, TA100, and TA1535.  
 Method: OECD Test Guideline 471
- : Test Method: Chromosome aberration test in vitro  
 Cell type: Human lymphocytes  
 Result: negative  
 Method: OECD Test Guideline 473  
 Note: Dose 760,000 ppm
- Genotoxicity in vivo : Species: Mouse  
 Cell type: Micronucleus  
 Dose: up to 200,000 ppm (4 hour)  
 Method: OECD Test Guideline 474  
 Result: negative
- Genotoxicity in vivo : Test Method: Unscheduled DNA synthesis  
 Dose: up to 50,000 ppm (4 weeks)  
 Method: OECD Test Guideline 486  
 Result: negative
- Genotoxicity in vivo : Species: Rat  
 Cell type: Micronucleus  
 Dose: up to 50,000 ppm (4 weeks)  
 Method: OECD Test Guideline 474  
 Result: negative

Carcinogenicity : Species: Rat  
 Note: Not classified as a human carcinogen. Substance not expected to be a carcinogen based on available data.

- Reproductive toxicity : Test Method: Two-generation study  
 Species: Rat  
 Application Route: Inhalation

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NOAEL, parent: 50,000 ppm  
NOAEL, F1: 50,000 ppm  
Method: OECD Test Guideline 416

Aspiration toxicity : Not applicable, as this product is a gas. Study technically not feasible.

Teratogenicity : Species: Rat Application Route: inhalation (gas)  
  
General Toxicity Maternal - No observed adverse effect level: 50,000 ppm  
Developmental Toxicity - No observed adverse effect level: 50,000 ppm  
Method: OECD Test Guideline 414

: Species: Rabbit Application Route: inhalation (gas)  
  
General Toxicity Maternal - Lowest observed adverse effect concentration: 2,500 ppm  
Embryo-fetal toxicity - No observed adverse effect concentration: 4,000 ppm  
Method: OECD Test Guideline 414  
Note: Embryo-fetal toxicity observed at maternally toxic concentrations

Further information : Note: Cardiac Sensitization (dog): No effects for exposures up to 12% (120,189 ppm)

**SECTION 12. ECOLOGICAL INFORMATION****Ecotoxicity effects**

Toxicity to fish : LC50: > 197 mg/l  
Exposure time: 96 h  
Species: Cyprinus carpio (Carp)  
Method: OECD Test Guideline 203  
Note: No demonstrable toxic effect in saturated solution.

Toxicity to daphnia and other aquatic invertebrates : EC50: > 83 mg/l  
Exposure time: 48 h  
Species: Daphnia magna (Water flea)  
Method: OECD Test Guideline 202



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Toxicity to algae : EC50: > 100 mg/l  
 Species: Scenedesmus capricornutum (fresh water algae)  
 Method: OECD Test Guideline 201

**Elimination information (persistence and degradability)**

Bioaccumulation : Note: Due to the distribution coefficient n-octanol/water, accumulation in organisms is not expected.

Surface tension : Note: Not applicable

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

**Further information on ecology****Ecotoxicology Assessment**

Results of PBT assessment

This substance is not considered to be persistent, bioaccumulating and toxic (PBT)., This substance is not considered to be very persistent and very bioaccumulating (vPvB).

**SECTION 13. DISPOSAL CONSIDERATIONS**

Disposal methods : Observe all Federal, State, and Local Environmental regulations.

**SECTION 14. TRANSPORT INFORMATION**

**DOT** UN/ID No. : UN 3161  
 Proper shipping name : LIQUEFIED GAS, FLAMMABLE, N.O.S.  
 ( R-1234yf)  
 Class : 2.1  
 Packing group  
 Hazard Labels : 2.1

**IATA** UN/ID No. : UN 3161  
 Description of the goods : LIQUEFIED GAS, FLAMMABLE, N.O.S.  
 ( R-1234yf)  
 Class : 2.1  
 Hazard Labels : 2.1  
 Packing instruction (cargo aircraft) : 200

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<b>IMDG</b>	UN/ID No.	:	UN 3161
	Description of the goods	:	LIQUEFIED GAS, FLAMMABLE, N.O.S. ( R-1234yf)
	Class	:	2.1
	Hazard Labels	:	2.1
	EmS Number	:	F-D, S-U
	Marine pollutant	:	no

**SECTION 15. REGULATORY INFORMATION****Inventories**

US. Toxic Substances Control Act	:	On TSCA Inventory
Australia. Industrial Chemical (Notification and Assessment) Act	:	On the inventory, or in compliance with the inventory
Canada. Canadian Environmental Protection Act (CEPA). Domestic Substances List (DSL)	:	All components of this product are on the Canadian DSL.
Japan. Kashin-Hou Law List	:	On the inventory, or in compliance with the inventory
Korea. Toxic Chemical Control Law (TCCL) List	:	On the inventory, or in compliance with the inventory
Philippines. The Toxic Substances and Hazardous and Nuclear Waste Control Act	:	Not in compliance with the inventory
China. Inventory of Existing Chemical Substances	:	Not in compliance with the inventory
New Zealand. Inventory of Chemicals (NZIoC), as published by ERMA New Zealand	:	Not in compliance with the inventory
TSCA 12B	:	US. Toxic Substances Control Act (TSCA) Section 12(b) Export Notification (40 CFR 707, Subpt D)

2,3,3,3-Tetrafluoroprop-1-ene 754-12-1

**National regulatory information**

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US. Toxic Substances Control Act (TSCA) Section 5(a)(2) Final Significant New Use Rules (SNURs) (40 CFR 721, Subpt E)	:	Issued.
	:	2,3,3,3-Tetrafluoroprop-1-ene 754-12-1
<b>SARA 302 Components</b>	:	No chemicals in this material are subject to the reporting requirements of SARA Title III, Section 302.
<b>SARA 313 Components</b>	:	This material does not contain any chemical components with known CAS numbers that exceed the threshold (De Minimis) reporting levels established by SARA Title III, Section 313.
<b>SARA 311/312 Hazards</b>	:	Fire Hazard Acute Health Hazard Sudden Release of Pressure Hazard
<b>California Prop. 65</b>	:	This product does not contain any chemicals known to State of California to cause cancer, birth defects, or any other reproductive harm.
<b>New Jersey RTK</b>	:	2,3,3,3-Tetrafluoroprop-1-ene 754-12-1
<b>Pennsylvania RTK</b>	:	2,3,3,3-Tetrafluoroprop-1-ene 754-12-1
<b>WHMIS Classification</b>	:	B1: Flammable gas A: Compressed Gas This product has been classified according to the hazard criteria of the CPR and the MSDS contains all of the information required by the CPR.

**SECTION 16. OTHER INFORMATION**

	<b>HMIS III</b>	<b>NFPA</b>
Health hazard	: 0	2
Flammability	: 2	2
Physical Hazard	: 2	
Instability	:	0

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Hazard rating and rating systems (e.g. HMIS® III, NFPA): This information is intended solely for the use of individuals trained in the particular system.

**Further information**

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

Changes since the last version are highlighted in the margin. This version replaces all previous versions.

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