

Solstice® L40X (R-455A)

000000018891

Version 6.6

Revision Date 06.11.2025

Supersedes 5

SECTION 1: Identification of the substance/mixture and of the company/undertaking**1.1. Product identifier**

Product name : Solstice® L40X (R-455A)
SDS-number : 000000018891
Type of product : Mixture
Remarks : SDS according to Art. 31 of Regulation (EC) 1907/2006.

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

Use of the Substance/Mixture : Refrigerant
Uses advised against : Consumer use

1.3. Details of the supplier of the safety data sheet

Company : SOLSTICE ADVANCED MATERIALS IRELAND LIMITED
1st Floor, Liffey Trust Centre,
117-126 Sheriff Street Upper
D01 YC43 Dublin
Ireland
Solstice Advanced Materials
US, Inc.
115 Tabor Road
Morris Plains, NJ 07950-2546
USA
Telephone : +353 1 447 9350
For further information,
please contact: : SafetyDataSheet@solstice.com

1.4. Emergency telephone number

Emergency telephone number : +1-703-527-3887 (ChemTrec-Transport)
+1 303-739-1378 (Medical)
: Poison Control Center:
United Kingdom: (+44) 844 892 0111

SECTION 2: Hazards identification**2.1. Classification of the substance or mixture****REGULATION (EC) No 1272/2008**

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Flammable gases Category 1B
 H221 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	:	H221 H280	Flammable gas. Contains gas under pressure; may explode if heated.
Precautionary statements	:	P210 P260 P280 P284 P308 + P313 P410 + P403	Keep away from heat/ sparks/ open flames/ hot surfaces. No smoking. Do not breathe dust/ fume/ gas/ mist/ vapours/ spray. Wear protective gloves/ eye protection/ face protection. In case of inadequate ventilation wear respiratory protection. IF exposed or concerned: Get medical advice/ attention. Protect from sunlight. Store in a well-ventilated place.
Special labelling of certain products:	:	Contains fluorinated greenhouse gases	

2.3. Other hazards

Vapours are heavier than air and can cause suffocation by reducing oxygen available for breathing. Rapid evaporation of the liquid may cause frostbite. This substance/mixture contains no components considered to be either persistent, bioaccumulative and toxic (PBT), or very persistent and very bioaccumulative (vPvB) at levels of 0.1% or higher. The substance/mixture does not contain components considered to have endocrine disrupting properties according to REACH Article 57(f) or

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Commission Delegated regulation (EU) 2017/2100 or Commission Regulation (EU) 2018/605 at levels of 0.1% or higher.

SECTION 3: Composition/information on ingredients**3.1. Substances**

Not applicable

3.2. Mixtures

Chemical name	CAS-No. Index-No. EC-No.	Classification 1272/2008	Concentration	Remarks
2,3,3,3-Tetrafluoroprop-1-ene	754-12-1 468-710-7	Press. Gas Liquefied gas; H280 Flam. Gas 1B; H221	75,5 %	
Difluoromethane	75-10-5 200-839-4	Flam. Gas 1B; H221 Press. Gas ; H280	21,5 %	
Carbon dioxide	124-38-9 204-696-9	Press. Gas Liquefied gas; H280	3 %	

Remaining components of this product are non-hazardous and/or are present at concentrations below reportable limits.

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:

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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.

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:

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

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.

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

Treat frost-bitten areas as needed. Treat symptomatically.

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

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SECTION 5: Firefighting measures**5.1. Extinguishing media***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.

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.
Fire may cause evolution of:
Hydrogen fluoride
Carbonyl halides
Halogenated compounds
Carbon oxides

5.3. Advice for firefighters

In the event of fire and/or explosion do not breathe fumes.
Wear self-contained breathing apparatus and protective suit.
No unprotected exposed skin areas.
Use extinguishing measures that are appropriate to local circumstances and the surrounding environment.

SECTION 6: Accidental release measures**6.1. Personal precautions, protective equipment and emergency procedures**

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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

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

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.

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:*

Handle with care. Wear personal protective equipment. Do not breathe vapor. 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. Use authorized cylinders only. 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.

Hygiene measures:

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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 vapor. Avoid contact with skin, eyes and clothing.

7.2. Conditions for safe storage, including any incompatibilities
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. Store away from incompatible substances. Store in original container.

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		
Difluoromethane	HONEYWELL TWA	2.200 mg/m3 1.000 ppm		We are not aware of any national exposure limit.
Carbon dioxide	EH40 WEL TWA	9.150 mg/m3 5.000 ppm		
Carbon dioxide	EH40 WEL STEL	27.400 mg/m3 15.000 ppm		

WEEL - US Workplace Environmental Exposure Level

TWA - Time weighted average

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EH40 WEL - UK. EH40 Workplace Exposure Limits (WELs), as amended
 STEL - Short term exposure limit

DNEL/ PNEC-Values

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	Workers / Acute systemic effects		186400 mg/m ³	Inhalation	
2,3,3,3-Tetrafluoroprop-1-ene	Consumers / Acute systemic effects		186400 mg/m ³	Inhalation	
Difluoromethane	Workers / Long-term systemic effects		7035 mg/m ³	Inhalation	
Difluoromethane	Consumers / Long-term systemic effects		750 mg/m ³	Inhalation	
Carbon dioxide					No data available

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: 1,51 mg/kg	
2,3,3,3-Tetrafluoroprop-1-ene	Marine sediment: 0,151 mg/kg	
2,3,3,3-Tetrafluoroprop-1-ene	Soil: 1,49 mg/kg	

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Difluoromethane	Fresh water: 0,142 mg/l	Assessment factor: 1000
Difluoromethane	Fresh water sediment: 0,534 mg/kg dw	
Carbon dioxide	:	No data available

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.

Do not breathe vapor.

Engineering measures

Use with local exhaust ventilation.

Personal protective equipment

Respiratory protection:

In case of insufficient ventilation wear suitable respiratory equipment.

Self-contained breathing apparatus (EN 133)

Hand protection:

Protective gloves against cold
(EN 511)

Eye protection:

Safety goggles

Skin and body protection:

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

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

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- (a) Physical state : gaseous
- (b) Colour : clear
- (c) Odour : slight
- (d) Melting point/freezing point : No data available
- (e) Boiling point/boiling range : -52,1 °C
- (f) Flammability : Flammable gas with a fundamental burning velocity of less than 10 cm/s
- (g) Lower and upper explosion limit : Lower explosion limit
11,8 %(V)
23 °C
Lower flammability limit
: Upper explosion limit
12,9 %(V)
23 °C
Upper flammability limit
- (h) Flash point : Not applicable
- (i) Auto-ignition temperature : 473 - 477 °C
- (j) Decomposition temperature : No decomposition if used as directed.
- (k) pH : Not applicable
- (l) Viscosity, kinematic : No data available
- (m) Solubility(ies) : Water solubility:
No data available
- (n) Partition coefficient: n-octanol/water : No data available
- (o) Vapour pressure : 1.235 kPa

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at 21,1 °C

2.638 kPa
at 54,4 °C1.042 kPa
at 25 °C

(p) Density and / or relative density : 1,11 g/cm³

(q) Relative vapour density : No data available

(r) Particle characteristics : No data available

9.2 Other Information

Polymer characteristics : No data available

Hot Surface Ignition Temperature (HSIT): > 800 °C (method: ASTM D8211-18)

Evaporation rate : No data available

Viscosity, dynamic : No data available

SECTION 10: Stability and reactivity**10.1. Reactivity**

Stable under normal conditions.

10.2. Chemical stability

No decomposition if used as directed.

10.3. Possibility of hazardous reactions

Hazardous polymerisation does not occur.

10.4. Conditions to avoid

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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.
Some risk may be expected of corrosive and toxic decomposition products.

10.5. Incompatible materials

Strong oxidizing agents
Finely divided aluminium
Finely divided magnesium
Zinc

10.6. Hazardous decomposition products

Hydrogen fluoride
Carbonyl halides
Carbon monoxide
Carbon dioxide (CO₂)

SECTION 11: Toxicological information**11.1. Information on hazard classes as defined in Regulation (EC) No 1272/2008****(a) Acute toxicity**

Acute oral toxicity:
Not applicable

Acute dermal toxicity:
No data available

Acute inhalation toxicity:
LC₅₀
Species: Rat
Value: > 520000 ppm
Exposure time: 4 h
Test substance: Difluoromethane (HFC-32)

LC₅₀
Species: Rat
Value: > 400000 ppm
Exposure time: 4 h

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Test substance: 2,3,3,3-Tetrafluoroprop-1-ene

Acute toxicity (other routes of administration):

No data available

(b) Skin corrosion/irritation:

No data available

(c) Serious eye damage/eye irritation:

No data available

(d) Respiratory or skin sensitisation:

Cardiac sensitization

Species: dogs

Result: No effects observed for exposures up to 12% (120,189 ppm).

Test substance: 2,3,3,3-Tetrafluoroprop-1-ene

(h) STOT-single exposure:

No data available

(i) STOT - repeated exposure:

No data available

(j) Aspiration hazard:

No data available

11.2. Information on other hazards

Endocrine disrupting properties

No data available

Other information:

No data available

SECTION 12: Ecological information**12.1. Toxicity**

Toxicity to fish:

LC50

Species: Cyprinus carpio (Carp)

Value: > 197 mg/l

Exposure time: 96 h

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Test substance: 2,3,3,3-Tetrafluoroprop-1-ene

Toxicity to aquatic plants:

EC50

Species: *Scenedesmus capricornutum* (fresh water algae)

Value: > 100 mg/l

Test substance: 2,3,3,3-Tetrafluoroprop-1-ene

Toxicity to aquatic invertebrates:

EC50

Species: *Daphnia magna* (Water flea)

Value: > 83 mg/l

Exposure time: 48 h

Test substance: 2,3,3,3-Tetrafluoroprop-1-ene

12.2. Persistence and degradability*Biodegradability:*

Result: Not readily biodegradable.

Test substance: 2,3,3,3-Tetrafluoroprop-1-ene

12.3. Bioaccumulative potential

No data available

12.4. Mobility in soil

No data available

12.5. Results of PBT and vPvB assessment

No data available

12.6. Endocrine disrupting properties

No data available

12.7. Other adverse effects

Accumulation in aquatic organisms is unlikely.

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SECTION 13: Disposal considerations**13.1. Waste treatment methods***Product:*

Dispose according to legal requirements.

Packaging:

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**14.1 UN number or ID number**

ADR/RID:3161

IMDG:3161

IATA:3161

14.2 UN proper shipping name

ADR/RID:LIQUEFIED GAS, FLAMMABLE, N.O.S.(R-1234yf, DIFLUOROMETHANE)

IMDG:LIQUEFIED GAS, FLAMMABLE, N.O.S.(R-1234yf,DIFLUOROMETHANE)

IATA:Liquefied gas, flammable, n.o.s.(R-1234yf, Difluoromethane)

14.3 Transport hazard class(es)

ADR/RID:2.1

IMDG: 2.1

IATA: 2.1

14.4 Packaging group

No data available

14.5 Environmental hazards

ADR/RID:no

Marine pollutant: no

14.6 Special precautions for user

IMDG Code segregation group according chapter 3.1.4.4 : NONE,

14.7 Maritime transport in bulk according to IMO instruments

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No data available

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 Listed in Regulation : P2: Flammable gases	Quantity: 10 t Quantity: 50 t	
Substances of very high concern (SVHC)		This product does not contain substances of very high concern according to Regulation (EC) No Article 57 above the respective regulatory 1907/2006 (REACH), concentration limit of $\geq 0.1\%$ (w/w).
Regulation (EC) No. 1907/2006, Annex XIV		Not listed
Regulation (EC) No. 1907/2006, Annex XVII Number in Regulation: 40		Listed

Global warming potential :
148

Other inventory information

USA. List of Active Substances on the Toxic Substances Control Act (TSCA) Chemical Substances Inventory, as amended

All substances listed as active on the TSCA inventory

Australian Inventory of Industrial Chemicals

All components are listed on the inventory, regulatory obligations/restrictions apply

Canada. Domestic Substances List (DSL), as amended

All components of this product are on the Canadian DSL

Japan. Kashin-Hou Law List

On the inventory, or in compliance with the inventory

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Korea. Existing Chemicals Inventory (KECI)

On the inventory, or in compliance with the inventory

Philippines. Inventory of Chemicals and Chemical Substances (PICCS)

On the inventory, or in compliance with the inventory

China. Inventory of Existing Chemical Substances (IECSC)

On the inventory, or in compliance with the inventory

Thailand. Existing Chemicals Inventory from FDA (TECI List)

On the inventory, or in compliance with the inventory

Taiwan Chemical Substance Inventory (TCSI)

On the inventory, or in compliance with the inventory

15.2 Chemical safety assessment

A Chemical Safety Assessment has not been carried out.

SECTION 16: Other information**Text of H-statements referred to under heading 3**

2,3,3,3-Tetrafluoroprop-1-ene : H280 Contains gas under pressure; may explode if heated.
H221 Flammable gas.

Difluoromethane : H221 Flammable gas.
H280 Contains gas under pressure; may explode if heated.

Carbon dioxide : 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

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CAS Chemical Abstracts Service
DNEL Derived no effect level
PNEC Predicted no effect level
vPvB Very persistent and very bioaccumulative substance
PBT Persistent, bioaccumulative and 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.

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