

SAFETY DATA SHEET

according to Regulation (EC) No. 1907/2006

Honeywell

Solstice® yf Refrigerant (R-1234yf)

000000023899

Version 1.0

Revision Date 08.01.2019

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

1.1. Product identifier

Product name : Solstice® yf Refrigerant (R-1234yf)
SDS-number : 000000023899
Type of product : Substance
Remarks : SDS according to Art. 31 of Regulation (EC) 1907/2006.
Chemical name : 2,3,3,3-Tetrafluoroprop-1-ene
CAS-No. : 754-12-1
REACH Registration Number : 01-0000019665-61

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

Use of the Substance/Mixture : Refrigerant - Mobile Air Conditioning in passenger cars
Uses advised against : Direct evaporation applications
Short title of exposure scenarios : Industrial Use, Heat Transfer Fluids – Refrigerants, Coolants
Professional Use, Heat Transfer Fluids – Refrigerants, Coolants
Formulation of preparations
Consumer Use, Heat Transfer Fluids Refrigerants, Coolants

1.3. Details of the supplier of the safety data sheet

Company : Honeywell Fluorine Products Europe B.V.
Laarderhoogtweg 18
1101 EA Amsterdam
Netherlands
Telephone : (31) 020 5656911
Telefax : (31) 020 5656600
For further information, please contact: : PMTEU Product Stewardship:
SafetyDataSheet@Honeywell.com
Honeywell International, Inc.
115 Tabor Road
Morris Plains, NJ 07950-2546
USA

1.4. Emergency telephone number

Emergency telephone number : +1-703-527-3887 (ChemTrec-Transport)
+1-303-389-1414 (Medical)

SAFETY DATA SHEET

according to Regulation (EC) No. 1907/2006

Honeywell

Solstice® yf Refrigerant (R-1234yf)

000000023899

Version 1.0

Revision Date 08.01.2019

Country based Poison : see chapter 15.1
Control Center

SECTION 2: Hazards identification


2.1. Classification of the substance or mixture

REGULATION (EC) No 1272/2008

Flammable gases Category 1
H220 Extremely flammable gas.
Gases under pressure Liquefied gas
H280 Contains gas under pressure; may explode if heated.

2.2. Label elements

REGULATION (EC) No 1272/2008

Hazard pictograms : 

Signal word : Danger

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

Precautionary statements : P210 Keep away from heat/sparks/open flames/hot surfaces. No smoking.
P377 Leaking gas fire: Do not extinguish, unless leak can be stopped safely.
P381 Eliminate all ignition sources if safe to do so.
P410 + P403 Protect from sunlight. Store in a well-ventilated place.

2.3. Other hazards

Warning! Container under pressure. Gas reduces oxygen available for breathing.

SECTION 3: Composition/information on ingredients

3.1. Substance

Chemical name	CAS-No. Index-No. REACH Registration Number	Classification 1272/2008	Concentration	Remarks
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SAFETY DATA SHEET

according to Regulation (EC) No. 1907/2006

Honeywell

Solstice® yf Refrigerant (R-1234yf)

000000023899

Version 1.0

Revision Date 08.01.2019

	EC-No.			
2,3,3,3-Tetrafluoroprop-1-ene	754-12-1 01-0000019665-61 468-710-7	Flam. Gas 1; H220 Press. Gas ; H280	100 %	1*

1* - For specific concentration limits see Annexes of 1272/2008

3.2. Mixture

Not applicable

Occupational Exposure Limit(s), if available, are listed in Section 8.

For the full text of the H-Statements mentioned in this Section, see Section 16.

SECTION 4: First aid measures

4.1. Description of first aid measures

General advice:

First aider needs to protect himself. Move out of dangerous area. Take off all contaminated clothing immediately.

Inhalation:

When inhaled remove to fresh air and seek medical aid. If breathing is irregular or stopped, administer artificial respiration. If unconscious, place in recovery position and seek medical advice.

Skin contact:

Rapid evaporation of the liquid may cause frostbite. In case of contact with liquid, thaw frosted parts with water, then remove clothing carefully. Wash with plenty of water Wash contaminated clothing before re-use. Consult a physician.

Eye contact:

Protect unharmed eye. Rinse immediately with plenty of water, also under the eyelids, for at least 15 minutes. Call a physician immediately.

Ingestion:

Ingestion is unlikely because of the physical properties and is not expected to be hazardous.

4.2. Most important symptoms and effects, both acute and delayed

no data available

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

Adrenaline derivatives are contra-indicated. Treat symptomatically.

See Section 11 for more detailed information on health effects and symptoms.

SAFETY DATA SHEET

according to Regulation (EC) No. 1907/2006

Honeywell

Solstice® yf Refrigerant (R-1234yf)

000000023899

Version 1.0

Revision Date 08.01.2019

SECTION 5: Firefighting measures

5.1. Extinguishing media

Suitable extinguishing media:

Use water spray, alcohol-resistant foam, dry chemical or carbon dioxide.

5.2. Special hazards arising from the substance or mixture

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/flashing back 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 (CO₂)

5.3. Advice for firefighters

Wear full protective clothing and self-contained breathing apparatus.

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

SECTION 6: Accidental release measures

6.1. Personal precautions, protective equipment and emergency procedures

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. Ensure that the oxygen content is $\geq 19.5\%$.

6.2. Environmental precautions

The product evaporates readily. Prevent product from entering drains.

6.3. Methods and materials for containment and cleaning up

Use explosion-proof equipment.

No sparking tools should be used.

Ventilate the area.

Allow to evaporate.

Inform the responsible authorities in case of gas leakage, or of entry into waterways, soil or drains.

Pay attention to the spreading of gases especially at ground level (heavier than air) and to the direction of the wind.

SAFETY DATA SHEET

according to Regulation (EC) No. 1907/2006

Honeywell

Solstice® yf Refrigerant (R-1234yf)

000000023899

Version 1.0

Revision Date 08.01.2019

6.4. Reference to other sections

For personal protection see section 8.

SECTION 7: Handling and storage

7.1. Precautions for safe handling

Advice on safe handling:

Exhaust ventilation at the object is necessary. Pressurized container: protect from sunlight and do not expose to temperatures exceeding 50 °C. Do not pierce or burn, even after use. Use suitably rated equipment.

Advice on protection against fire and explosion:

Keep product and empty container away from heat and sources of ignition. Fire or intense heat may cause violent rupture of packages. Use suitably rated equipment.

Hygiene measures:

Provide adequate ventilation. Do not smoke. When using do not eat or drink.

7.2. Conditions for safe storage, including any incompatibilities

Further information on storage conditions:

Keep containers tightly closed in a cool, well-ventilated place. Containers should be protected against falling down. Protect from warmth. Keep away from direct sunlight. Keep only in the original container at temperature not exceeding 50°C

7.3. Specific end use(s)

no additional data available

SECTION 8: Exposure controls/personal protection

8.1. Control parameters

Occupational exposure limits:

Components	Basis / Value type	Value / Form of exposure	Exceeding Factor	Remarks
2,3,3,3-Tetrafluoroprop-1-ene	WEEL TWA	500 ppm		
2,3,3,3-Tetrafluoroprop-1-ene	HONEYWELL TWA	500 ppm		

TWA - Time weighted average

DNEL/ PNEC-Values

SAFETY DATA SHEET

according to Regulation (EC) No. 1907/2006

Honeywell

Solstice® yf Refrigerant (R-1234yf)

000000023899

Version 1.0

Revision Date 08.01.2019

Component	End-use/impact	Exposure duration	Value	Exposure routes	Remarks
2,3,3,3-Tetrafluoroprop-1-ene	Workers / Long-term systemic effects		950 mg/m ³	Inhalation	
2,3,3,3-Tetrafluoroprop-1-ene	Consumers / Long-term systemic effects		113,1 mg/m ³	Inhalation	
2,3,3,3-Tetrafluoroprop-1-ene	Consumers / Acute systemic effects		186400 mg/m ³	Inhalation	

Component	Environmental compartment / Value	Remarks
2,3,3,3-Tetrafluoroprop-1-ene	Fresh water: 0,1 mg/l	
2,3,3,3-Tetrafluoroprop-1-ene	Marine water: 0,01 mg/l	
2,3,3,3-Tetrafluoroprop-1-ene	Fresh water sediment: 1,77 mg/kg	
2,3,3,3-Tetrafluoroprop-1-ene	Marine sediment: 0,178 mg/kg	
2,3,3,3-Tetrafluoroprop-1-ene	Soil: 1,54 mg/kg	

8.2. Exposure controls

Occupational exposure controls

The Personal Protective Equipment must be in accordance with EN standards:respirator EN 136, 140, 149; safety glasses EN 166; protective suit: EN 340, 463, 468, 943-1, 943-2; gloves EN 374, 511; safety shoes EN-ISO 20345.

Engineering measures

Highly effective exhaust ventilation

Personal protective equipment

Respiratory protection:

In case of insufficient ventilation wear suitable respiratory equipment.

Self-contained breathing apparatus (EN 133)

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

Hand protection:

Protective gloves against cold (EN 511)

Eye protection:

Safety goggles

SAFETY DATA SHEET

according to Regulation (EC) No. 1907/2006



Solstice® yf Refrigerant (R-1234yf)

000000023899

Version 1.0

Revision Date 08.01.2019

Skin and body protection:

Wear suitable protective equipment.

Environmental exposure controls

Handle in accordance with local environmental regulations and good industrial practices.

SECTION 9: Physical and chemical properties

9.1. Information on basic physical and chemical properties

Form	:	compressed liquefied gas
Colour	:	colourless
Odour	:	slight, original odour
molecular weight	:	114 g/mol
Melting point/range	:	Not applicable, as this product is a gas.
Boiling point/boiling range	:	-29,4 °C
Flash point	:	Not applicable, as this product is a gas.
Flammability (solid, gas)	:	Extremely flammable gas. Method: Flammability (gases)
Auto-ignition temperature	:	405 °C
Oxidizing properties	:	Not applicable: Not expected to have oxidizing properties based on theoretical evaluation
Lower explosion limit	:	6,2 %(V) Method: ASTM E681-04 lower flammability limit
Upper explosion limit	:	12,3 %(V) Method: ASTM E681-04 upper flammability limit
Vapour pressure	:	6.067 hPa at 21,1 °C
Vapour pressure	:	14.203 hPa at 54,4 °C
Density	:	1,1 g/cm ³ at 25 °C

SAFETY DATA SHEET

according to Regulation (EC) No. 1907/2006

Honeywell

Solstice® yf Refrigerant (R-1234yf)

000000023899

Version 1.0

Revision Date 08.01.2019

Viscosity, dynamic	:	Not applicable, as this product is a gas.
Viscosity, kinematic	:	Not applicable, as this product is a gas.
pH	:	Not applicable, as this product is a gas.
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
Relative vapour density	:	4
Evaporation rate	:	Not applicable, as this product is a gas.

9.2. Other Information

no additional data available

SECTION 10: Stability and reactivity

10.1. Reactivity

Stable under normal conditions.

10.2. Chemical stability

Stable under normal conditions.

10.3. Possibility of hazardous reactions

Hazardous polymerisation does not occur.

10.4. Conditions to avoid

Do not pierce or burn, even after use. Do not spray on a naked flame or any incandescent material.
Heat, flames and sparks.
Pressurized container. Protect from sunlight and do not expose to temperatures exceeding 50 °C.

10.5. Incompatible materials

Alkali metals
Oxidizers (e.g. peroxide residues present in insufficiently cured rubbers)
Finely divided metal powders such as aluminum, magnesium, or zinc.

SAFETY DATA SHEET

according to Regulation (EC) No. 1907/2006

Honeywell

Solstice® yf Refrigerant (R-1234yf)

000000023899

Version 1.0

Revision Date 08.01.2019

10.6. Hazardous decomposition products

In case of fire hazardous decomposition products may be produced such as:

Hydrogen fluoride

Carbonyl halides

Carbon monoxide

Carbon dioxide (CO₂)

SECTION 11: Toxicological information

11.1. Information on toxicological effects

Acute oral toxicity:

Not applicable

study technically not feasible

Acute dermal toxicity:

Not applicable

study technically not feasible

Acute inhalation toxicity:

LC50

Species: Rat

Value: > 400000 ppm

Exposure time: 4 h

Method: OECD Test Guideline 403

Skin irritation:

Not applicable

study technically not feasible

Eye irritation:

Not applicable

study technically not feasible

Respiratory or skin sensitisation:

Route of exposure: Dermal

Not applicable, as this product is a gas.

study technically not feasible

Repeated dose toxicity:

Species: Rat

Application Route: Inhalation

Exposure time: 2 Weeks

NOEL: 50000 ppm

Method: OECD Test Guideline 412

Species: Rat

Application Route: Inhalation

SAFETY DATA SHEET

according to Regulation (EC) No. 1907/2006

Honeywell

Solstice® yf Refrigerant (R-1234yf)

000000023899

Version 1.0

Revision Date 08.01.2019

Exposure time: 4 Weeks
NOAEL: 50000 ppm
Method: OECD Test Guideline 412

Species: Rat
Application Route: Inhalation
Exposure time: 13 Weeks
NOAEL: 50000 ppm
Method: OECD Test Guideline 413

Species: Rabbit, male
Application Route: Inhalation
Exposure time: 28 d
NOEL: 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
Exposure time: 28 d
NOEL: 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: 10000 ppm
Note: highest exposure tested

Carcinogenicity:

Species: Rat

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

Germ cell mutagenicity:

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

Species: Mouse

SAFETY DATA SHEET

according to Regulation (EC) No. 1907/2006

Honeywell

Solstice® yf Refrigerant (R-1234yf)

000000023899

Version 1.0

Revision Date 08.01.2019

Cell type: Micronucleus
Dose: up to 200,000 ppm (4 hour)
Method: OECD Test Guideline 474
Result: negative

Test Method: Unscheduled DNA synthesis
Dose: up to 50,000 ppm (4 weeks)
Method: OECD Test Guideline 486
Result: negative

Species: Rat
Cell type: Micronucleus
Dose: up to 50,000 ppm (4 weeks)
Method: OECD Test Guideline 474
Result: negative

Reproductive toxicity:

Test Type: Two-generation study
Method: OECD Test Guideline 416
Species: Rat
Route of Application: Inhalation
General Toxicity - Parent: NOAEC: 50.000 ppm
General Toxicity F1: NOAEC: 50.000 ppm

Method: OECD Test Guideline 414
Species: Rat
Route of Application: inhalation (gas)
General Toxicity Maternal: NOAEL: 50.000 ppm
Developmental Toxicity: NOAEL: 50.000 ppm

Method: OECD Test Guideline 414
Species: Rabbit
Route of Application: inhalation (gas)
General Toxicity Maternal: LOAEC: 2.500 ppm
Embryo-fetal toxicity: NOAEC: 4.000 ppm
Remarks: Embryo-fetal toxicity observed at maternally toxic concentrations

Aspiration hazard:

Not applicable, as this product is a gas.

Other information:

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

SECTION 12: Ecological information

12.1. Toxicity

Toxicity to fish:
LC50

SAFETY DATA SHEET

according to Regulation (EC) No. 1907/2006



Solstice® yf Refrigerant (R-1234yf)

000000023899

Version 1.0

Revision Date 08.01.2019

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

Toxicity to aquatic plants:

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

Toxicity to aquatic invertebrates:

EC50
Species: Daphnia magna (Water flea)
Value: > 83 mg/l
Exposure time: 48 h
Method: OECD Test Guideline 202

12.2. Persistence and degradability

Biodegradability:

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

12.3. Bioaccumulative potential

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

12.4. Mobility in soil

no data available

12.5. Results of PBT and vPvB 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).

12.6. Other adverse effects

An environmental hazard cannot be excluded in the event of unprofessional handling or disposal.

SECTION 13: Disposal considerations

13.1. Waste treatment methods

Product:

Dispose according to legal requirements.

Packaging:

SAFETY DATA SHEET

according to Regulation (EC) No. 1907/2006

Honeywell

Solstice® yf Refrigerant (R-1234yf)

000000023899

Version 1.0

Revision Date 08.01.2019

Legal requirements are to be considered in regard of reuse or disposal of used packaging materials

Further information:

Provisions relating to waste:
EC Directive 2006/12/EC; 2008/98/EEC
Regulation No. 1013/2006

For personal protection see section 8.

SECTION 14: Transport information

ADR/RID

UN Number : 3161
Description of the goods : LIQUEFIED GAS, FLAMMABLE, N.O.S.
(R-1234yf)
Class : 2
Classification Code : 2F
Hazard Identification : 23
Number
ADR/RID-Labels : 2.1
Environmentally hazardous : no

IATA

UN Number : 3161
Description of the goods : Liquefied gas, flammable, n.o.s.
(R-1234yf)
Class : 2.1
Hazard Labels : 2.1

IMDG

UN Number : 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

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

Basis	Value	Remarks
Directive 2012/18/EC SEVESO III	Amount 1: 50.000 kg Amount 2: 200.000 kg	Annex I, Part 2: 18. Liquefied flammable gases, Category 1 or 2

Poison Control Center

SAFETY DATA SHEET

according to Regulation (EC) No. 1907/2006

Honeywell

Solstice® yf Refrigerant (R-1234yf)

000000023899

Version 1.0

Revision Date 08.01.2019

Country	Phone Number
Austria	+4314064343
Belgium	070 245245
Bulgaria	(+35929154233
Croatia	(+3851)23-48-342
Cyprus	no data available
Czech Republic	+420224919293; +420224915402
Denmark	82121212
Estonia	16662; (+372)6269390
Finland	9471977
France	+33(0)145425959
Greece	no data available
Hungary	(+36-80)201-199
Iceland	5432222
Ireland	+353(1)8092166
Italy	no data available
Germany	Berlin : 030/19240
	Bonn : 0228/19240
	Erfurt : 0361/730730
	Freiburg : 0761/19240
	Göttingen : 0551/19240
	Homburg : 06841/19240
	Mainz : 06131/19240
	Munich : 089/19240

Country	Phone Number
Latvia	+37167042473
Liechtenstein	no data available
Lithuania	+370532362052
Luxembourg	070245245; (+352)80002-5500
Malta	no data available
Netherlands	030-2748888
Norway	22591300
Poland	no data available
Portugal	808250143
Romania	no data available
Slovakia (NTIC)	+421 2 54 774 166
Slovenia	no data available
Spain	+34915620420
Sweden	112 (begär Giftinformation);+46104566786
United Kingdom	no data available

Other inventory information

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

SAFETY DATA SHEET

according to Regulation (EC) No. 1907/2006

Honeywell

Solstice® yf Refrigerant (R-1234yf)

000000023899

Version 1.0

Revision Date 08.01.2019

Korea. Existing Chemicals Inventory (KECI)
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
On the inventory, or in compliance with the inventory

New Zealand. Inventory of Chemicals (NZIoC), as published by ERMA New Zealand
On the inventory, or in compliance with the inventory

15.2 Chemical safety assessment

A Chemical Safety Assessment has been carried out.

SECTION 16: Other information

Text of H-statements referred to under heading 3

2,3,3,3-Tetrafluoroprop-1-ene	:	H220	Extremely flammable gas.
		H280	Contains gas under pressure; may explode if heated.

Further information

All directives and regulations refer to amended versions.
Vertical lines in the left- hand margin indicate a relevant amendment from the previous version.

Abbreviations:

EC European Community
CAS Chemical Abstracts Service
DNEL Derived no effect level
PNEC Predicted no effect level
vPvB Very persistent and very bioaccumulative substance
PBT Persistent, bioaccumulative und toxic substance

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.

SAFETY DATA SHEET

according to Regulation (EC) No. 1907/2006



Solstice® yf Refrigerant (R-1234yf)

000000023899

Version 1.0

Revision Date 08.01.2019

Index

ES number	Short title of exposure scenario	Sector of Use (SU) ^a	Product Category (PC)	Process Category (PROC)	Article Category (AC)	Environmental Release Category (ERC)
ES1	Industrial use, Heat transfer fluids – Refrigerants, coolants	3, 10, 17	16	8b, 9	1, 2	7
ES2	Professional use, Heat transfer fluids – Refrigerants, coolants	22	16	1,8a	1, 2	9a or 9b
ES3	Formulation of preparations	3, 10, 17	16	3	1, 2	2
ES4	Consumer Use, Heat Transfer Fluids Refrigerants, Coolants	10, 17, 21, 22	16	Not applicable	1,2	9a, 9b, 10a, 11a

1. ES 1: Industrial Use, Heat Transfer Fluids Refrigerants, Coolants

1.1 Title section

ES name: Industrial Use, Heat Transfer Fluids Refrigerants, Coolants

Environment	
1: Industrial use of substance in closed systems	ERC7
Worker	
2: Transfer of substance or preparation into small containers (dedicated filling line, including weighing)	PROC 9
3: Transfer of substance or preparation (charging/discharging) from/to vessels/large containers at dedicated facilities	PROC8b

1.2. Conditions of use affecting exposure:

1.2.1 Control of environmental exposure: Wide dispersive outdoor use of substances in closed systems (ERC7)

Product Characteristics
Low global warming potential (GWP) liquefied gas; Covers percentage substance in the product up to 100 % (unless stated differently); Not biodegradable

SAFETY DATA SHEET

according to Regulation (EC) No. 1907/2006

Honeywell

Solstice® yf Refrigerant (R-1234yf)

000000023899

Version 1.0

Revision Date 08.01.2019

Amounts used

19225 tonnes per annum (tpa); Daily amount: 52671 kg/day

Fraction of EU tonnage to region: 0.1

Technical and organisational conditions and measures

Process designed to minimize releases to wastewater; Process designed to minimize releases to soil; Ensure that the valves of the cylinders are tightly closed and not leaking; Handle substance within a closed system; Transfer via enclosed lines; Clear transfer lines prior to de-coupling.

Organizational measures to prevent/limit release from site

Use of ATEX 137 and ATEX 95 Directives to mitigate flammability properties of HFO-1234yf and/or Chemical Substances at Work (Directive 98/24/EC); Regular inspection and maintenance of equipment and machines.

Conditions and measures related to municipal sewage treatment plant

No STP

1.2.2 Control of worker exposure: Transfer of substance or preparation into small containers (dedicated filling line, including weighing) (PROC9)

Product characteristic

Liquefied gas; Covers percentage substance in the product up to 100 % (unless stated differently);

Amounts used

120 kg/8-hour shift

Frequency and duration of use/exposure

Duration of use/exposure: Intermittent; <= 20 minutes/day

Frequency: 200 days/year

Other given operational conditions affecting workers exposure

Indoor use;

Assumes activities are at room temperature.

Technical conditions and measures at process level (source) to prevent release

Ensure that the valves of the cylinders are tightly closed and not leaking; Handle substance within a closed system; Transfer via enclosed lines; Clear transfer lines prior to de-coupling.

SAFETY DATA SHEET

according to Regulation (EC) No. 1907/2006

Honeywell

Solstice® yf Refrigerant (R-1234yf)

000000023899

Version 1.0

Revision Date 08.01.2019

Technical conditions and measures to control dispersion from source towards the worker

Mechanical ventilation giving at least [ACH]: 3; Room volume: >50 m³.; Local exhaust ventilation (Effectiveness: < 10 ppm)

Organisational measures to prevent /limit releases, dispersion and exposure

Use of ATEX 137 and ATEX 95 Directives to mitigate flammability properties of HFO-1234yf and/or Chemical Substances at Work (Directive 98/24/EC); Use of ISO 13043 (April 15, 2011) (Road vehicles – Refrigerant systems used in mobile air conditioning systems (MAC) – Safety requirements) and SAE J639 (Safety Standards for Motor Vehicle Refrigerant Vapor Compression Systems), SAE J2843 (R-1234yf [HFO-1234yf] Recovery/Recycling/Recharging Equipment for Flammable Refrigerants for Mobile Air-Conditioning Systems) and SAE J2845 (Technician Certification for Service and Containment of Refrigerants Used in Mobile A/C Systems); Regular inspection and maintenance of equipment and machines.; Ensure operatives are trained to minimise exposures.

Conditions and measures related to personal protection, hygiene and health evaluation

Use eye protection to EN 166 or ANSI Z87.1, designed to protect against liquid splashes. Wear suitable gloves tested to EN374 or complying with U.S. OSHA guidelines. For further specification, refer to section 8 of the SDS.

1.2.3 Control of worker exposure: Transfer of substance or preparation (charging/discharging) from/to vessels/large containers at dedicated facilities (PROC8b)

Product characteristic

Liquefied gas; Covers percentage substance in the product up to 100 % (unless stated differently)

Amounts used

Not applicable

Frequency and duration of use/exposure

Duration of use/exposure: Intermittent; <= 15 minutes/day

Frequency: 200 days/year

Other given operational conditions affecting service workers exposure

Outdoor use.

Assumes activities are at room temperature.

Technical conditions and measures at process level (source) to prevent release

Ensure that the valves of the cylinders are tightly closed and not leaking; Handle substance within a closed

SAFETY DATA SHEET

according to Regulation (EC) No. 1907/2006



Solstice® yf Refrigerant (R-1234yf)

000000023899

Version 1.0

Revision Date 08.01.2019

system; Transfer via enclosed lines; Clear transfer lines prior to de-coupling.

Technical conditions and measures to control dispersion from source towards the worker

Mechanical ventilation giving at least [ACH]: 3; Room volume: >50 m³.; Local exhaust ventilation (Effectiveness: < 10 ppm)

Organisational measures to prevent /limit releases, dispersion and exposure

Use of ATEX 137 and ATEX 95 Directives to mitigate flammability properties of HFO-1234yf and/or Chemical Substances at Work (Directive 98/24/EC); Use of ISO 13043 (April 15, 2011) (Road vehicles – Refrigerant systems used in mobile air conditioning systems (MAC) – Safety requirements) and SAE J639 (Safety Standards for Motor Vehicle Refrigerant Vapor Compression Systems), SAE J2843 (R-1234yf [HFO-1234yf] Recovery/Recycling/Recharging Equipment for Flammable Refrigerants for Mobile Air-Conditioning Systems) and SAE J2845 (Technician Certification for Service and Containment of Refrigerants Used in Mobile A/C Systems); Regular inspection and maintenance of equipment and machines.; Ensure operatives are trained to minimise exposures.

Conditions and measures related to personal protection, hygiene and health evaluation

Use eye protection to EN 166 or ANSI Z87.1, designed to protect against liquid splashes. Wear suitable gloves tested to EN374 or complying with U.S. OSHA guidelines. For further specification, refer to section 8 of the SDS.

1.3. Exposure estimation and reference to its source

1.3.1. Environmental release and exposure:

Release route	Release rate	Release factor estimation method
Water	0 kg/day.	Process and substance knowledge
Air	62.5 kg/day across EU-27+.	Process and substance knowledge
Soil	0 kg/day.	Process and substance knowledge

Protection target	Exposure concentration	Risk characterisation ratio (RCR)
Sewage treatment plant (STP)	Not released to STP	Not applicable
Freshwater	1.11E-10 mg/L	< 0.01
Sediment (freshwater)	1.67E-09 mg/kg dwt	< 0.01
Agricultural soil	1.97E-09 mg/kg dwt	< 0.01
Marine water	3.19E-11 mg/L	< 0.01

SAFETY DATA SHEET

according to Regulation (EC) No. 1907/2006



Solstice® yf Refrigerant (R-1234yf)

000000023899

Version 1.0

Revision Date 08.01.2019

Protection target	Exposure concentration	Risk characterisation ratio (RCR)
Sediment (marine water)	4.81E-10 mg/kg dwt	< 0.01
Man via the environment (local)	3.28E-06 mg/kg bw/day	< 0.01

1.3.2. Worker exposure: Transfer of substance or preparation into small containers (dedicated filling line, including weighing) (PROC9)

Route of exposure and type of effects	Exposure concentration (mg/m ³)	Source for exposure concentration	DNEL/DMEL (mg/m ³)	Risk characterisation ration (RCR)
Inhalation, systemic, long-term	37	Bureau Veritas North America, 2008; data generated on HFC-134a	950	0.039

1.3.3. Worker exposure: Transfer of substance or preparation (charging/discharging) from/to vessels/large containers at dedicated facilities (PROC8b)

Route of exposure and type of effects	Exposure concentration (mg/m ³)	Source for exposure concentration	DNEL/DMEL (mg/m ³)	Risk characterisation ration (RCR)
Inhalation, systemic, long-term	37	Bureau Veritas North America, 2008; data generated on HFC-134a	950	0.039

1.4. Guidance to DU to evaluate whether he works inside the boundaries set by the ES

No information on scaling available

Solstice® yf Refrigerant (R-1234yf)

000000023899

Version 1.0

Revision Date 08.01.2019

2. ES 2: Professional Use, Heat Transfer Fluids Refrigerants, Coolants

2.1 Title section

ES name: Professional Use, Heat Transfer Fluids Refrigerants, Coolants

Environment	
1: Widespread use of functional fluid	ERC9a/ERC9b
Worker	
2: Transfer of substance or preparation (charging/discharging) from/to vessels/large containers at non-dedicated facilities	PROC 8a

2.2. Conditions of use affecting exposure:

2.2.1 Control of environmental exposure: Widespread use of functional fluid (indoor/ outdoor) (ERC9a/9b)

Product Characteristics
Low global warming potential (GWP) liquefied gas; Covers percentage substance in the product up to 100 % (unless stated differently); Not biodegradable
Amounts used
19225 tonnes per annum (tpa); Daily amount: 52671 kg/day Fraction of EU tonnage to region: 0.1
Technical and organisational conditions and measures
Process designed to minimize releases to wastewater; Process designed to minimize releases to soil; Ensure that the valves of the cylinders are tightly closed and not leaking; Handle substance within a closed system; Transfer via enclosed lines; Clear transfer lines prior to de-coupling.
Organizational measures to prevent/limit release from site
Use of ATEX 137 and ATEX 95 Directives to mitigate flammability properties of HFO-1234yf and/or Chemical Substances at Work (Directive 98/24/EC); Regular inspection and maintenance of equipment and machines.
Conditions and measures related to municipal sewage treatment plant
No STP

2.2.2 Control of worker exposure: Transfer of substance or preparation (charging/discharging) from/to vessels/large containers at non-dedicated facilities (PROC8a)

SAFETY DATA SHEET

according to Regulation (EC) No. 1907/2006

Honeywell

Solstice® yf Refrigerant (R-1234yf)

000000023899

Version 1.0

Revision Date 08.01.2019

Product characteristic

Liquefied gas; Covers percentage substance in the product up to 100 % (unless stated differently);

Amounts used

Mobile A/C: 0.5 kg/service event; Stationary Equipment: 0.05 – 300 kg/service event

Frequency and duration of use/exposure

Duration of use/exposure: Intermittent; <= 1 minutes/day

Frequency: 200 days/year

Other given operational conditions affecting workers exposure

Indoor use.

Assumes activities are at room temperature.

Technical conditions and measures at process level (source) to prevent release

Ensure that the valves of the cylinders are tightly closed and not leaking; Handle substance within a closed system; Transfer via enclosed lines; Clear transfer lines prior to de-coupling.

Technical conditions and measures to control dispersion from source towards the worker

None

Organisational measures to prevent /limit releases, dispersion and exposure

Use of ATEX 137 and ATEX 95 Directives to mitigate flammability properties of HFO-1234yf and/or Chemical Substances at Work (Directive 98/24/EC); Use of ISO 13043 (April 15, 2011) (Road vehicles – Refrigerant systems used in mobile air conditioning systems (MAC) – Safety requirements) and SAE J639 (Safety Standards for Motor Vehicle Refrigerant Vapor Compression Systems), SAE J2843 (R-1234yf [HFO-1234yf] Recovery/Recycling/Recharging Equipment for Flammable Refrigerants for Mobile Air-Conditioning Systems) and SAE J2845 (Technician Certification for Service and Containment of Refrigerants Used in Mobile A/C Systems); EN 378:2007 (Refrigerating systems and heat pumps – Safety and environmental requirements); Regular inspection and maintenance of equipment and machines.; Ensure operatives are trained to minimise exposures.

Conditions and measures related to personal protection, hygiene and health evaluation

Use eye protection to EN 166 or ANSI Z87.1, designed to protect against liquid splashes. Wear suitable gloves tested to EN374 or complying with U.S. OSHA guidelines. For further specification, refer to section 8 of the SDS.

2.3. Exposure estimation and reference to its source

SAFETY DATA SHEET

according to Regulation (EC) No. 1907/2006

Honeywell

Solstice® yf Refrigerant (R-1234yf)

000000023899

Version 1.0

Revision Date 08.01.2019

2.3.1. Environmental release and exposure:

Release route	Release rate	Release factor estimation method
Water	0 kg/day.	Process and substance knowledge
Air	62.5 kg/day across EU-27+.	Process and substance knowledge
Soil	0 kg/day.	Process and substance knowledge

Protection target	Exposure concentration	Risk characterisation ratio (RCR)
Sewage treatment plant (STP)	Not released to STP	Not applicable
Freshwater	1.11E-10 mg/L	< 0.01
Sediment (freshwater)	1.67E-09 mg/kg dwt	< 0.01
Agricultural soil	1.97E-09 mg/kg dwt	< 0.01
Marine water	3.19E-11 mg/L	< 0.01
Sediment (marine water)	4.81E-10 mg/kg dwt	< 0.01
Man via the environment (local)	3.28E-06 mg/kg bw/day	< 0.01

2.3.2. Worker exposure: Transfer of substance or preparation (charging/discharging) from/to vessels/large containers at non-dedicated facilities (PROC8a)

Route of exposure and type of effects	Exposure concentration (mg/m ³)	Source for exposure concentration	DNEL/DME L (mg/m ³)	Risk characterisation ration (RCR)
Inhalation, systemic, long-term	85.6	Gjølstad et al., 2003; refrigeration repair workers' data generated on HFC-134a	950	0.09
	5.1	Bureau Veritas North America, 2007; mobile A/C workers; data generated on HFC-134a		0.005

2.4. Guidance to DU to evaluate whether he works inside the boundaries set by the ES

Solstice® yf Refrigerant (R-1234yf)

000000023899

Version 1.0

Revision Date 08.01.2019

No information on scaling available

3. ES 3: Formulation of Preparations

3.1 Title section

ES name: Formulation of Preparations

Environment	
1: Formulation of preparations	ERC2
Worker	
2: Use in closed batch process (synthesis or formulation)	PROC 3

3.2. Conditions of use affecting exposure:

3.2.1 Control of environmental exposure: Formulation of preparations (ERC2)

Product Characteristics
Low global warming potential (GWP) liquefied gas; Covers percentage substance in the product up to 100 % (unless stated differently); Not biodegradable
Amounts used
19225 tonnes per annum (tpa); Daily amount: 52671 kg/day Fraction of EU tonnage to region: 0.1
Technical and organisational conditions and measures
Process designed to minimize releases to wastewater; Process designed to minimize releases to soil; Ensure that the valves of the cylinders are tightly closed and not leaking; Handle substance within a closed system; Transfer via enclosed lines; Clear transfer lines prior to de-coupling.
Organizational measures to prevent/limit release from site
Use of ATEX 137 and ATEX 95 Directives to mitigate flammability properties of HFO-1234yf and/or Chemical Substances at Work (Directive 98/24/EC); Regular inspection and maintenance of equipment and machines.
Conditions and measures related to municipal sewage treatment plant
No STP

3.2.2 Control of worker exposure: Use in closed batch process (synthesis or formulation) (PROC3)

Solstice® yf Refrigerant (R-1234yf)

000000023899

Version 1.0

Revision Date 08.01.2019

Product characteristic

Liquefied gas; Covers percentage substance in the product up to 100 % (unless stated differently);

Amounts used

Up to 2 500 kg/shift – worker,

Frequency and duration of use/exposure

Duration of use/exposure: Intermittent; <= 15 minutes/day

Frequency: 200 days/year

Other given operational conditions affecting workers exposure

Outdoor use;

Assumes activities are at ambient temperature (unless stated differently).

Technical conditions and measures at process level (source) to prevent release

Ensure that the valves of the cylinders are tightly closed and not leaking; Handle substance within a closed system; Transfer via enclosed lines; Clear transfer lines prior to de-coupling.

Technical conditions and measures to control dispersion from source towards the worker

None

Organisational measures to prevent /limit releases, dispersion and exposure

Use of ATEX 137 and ATEX 95 Directives to mitigate flammability properties of HFO-1234yf and/or Chemical Substances at Work (Directive 98/24/EC); EN 378:2007 Regular inspection and maintenance of equipment and machines.; Ensure operatives are trained to minimise exposures.

Conditions and measures related to personal protection, hygiene and health evaluation

Use eye protection to EN 166 or ANSI Z87.1, designed to protect against liquid splashes. Wear suitable gloves tested to EN374 or complying with U.S. OSHA guidelines. For further specification, refer to section 8 of the SDS.

3.3. Exposure estimation and reference to its source

3.3.1. Environmental release and exposure:

Release route	Release rate	Release factor estimation method
Water	0 kg/day.	Process and substance knowledge

Solstice® yf Refrigerant (R-1234yf)

000000023899

Version 1.0

Revision Date 08.01.2019

Release route	Release rate	Release factor estimation method
Air	62.5 kg/day across EU-27+.	Process and substance knowledge
Soil	0 kg/day.	Process and substance knowledge

Protection target	Exposure concentration	Risk characterisation ratio (RCR)
Sewage treatment plant (STP)	Not released to STP	Not applicable
Freshwater	1.11E-10 mg/L	< 0.01
Sediment (freshwater)	1.67E-09 mg/kg dwt	< 0.01
Agricultural soil	1.97E-09 mg/kg dwt	< 0.01
Marine water	3.19E-11 mg/L	< 0.01
Sediment (marine water)	4.81E-10 mg/kg dwt	< 0.01
Man via the environment (local)	3.28E-06 mg/kg bw/day	< 0.01

3.3.2. Worker exposure: Use in closed batch process (synthesis or formulation) (PROC3)

Route of exposure and type of effects	Exposure concentration (mg/m ³)	Source for exposure concentration	DNEL/DMEL (mg/m ³)	Risk characterisation ratio (RCR)
Inhalation, systemic, long-term	17	TRA v.3 tool used to estimate exposure concentration	950	0.018

3.4. Guidance to DU to evaluate whether he works inside the boundaries set by the ES

No information on scaling available

SAFETY DATA SHEET

according to Regulation (EC) No. 1907/2006

Honeywell

Solstice® yf Refrigerant (R-1234yf)

000000023899

Version 1.0

Revision Date 08.01.2019

4. ES 4: Consumer Use, Heat Transfer Fluids Refrigerants, Coolants

4.1 Title section

ES name: Consumer Use, Heat Transfer Fluids Refrigerants, Coolants

Environment

1: Wide dispersive indoor/outdoor use of substances in closed systems	ERC9a/9b, ERC10a/11a
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Worker

2: Passenger-car use	PC16
3: Consumer exposure due to Recharging domestic/consumer vehicles	PC16

4.2. Conditions of use affecting exposure:

4.2.1 Control of environmental exposure: Wide dispersive use of substances in closed systems (ERC9a/9b), and Widespread use of articles with low release (ERC10a/11a)

Product Characteristics

Low global warming potential (GWP) liquefied gas; Covers percentage substance in the product up to 100 % (unless stated differently); Not biodegradable

Amounts used

19225 tonnes per annum (tpa); Daily amount: 52671 kg/day
Fraction of EU tonnage to region: 0.1

Technical and organisational conditions and measures

Process designed to minimize releases to wastewater; Process designed to minimize releases to soil; Ensure that the valves of the cylinders are tightly closed and not leaking; Handle substance within a closed system; Transfer via enclosed lines; Clear transfer lines prior to de-coupling.

Organizational measures to prevent/limit release from site

Use of ATEX 137 and ATEX 95 Directives to mitigate flammability properties of HFO-1234yf and/or Chemical Substances at Work (Directive 98/24/EC); Regular inspection and maintenance of equipment and machines.

Conditions and measures related to municipal sewage treatment plant

No STP

4.2.2 Control of consumer exposure: Passenger-car use (PC16)

Solstice® yf Refrigerant (R-1234yf)

000000023899

Version 1.0

Revision Date 08.01.2019

Product characteristic

Liquefied gas; Covers percentage substance in the product up to 100 % (unless stated differently);

Amounts used, Frequency and duration of use/exposure

Release rate to passenger/driver area: ≤ 5 g/year

Exposure time per day: ≤ 60 minutes

Other given operational conditions affecting consumer exposure

Room volume: ≥ 1.25 m³

Assumes activities are at room temperature.

4.2.3 Control of consumer exposure: recharging domestic/consumer vehicles (PC16)

Product characteristic

Liquefied gas; Covers percentage substance in the product up to 100 % (unless stated differently);

Amounts used, Frequency and duration of use/exposure

Amount of product available for exposure: ≤ 3 g

Exposure time per day: ≤ 10 minutes

Other given operational conditions affecting consumer exposure

Ventilation rate (number of air changes per minute): ≥ 0.025

Room volume: ≥ 34 m³

Assumes activities are at room temperature.

4.3. Exposure estimation and reference to its source

4.3.1. Environmental release and exposure:

Release route	Release rate	Release factor estimation method
Water	0 kg/day.	Process and substance knowledge
Air	62.5 kg/day across EU-27+.	Process and substance knowledge
Soil	0 kg/day.	Process and substance knowledge

Protection target	Exposure concentration	Risk characterisation ratio (RCR)
Sewage treatment plant (STP)	Not released to STP	Not applicable

SAFETY DATA SHEET

according to Regulation (EC) No. 1907/2006

Honeywell

Solstice® yf Refrigerant (R-1234yf)

000000023899

Version 1.0

Revision Date 08.01.2019

Protection target	Exposure concentration	Risk characterisation ratio (RCR)
Freshwater	1.11E-10 mg/L	< 0.01
Sediment (freshwater)	1.67E-09 mg/kg dwt	< 0.01
Agricultural soil	1.97E-09 mg/kg dwt	< 0.01
Marine water	3.19E-11 mg/L	< 0.01
Sediment (marine water)	4.81E-10 mg/kg dwt	< 0.01
Man via the environment (local)	3.28E-06 mg/kg bw/day	< 0.01

4.3.2. Consumer exposure: Passenger-car use (PC16)

Route of exposure and type of effects	Exposure concentration (mg/m ³)	Source for exposure concentration	DNEL/DMEL (mg/m ³)	Risk characterisation ration (RCR)
Inhalation, systemic, long-term				<1

4.3.3. Consumer exposure: recharging domestic/consumer vehicles (PC16)

Route of exposure and type of effects	Exposure concentration (mg/m ³)	Source for exposure concentration	DNEL/DMEL (mg/m ³)	Risk characterisation ration (RCR)
Inhalation, systemic, long-term	78	ConsExpo Web 1.0.5	186400	4.2E-4

4.4. Guidance to DU to evaluate whether he works inside the boundaries set by the ES

No information on scaling available