

Solstice® PF-C

Technical Bulletin

Introduction

Solstice PF-C is a member of the Solstice Performance Fluid solvent platform that lends itself to use in a variety of industrial and consumer applications. Potential applications can range from aerosolized coatings and adhesives, to household and industrial cleaning formulations, including but not limited to:

- Flux from printed circuit boards
- Metal parts, such as automotive parts, aerospace components
- Household cleaning, such as spot removal

Characteristics

Solstice PF-C is an effective ingredient that provides formulators the ability to 1) manage solubility of other key ingredients, 2) assist in flame suppression, and 3) enhance cleaning power by the removal of industrial oils from a surface. Solstice PF-C has low surface tension, allowing excellent surface wetting, even in the smallest of spaces; a high solvency power to dissolve a range of oils (industrial, household, personal care) and is nonflammable. Solstice PF-C offers broad use options to formulators and end-users.

Applications

Solstice PF-C can be used:

- 1) In cleaning applications
 - a. To increase cleaning efficacy and/or provide flame suppression for aerosol solvent based formulations,
 - b. As a solvent for flushing used in conjunction with the Ekoflush machine to remove old lubricants, solids and acids from A/C and refrigeration circuits, during a refrigerant change out or after a compressor failure,
- 2) As a carrier fluid for coatings and adhesives formulations, to dissolve other key ingredients, lower flammability and increase surface wetting
- 3) In home care formulations, utilizing high cleaning efficiency in textile spot removers, such as nylon carpet, and other household products.



Table 1. Physical Properties

Chemical Family	HFO
Formula	Trans-1-chloro-3,3,3-trifluoropropene CF ₃ -CH=CClH
Molecular Weight	130
Appearance	Colorless
Boiling Point	19°C / 68°F
Latent Heat of Vaporization at Boiling	194 kJ/kg / 83.4 BTU/lb
Freezing Point	-107°C / -161°F
Vapor Pressure at 25°C	126 kPa
Liquid Density at 25°C	1.26 g/mL
Surface Tension at 25°C	12.7 dyne/cm
Solubility of water in solvent at 25°C	460 ppm
KB Value	25

Cleaning Formulations

Effective solvent cleaning is very dependent on the oils being removed from the substrate. Combinations with different hydrocarbon solvents may be used to maximize solubility and removal of the oil. Non-flammable blends can be formulated by adding Solstice PF-C to other cleaning agents. The results provided in Table 2 illustrate how blending with Solstice PF-C can reduce the flammability of commonly used hydrocarbon solvents, such as used in aerosol based cleaning solutions. Your specific formulation incorporating PF-C would require flash point or other flammability testing to confirm it is non-flammable.

Carrier Fluid

The combination of its high solvency and desirable safety and environmental attributes make Solstice PF-C an effective carrier fluid. For example, in clear coat formulations for automotive refinishing, Solstice PF-C used at levels up to 20% in the formulation increased the solids content by 4% without affecting the coating flow, leveling or curing properties. Comparing a formulation with PF-C to a commercial formula, basic paint properties were not compromised.

Table 2. Flash Point Testing of Solstice PF-C Co-solvent Blends

Mixture	Amount of Solstice PF-C wt% to Achieve Non-flammability*	Flash Point Pure Flammable Component
Acetone / Solstice PF-C	60	Acetone: -0.4°F -18°C
Toluene/ Solstice PF-C	15	Toluene: 43°F 6.1°C
Ethyl Acetate / Solstice PF-C	40	Ethyl Acetate: 25°F -3.9°C
Heptane / Solstice PF-C	15	Heptane: 25°F -3.9°C
Varnish Makers & Painters Naphtha (VM&P)/Solstice PF-C	10	VM&P: ~32°F 0°C
IPA / Solstice PF-C	10	IPA: 54°F 12.2°C
Ethanol / Solstice PF-C	10	Ethanol: 55°F 12.8°C

*As determined by Seta Flash closed cup flash point test at 70°F according to ASTM D3278

Home Care

Solstice PF-C can be formulated into textile spot cleaners to lower product flammability, while its powerful solvency improves the removal of oils, greases, and hydrocarbon-based stains. It is strongly suggested to check for compatibility of your specific resin and dyes used with Solstice PF-C.

Table 3. Solstice PF-C in a Desmodur N3300 Coating

Solvent (Reducer) Composition	Gel Time, Minutes	Weight % Solids	Calculated Volume % Solids	ASTM D4212 Dry to Touch Time	Tape Free Time, Hours	Flow and Leveling Score, 10 = Perfect (no coating is perfect)
Solstice PF-C/Xylene/MAK (20/40/40 wt.%)	80	47.5	56	50	4	9
Solstice PF-C/TBAC/PCBTF (20/40/40 wt%)	45	51.6	66	60	4	8
TBAC	95	45.1	52	65	5	7
PCBTF	118	34.8	50	75	6	9
Xylene	105	45.2	52	75	5	7
Toluene	160	45.7	53	60	5	6
MAK	120	48.7	56	60	5	7

Environment and Safety

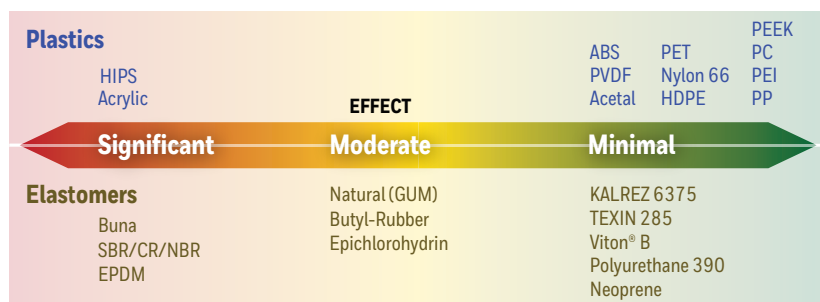
Solstice PF-C is non-ozone-depleting (ODP ~ 0) and has an ultra-low global warming potential (GWP=1). The Maximum Incremental Reactivity (MIR) also indicates that Solstice PF-C will create less ground-level ozone or smog than ethane. Solstice PF-C is nonflammable (ASTM E-681). It doesn't have a flash point or vapor flame limits up to 100°C, the highest temperature tested.

Stability and Compatibility

Solstice PF-C has been determined to be compatible with stainless steel, cold rolled steel, galvanized steel, copper, iron and aluminum with or without excess water, and with commonly-used metal and plastic packaging materials. The tests were conducted by refluxing the solvent for two weeks in the presence of the metal and water. At the conclusion of the test no chemical breakdown of the solvent was observed. For compatibility of Solstice PF-C with common plastics and elastomers can be found in Figure 1.

The electrical stability of Solstice PF-C is also very high. The dielectric strength of Solstice PF-C is 18.0 kV for a one-inch gap. This dielectric strength is 2.5 times higher than nitrogen.

Figure 1: Plastics and Elastomer Compatibility with Solstice PF/PF-2A



Because of the many grades of plastics and elastomers available, Honeywell suggests to always test your specific plastic/elastomer with Solstice Performance Fluids

Storage and Handling

Honeywell recommends reading the Safety Data Sheet (SDS) before using the product. Honeywell SDSs are located at www.honeywell-solvents.com/resources/product-literature/. Solstice PF-C is non-flammable and is resistant to thermal and hydrolytic breakdown. Ensure that all containers are rated for the storage of Solstice PF-C before transferring. Solstice PF-C is shipped in cylinders.

Package Sizes

Solstice PF-C is available in a variety of packaging sizes from 50 lb (22.7 kg) cylinders to ISO bulk containers.

Table 4. Environment and Safety

Vapor Flame Limits	None
Flash Point	None
LFL / UFL (%vol)	None
VOC (U.S. EPA)	Exempt
REACH	Registered
OEL	800 ppm
ODP	~0*
GWP rev 3rd/4th/5th IPCC, 100 year	1

*No impact on ozone layer depletion (K.O. Patten, D.J. Wuebbles, Atmos. Chem. Phys., 10, 10867–10874, 2010)

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