

**00000022311**

Version 1.2

Revision Date 08/17/2018

Print Date 05/21/2021

**SECTION 1. IDENTIFICATION**

Product name : Solstice® 452A

Number : 00000022311

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 colourless

Odor : slight ether-like

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**Classification of the substance or mixture**

Classification of the substance or mixture : Gases under pressure, Liquefied gas  
Simple Asphyxiant

**GHS Label elements, including precautionary statements**

Symbol(s) :



Signal word : Warning

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

Precautionary statements : **Prevention:**  
Wear protective gloves/protective clothing/eye protection/face protection.

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

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

**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 : Mixture

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| Chemical name                 | CAS-No.  | Concentration |
|-------------------------------|----------|---------------|
| Pentafluoroethane             | 354-33-6 | 59.00 %       |
| 2,3,3,3-Tetrafluoroprop-1-ene | 754-12-1 | 30.00 %       |
| Difluoromethane               | 75-10-5  | 11.00 %       |

**SECTION 4. FIRST AID MEASURES**

- General advice : First aider needs to protect himself. Move out of dangerous area. Take off all contaminated clothing immediately.
- Inhalation : Move to fresh air. If breathing is irregular or stopped, administer artificial respiration. Use oxygen as required, provided a qualified operator is present. Call a physician. Do not give drugs from adrenaline-ephedrine group.
- Skin contact : After contact with skin, wash immediately with plenty of water. 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. If symptoms persist, call a physician.
- 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. If symptoms persist, call a physician.
- Ingestion : As this product is a gas, refer to the inhalation section. Do not induce vomiting without medical advice. Call a physician immediately.

**Notes to physician**

- Indication of immediate medical attention and special treatment needed, if necessary : Because of the possible disturbances of cardiac rhythm, catecholamine drugs, such as epinephrine, should be used with special caution and only in situations of emergency life support. Treatment of overexposure should be directed at the

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control of symptoms and the clinical conditions. Treat frost-bitten areas as needed.

**SECTION 5. FIREFIGHTING MEASURES**

- Suitable extinguishing media : The product is not flammable.  
ASHRAE 34  
Use water spray, alcohol-resistant foam, dry chemical or carbon dioxide.  
Use extinguishing measures that are appropriate to local circumstances and the surrounding environment.
- Specific hazards during firefighting : Contents under pressure.  
This product is not flammable at ambient temperatures and atmospheric pressure.  
However, this material can ignite when mixed with air under pressure and exposed to strong ignition sources.  
Container may rupture on heating.  
Cool closed containers exposed to fire with water spray.  
Do not allow run-off from fire fighting to enter drains or water courses.  
Vapours are heavier than air and can cause suffocation by reducing oxygen available for breathing.  
Fire may cause evolution of:  
Halogenated compounds  
Hydrogen fluoride  
Carbonyl halides  
Carbon oxides
- Special protective equipment 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.

**SECTION 6. ACCIDENTAL RELEASE MEASURES**

- 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

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must be kept away.  
Remove all sources of ignition.  
Avoid skin contact with leaking liquid (danger of frostbite).  
Ventilate the area.  
After release, disperses into the air.  
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.

Methods and materials for containment and cleaning up : Ventilate the area.

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

Precautions for safe handling : Handle with care.  
Avoid inhalation of vapour or mist.  
Do not get in eyes, on skin, or on clothing.  
Wear personal protective equipment.  
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 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 pierce or burn, even after use. Do not spray on a naked flame or any incandescent material.  
Do not remove screw cap until immediately ready for use.  
Always replace cap after use.

Advice on protection against fire and explosion : The product is not flammable.  
Can form a combustible mixture with air at pressures above

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atmospheric pressure.  
Normal measures for preventive fire protection.

**Storage**

Conditions for safe storage, including any incompatibilities : 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.  
Storage rooms must be properly ventilated.  
Ensure adequate ventilation, especially in confined areas.  
Protect cylinders from physical damage.

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

Engineering measures : General room ventilation is adequate for storage and handling. Perform filling operations only at stations with exhaust ventilation facilities.

Eye protection : Wear as appropriate:  
Safety glasses with side-shields  
If splashes are likely to occur, wear:  
Goggles or face shield, giving complete protection to eyes

Skin and body protection : Wear suitable protective equipment.  
Wear as appropriate:  
Protective suit

Respiratory protection : In case of insufficient ventilation, wear suitable respiratory equipment.  
Wear a positive-pressure supplied-air respirator.  
Vapours are heavier than air and can cause suffocation by reducing oxygen available for breathing.  
For rescue and maintenance work in storage tanks use self-contained breathing apparatus.

Hygiene measures : Handle in accordance with good industrial hygiene and safety practice.  
Ensure adequate ventilation, especially in confined areas.

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Avoid contact with skin, eyes and clothing.  
 Remove and wash contaminated clothing before re-use.  
 Keep working clothes separately.  
 When using, do not eat, drink or smoke.

**Exposure Guidelines**

| Components                    | CAS-No.  | Value                               | Control parameters                     | Update     | Basis  |
|-------------------------------|----------|-------------------------------------|--|------------|--|
| Pentafluoroethane             | 354-33-6 | TWA :<br>Time weighted average      | 4,900 mg/m <sup>3</sup><br>(1,000 ppm) | 2007       | WEEL:US. OARS.<br>WEELs Workplace Environmental Exposure Level Guide |
| Pentafluoroethane             | 354-33-6 | TWA :<br>Time weighted average      | (1,000 ppm)                            |            | Honeywell:Limit established by Honeywell International Inc.          |
| 2,3,3,3-Tetrafluoroprop-1-ene | 754-12-1 | TWA :<br>Time weighted average      | (500 ppm)                              | 2009       | WEEL:US. OARS.<br>WEELs Workplace Environmental Exposure Level Guide |
| 2,3,3,3-Tetrafluoroprop-1-ene | 754-12-1 | TWA :<br>Time weighted average      | (500 ppm)                              | 03 15 2010 | Honeywell:Limit established by Honeywell International Inc.          |
| 2,3,3,3-Tetrafluoroprop-1-ene | 754-12-1 | STEL :<br>Short term exposure limit | (1,500 ppm)                            | 03 15 2010 | Honeywell:Limit established by Honeywell International Inc.          |

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|                 |         |                                      |  |      |   |
|-----------------|---------|--------------------------------------|--|------|---|
| Difluoromethane | 75-10-5 | TWA :<br>Time<br>weighted<br>average | 2,200 mg/m <sup>3</sup><br>(1,000 ppm) | 2007 | WEEL:US. OARS.<br>WEELs Workplace<br>Environmental<br>Exposure Level<br>Guide |
| Difluoromethane | 75-10-5 | TWA :<br>Time<br>weighted<br>average | (1,000 ppm)                            | 1994 | Honeywell:Limit<br>established by<br>Honeywell<br>International Inc.          |

**SECTION 9. PHYSICAL AND CHEMICAL PROPERTIES**

|                             |                           |
|-----------------------------|---------------------------|
| Physical state              | : Liquefied gas           |
| Color                       | : clear colourless        |
| Odor                        | : slight ether-like       |
| Odor threshold              | : Note: no data available |
| pH                          | : Note: no data available |
| Melting point/range         | : Note: no data available |
| Boiling point/boiling range | : Note: no data available |
| Flash point                 | : Note: Not applicable    |
| Flammability                | : does not ignite         |
| lower flammability limit    | : Note: Not applicable    |



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|  |                                   |
|--|-----------------------------------|
| upper flammability limit               | : Note: Not applicable            |
| Vapor pressure                         | : 1.07 MPa<br>at 21.1 °C(70.0 °F) |
| Vapor density                          | : Note: no data available         |
| Density                                | : 1.14 g/cm <sup>3</sup>          |
| Water solubility                       | : Note: negligible                |
| Partition coefficient: n-octanol/water | : Note: no data available         |
| Ignition temperature                   | : Note: no data available         |
| Decomposition temperature              | : Note: no data available         |

**SECTION 10. STABILITY AND REACTIVITY**

|                                    |  |
|------------------------------------|--|
| Chemical stability                 | : Stable under normal conditions.  |
| Possibility of hazardous reactions | : Hazardous polymerisation does not occur.   |
| Conditions to avoid                | : Pressurized container. Protect from sunlight and do not expose to temperatures exceeding 50 °C.<br>Decomposes under high temperature.<br>Some risk may be expected of corrosive and toxic decomposition products.<br>Can form a combustible mixture with air at pressures above atmospheric pressure.<br>Do not mix with oxygen or air above atmospheric pressure. |
| Incompatible materials             | : Alkali metals  |

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

Hazardous decomposition products : In case of fire hazardous decomposition products may be produced such as:  
Halogenated compounds  
Hydrogen fluoride  
Carbonyl halides  
Carbon monoxide  
Carbon dioxide (CO<sub>2</sub>)

**SECTION 11. TOXICOLOGICAL INFORMATION**

Acute inhalation toxicity  
Pentafluoroethane : > 769000 ppm  
Exposure time: 4 h  
Species: Rat

2,3,3,3-Tetrafluoroprop-1-ene : LC50: > 400000 ppm  
Exposure time: 4 h  
Species: Rat  
Method: OECD Test Guideline 403

Difluoromethane : LC50: > 520000 ppm  
Exposure time: 4 h  
Species: Rat

Skin irritation  
2,3,3,3-Tetrafluoroprop-1-ene : Note: Not applicable  
study technically not feasible

Eye irritation  
2,3,3,3-Tetrafluoroprop-1-ene : Note: Not applicable  
study technically not feasible

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## Sensitisation

Pentafluoroethane

: Cardiac sensitization  
Species: dogs  
Note: No-observed-effect level  
75 000 ppm  
Lowest observed effect level  
100 000 ppm

2,3,3,3-Tetrafluoroprop-1-ene

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

Difluoromethane

: Cardiac sensitization  
Species: dogs  
Note: No-observed-effect level  
>350 000 ppm

## Repeated dose toxicity

Pentafluoroethane

: Species: Rat  
Application Route: Inhalation  
Exposure time: (4 Weeks)  
NOEL: 50000 ppm  
Subchronic toxicity

2,3,3,3-Tetrafluoroprop-1-ene

: 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

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Species: Rabbit, male  
Application Route: Inhalation  
Exposure time: (28 d)  
No-observed-effect level: 500 ppm  
Method: OECD Test Guideline 412  
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)  
No-observed-effect level: 1000 ppm  
Method: OECD Test Guideline 412  
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  
highest exposure tested

Difluoromethane : Species: Rat  
Application Route: Inhalation  
Exposure time: (90 d)  
NOEL: 50000 ppm  
Subchronic toxicity

Genotoxicity in vitro  
Pentafluoroethane : Test Method: Ames test  
Result: negative

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

Difluoromethane : Test Method: Ames test  
Result: negative

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- : Cell type: Human lymphocytes  
Result: negative
- : Cell type: Chinese Hamster Ovary Cells  
Result: negative
- : Test Method: Chromosome aberration test in vitro  
Cell type: Human lymphocytes  
Result: negative  
Method: OECD Test Guideline 473  
Note: Dose 760,000 ppm
- : Cell type: Human lymphocytes  
Result: negative  
Method: Mutagenicity (in vitro mammalian cytogenetic test)
- : Test Method: Chromosome aberration test in vitro  
Result: negative

Genotoxicity in vivo  
2,3,3,3-Tetrafluoroprop-1-  
ene

- : Species: Mouse  
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

Difluoromethane

- : Species: Mouse  
Cell type: Bone marrow  
Method: Mutagenicity (micronucleus test)  
Result: negative

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**Carcinogenicity**

2,3,3,3-Tetrafluoroprop-1-ene

: Species: Rat

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

**Teratogenicity**

Pentafluoroethane

: Species: Rabbit

Application Route: Inhalation exposure

NOAEL, Teratog: 50,000 ppm

NOAEL, Maternal: 50,000 ppm

Note: Did not show teratogenic effects in animal experiments.

Species: Rat

Application Route: Inhalation exposure

NOAEL, Teratog: 50,000 ppm

NOAEL, Maternal: 50,000 ppm

Note: Did not show teratogenic effects in animal experiments.

Difluoromethane

: Species: Rat

Dose: NOEL - 50,000 ppm

Note: Did not show teratogenic effects in animal experiments.

Species: Rabbit

Dose: NOEL - 50,000 ppm

Note: Did not show teratogenic effects in animal experiments.

Further information

: Note: Rapid evaporation of the liquid may cause frostbite. Vapours are heavier than air and can cause suffocation by reducing oxygen available for breathing. Handle in accordance with good industrial hygiene and safety practice.

**SECTION 12. ECOLOGICAL INFORMATION**

Toxicity to fish

2,3,3,3-Tetrafluoroprop-1-

: LC50: &gt; 197 mg/l

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ene 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  
2,3,3,3-Tetrafluoroprop-1-ene : EC50: > 83 mg/l  
Exposure time: 48 h  
Species: Daphnia magna (Water flea)  
Method: OECD Test Guideline 202

Toxicity to algae  
2,3,3,3-Tetrafluoroprop-1-ene : EC50: > 100 mg/l  
Species: Scenedesmus capricornutum (fresh water algae)  
Method: OECD Test Guideline 201

Bioaccumulation  
2,3,3,3-Tetrafluoroprop-1-ene : Note: Due to the distribution coefficient n-octanol/water, accumulation in organisms is not expected.

Biodegradability  
Pentafluoroethane : Result: Not readily biodegradable.  
Value: 5 %  
Method: OECD 301 D

2,3,3,3-Tetrafluoroprop-1-ene : Result: Not readily biodegradable.  
Method: OECD Test Guideline 301F

Difluoromethane : Note: Minimal

**Further information on ecology**

Additional ecological information : This product is subject to U.S. Environmental Protection Agency Clean Air Act Regulations at 40 CFR Part 82. This product contains greenhouse gases which may contribute to global warming. Do NOT vent to the atmosphere. To comply with provisions of the U.S. Clean Air Act, any residual must be recovered.

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**SECTION 13. DISPOSAL CONSIDERATIONS**

- Disposal methods : Observe all Federal, State, and Local Environmental regulations.
- Note : This product is subject to U.S. Environmental Protection Agency Clean Air Act Regulations Section 608 in 40 CFR Part 82 regarding refrigerant recycling.

**SECTION 14. TRANSPORT INFORMATION**

- DOT**
- |                      |   |
|----------------------|---|
| UN/ID No.            | : UN 3163   |
| Proper shipping name | : LIQUEFIED GAS, N.O.S.<br>(Pentafluoroethane, R-1234yf, Difluoromethane) |
| Class                | : 2.2   |
| Packing group        |   |
| Hazard Labels        | : 2.2   |
- IATA**
- |  |   |
|--|---|
| UN/ID No.                                | : UN 3163   |
| Description of the goods                 | : LIQUEFIED GAS, N.O.S.<br>(Pentafluoroethane, R-1234yf, Difluoromethane) |
| Class                                    | : 2.2   |
| Hazard Labels                            | : 2.2   |
| Packing instruction (cargo aircraft)     | : 200   |
| Packing instruction (passenger aircraft) | : 200   |
- IMDG**
- |                          |   |
|--------------------------|---|
| UN/ID No.                | : UN 3163   |
| Description of the goods | : LIQUEFIED GAS, N.O.S.<br>(PENTAFLUOROETHANE, R-1234yf, DIFLUOROMETHANE) |
| Class                    | : 2.2   |
| Hazard Labels            | : 2.2   |
| EmS Number               | : F-C, S-V  |
| Marine pollutant         | : no  |



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**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. 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 : 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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|                             |   |  |
|-----------------------------|---|--|
| <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> | : | Sudden Release of Pressure Hazard<br>Acute Health Hazard   |
| <b>California Prop. 65</b>  | : |  <b>WARNING:</b> This product can expose you to chemicals, listed below, known to the State of California to cause cancer and birth defects or other reproductive harm. For more information go to <a href="http://www.P65Warnings.ca.gov">www.P65Warnings.ca.gov</a> .<br>Dichloromethane 75-09-2<br>Chloromethane 74-87-3 |
| <b>Massachusetts RTK</b>    | : | Dichloromethane 75-09-2  |
| <b>Pennsylvania RTK</b>     | : | Difluoromethane 75-10-5  |

**SECTION 16. OTHER INFORMATION**

|                 | <b>HMIS III</b> | <b>NFPA</b> |
|-----------------|-----------------|-------------|
| Health hazard   | : 1             | 2           |
| Flammability    | : 1             | 1           |
| Physical Hazard | : 1             |             |
| Instability     | :               | 0           |

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,

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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.

Previous Issue Date: 09/01/2017

Prepared by Honeywell Performance Materials and Technologies Product Stewardship Group