

# **SOLSTICE® PERFORMANCE FLUID**

Technical Bulletin





# Solstice<sup>®</sup> Performance Fluid

## Introduction

Honeywell's Solstice Performance Fluid (PF) is a highly effective cleaning solution that is non-flammable, has favorable toxicity properties and a low global warming potential. Solstice PF is suitable for electronics, metal, medical and precision cleaning. It can be used in vapor degreasing equipment and may be dispensed from an aerosol can.

Solstice PF has been shown to have desirable environmental properties, specifically negligible ozone depletion, ultra-low MIR and a global warming potential of 1. It is also not a volatile organic compound (VOC) as determined by the U.S. EPA. With these exceptional environmental properties and good solvency, Solstice PF is an excellent choice for a variety of cleaning applications.

## Physical Properties

Select physical properties of Solstice PF are given in *Table 1*. With a high heat of vaporization, Solstice PF will remain a liquid for an extended period of time even at room temperature. The vapor pressure of Solstice PF will facilitate quick evaporation and drying of cleaned materials. The low surface tension gives good wetting of the parts to be cleaned and facilitates the rapid cleaning of intricate pieces and parts that contain small channels.

PROPERTY	SOLSTICE PF
Chemical name	trans-1-chloro-3,3,3-trifluoropropene
Molecular Formula	CF <sub>3</sub> – CH = CClH
Molecular Weight	130
Boiling Point	66°F 19°C
Latent Heat of Vaporization at boiling point	83.4 BTU/lb 194 kJ/kg
Freezing Point	-161°F -107°C
Vapor Pressure at 77°F (25°C)	18.6 psia 126 kPa
Liquid Density at 77°F (25°C)	10.5 lb/gal 1.26 gm/mL
Surface Tension at 77°F (25°C)	12.7 dyne/cm
Liquid Viscosity at 77°F (25°C)	0.446 cP
Solubility of water in solvent at 25°C	460 ppm
KB value	25

**Table 1.** Physical Properties of Solstice PF

## Environmental and Safety

It is extremely important to consider the effect on the surrounding area and the safety of those who come in contact with a cleaning solution. The environmental impact of Solstice PF has been studied and is shown to have negligible ozone depletion and a very low global warming potential. The MIR also indicates that Solstice PF will create less ground level ozone or smog than ethane. *Table 2* lists a few of the important environmental and safety properties of Solstice PF. Solstice PF has also been found to be completely non-flammable in that it does not have a flash point or vapour flame limits up to 100°C, which was the highest temperature tested.

PROPERTY	SOLSTICE PF
Flash Point	None
Lower Flame Limit, vol %	None
OEL (PPM)	800
GWP (100-year)	1
VOC (U.S.)	Exempt

**Table 2.** Environmental and Safety Properties of Solstice PF

## Cleaning Effectiveness

Solstice® PF is a very effective cleaning solution for aliphatic and fluorinated soils as well as silicone and glycol. A list of common soils that Solstice PF can remove is given in Table 3. Solstice PF is such an effective cleaning solution that even at -40°C a 50:50 wt mixture of Solstice PF with a mineral oil, high viscosity silicone oil or cutting oil will remain a single phase.

SOILS THAT CAN BE CLEANED WITH SOLSTICE PF	
Mineral Oils	Heavy Grease
Silicone Oils	Vacuum Oils
Silicone Grease	Refrigerant Oils
Cutting Oils	Fluorinated Oils

Table 3. Example of soils that can be readily cleaned with Solstice PF

## Plastic and Elastomer Compatibility

A variety of different polymers and elastomers may need to be cleaned or can be encountered in cleaning equipment. Solstice PF is compatible with a large number of commonly used plastics and elastomers. Even for a single plastic or elastomer type there can be large variability among grades so that specific materials should be tested before use. Table 4 summarizes a two-week full immersion study of unstressed plastics and elastomers that looked at the compatibility of Solstice PF.

## Recycling and Solvent Recovery

Solstice PF can be recovered or recycled by simple flash distillation or through carbon absorption with steam desorption. Since Solstice PF is a pure component and does

not require a stabilizer there is no issue in vapor recovery. In addition Solstice PF has been tested with a typical carbon absorption steam desorption system and was found to be hydrolytically stable with no breakdown seen in either the recovered Solstice PF or in the water. This will allow for multiple ways to recover and recycle Solstice PF in a system. Additional data about the carbon absorption study is available from Honeywell.

## Stability

Solstice PF has been determined to be compatible with stainless steel, cold rolled steel, galvanized steel, copper, iron and aluminum with or without excess water. 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.

The electrical stability of Solstice PF is also very high. The dielectric strength of Solstice PF is 18.0 kV for a one- inch gap. This dielectric strength is 2.5 times higher than nitrogen and 1.2 times higher than that of CFC-113.

## Storage and Handling

Solstice PF is non-flammable and is resistant to thermal and hydrolytic breakdown. Ensure that all containers are rated for the storage of Solstice PF when transferring. Solstice PF will be shipped in cylinders or properly pressure rated drums.

PLASTICS			ELASTOMERS		
Minimal Effect		Significant Effect	Minimal Effect	Moderate Effect	Significant Effect
ABS	PTFE	HIPS	VITON® B	Natural (GUM)	SBR/CR/ NBR
PVDF	NYLON 66	Acrylic	Polyurethane 390	Butyl-Rubber	EPDM
ACETAL	PVC		TEXIN® 285	Epichlorohydrin	BUNA-NITRILE
PET	Poly-Carbonate		NEOPRENE		
HDPE	Polypropylene		KALREZ® 6375		
PEEK	Polyetherimide				

Table 4. Solstice PF Compatibility with Plastics and Elastomers

## Solvent Comparison

Solstice® PF is a highly effective cleaner that has favorable environmental, flammability and toxicity properties. The physical properties of Solstice PF are compared with other solvents in *Table 5*.

SOILS THAT CAN BE CLEANED WITH SOLSTICE PF									
Property	Solstice PF	HFC-4310-mee	HFE-7100	NPB	Perchloro ethylene	Trichloro ethylene	HCFC – 225ca	Modified Alcohol PnB	Iso-Parafin
Boiling Point (°C)	19	54	61	71	121	87	54	170	~180
Liquid Density (@ 25°C g/mL)	1.26	1.58	1.51	1.34	1.61	1.46	1.55	0.87	0.76
Surface Tension (@ 25°C dyne/cm)	12.7	13.2	13.6	25	31.6	29	16.2	26.6	23
Heat of Vaporization at Boiling Point (kJ/kg)	194	130	112	246	210	236	145	318	N/A
KB Value	25	9	10	125	90	129	31	N/A	26
Flash Point (°C)	None	None	None	None	None	None	None	59	53
OEL (PPM)	800	200	750	1-100	20	10	100	200	177
GWP (100 Year)	1	1700	320	0.31	800	140	370	N/A	N/A
VOC (U.S.)	Exempt	Exempt	Exempt	Non-Exempt	Exempt	Non-Exempt	Exempt	Non-Exempt	Non-Exempt

**Table 5.** Comparison of Solvent Physical Properties



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