



# Opteon™ SF10

Specialty Fluid

## Specialty Fluids for Heat Transfer Applications

### Technical Information

#### Introduction

Opteon™ SF10 specialty fluid is a clear, colorless, nonflammable, thermally stable, specialty fluid developed in response to a global market demand for a low environmental impact thermal management technology. Opteon™ SF10 specialty fluid has a boiling point of 110 °C (230 °F), zero ozone depletion potential (ODP), and a very low global warming potential (GWP) of 2.5 (100-yr ITH). The combination of favorable properties and attractive environmental profile makes Opteon™ SF10 specialty fluid a significant alternative for replacement of PFCs, PFPEs, HFEs, HFCs, and HCFCs in heat transfer applications, as well as reduction of greenhouse gas emissions.

#### Typical Applications

The commercial uses of Opteon™ SF10 specialty fluid include single phase specialty fluid for semiconductor manufacturing, brine coolant, dielectric fluid, fuel cells, reactor cooling fluids, heat exchangers, dryers, turbines, heat pumps, and test fluid for leaks in devices (i.e., bubble tests). The recommended operating temperature range in heat transfer applications is -80 to 105 °C (-112 to 221 °F).

#### Why Choose Opteon™ SF10?

- Low GWP HFO technology enables significant reduction in annual greenhouse gas emission compared to PFCs, HFCs, PFPEs, and HFEs.

- Comparable heat transfer performance offers seamless retrofits without any process upsets, eliminating the need for adjusting or re-validating process centerlines and set points.
- Miscibility with other fluids allows drop-in replacement to phase out high GWP fluids.
- Low density guarantees more solvent for the same fill weight; hence, low cost of ownership.
- Low viscosity provides significant cost saving in power consumption, resulting in further low cost of ownership.
- Low dielectric constant supports direct cooling of energized equipment by immersion.
- High exposure limit is desirable for worker safety.

#### Safety, Toxicity, and Environmental

Opteon™ SF10 specialty fluid is nonflammable and does not become flammable during typical use conditions, boiling, or evaporation. The material is thermally stable to more than 175 °C (347 °F). The material has been found to have a safe toxicity profile in mammalian studies. The occupational exposure limits for Opteon™ SF10 specialty fluid is 500 ppm. It is not a skin or eye irritant in laboratory tests. In environmental tests, Opteon™ SF10 specialty fluid exhibited low concern for aquatic life. Results of extensive toxicity testing are available in the Safety Data Sheet (SDS).

#### Environmental Properties

Property	Opteon™ SF10	Fluorinert™ 3283	Galden™ HT-110	Fluorinert™ 77	Galden™ HT-135
Global Warming Potential (GWP) 100-yr ITH	2.5	>8,600	>10,000	>7,000	>10,000



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## General Material Compatibility

Opteon™ SF10 specialty fluid is compatible with most metals, plastics, and elastomers, including stressed acrylic and polycarbonate plastics. Exposures to stainless steel, copper, brass, and aluminum showed good stability.

## Plastics and Elastomer Compatibility

Compatibility depends on exposure time and temperature. Guidelines described here are based on short-term (~24 hr) compatibility testing. Examples of plastics/elastomers that are compatible with Opteon™ SF10 specialty fluid include: polyethylene, polypropylene, polystyrene, polycarbonate, polyester, polyethylene terephthalate, polybutylene terephthalate, polyimide, polysulfone, polyacrylate, acrylonitrile butadiene, acetal, nylon, butyl rubber, isoprene, and polychloroprene. Examples of incompatible polymers/elastomers include: DuPont™ Kalrez® perfluoroelastomer, Viton™ fluoroelastomer, Teflon™ FEP and PFA fluoroplastics, Buna N, silicone, and polyurethane. Consult with your local Opteon™ specialty fluids representative to help answer questions about specific materials compatibility for your application.

## Physical Properties

Property (at 25 °C [77 °F])	Units	Opteon™ SF10 Specialty Fluid
Molecular Weight	g/mol	362
Boiling Point	°C (°F)	110 (230)
Freezing Point	°C (°F)	<-90 (<-130)
Critical Temperature	°C (°F)	240 (464)
Critical Pressure	MPa	1.7
Liquid Density	g/cm <sup>3</sup>	1.58
Liquid Viscosity	cSt	0.71
Liquid Specific Heat	kJ/kg-K	1.0
Liquid Thermal Conductivity	W/m-K	0.065
Surface Tension	dyn/cm	18
Vapor Pressure	kPa	2.9
Heat of Vaporization	kJ/kg	115
Solubility in Water	ppm	<1
Water Solubility	ppm	80
Flash Point, CC ASTM D56	°C (°F)	None
Dielectric Constant at 1 kHz		5.48
Resistivity	ohm-cm	10 <sup>9-11</sup>
Occupational Exposure Limits	ppm	500
Global Warming Potential (GWP) 100-yr ITH		2.5

## Storage and Handling

Opteon™ SF10 specialty fluid is thermally stable and does not oxidize nor degrade during storage. Store in a clean, dry area.

Protect from freezing temperature, and do not allow stored container to exceed 52 °C (126 °F). Package sizes for Opteon™ SF10 specialty fluids are 6 and 15 kg net weight in HDPE containers.

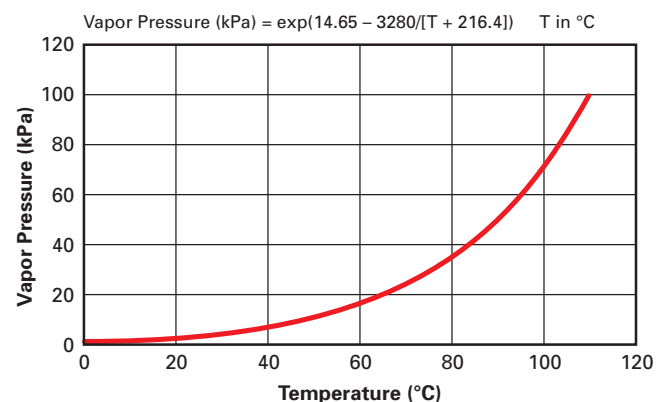
When pumping or transferring Opteon™ SF10 specialty fluid from a drum or pail, a braided stainless steel hose is recommended. If a flexible hose is desired, a static charge dissipation hose is recommended, i.e., one constructed with carbon black-filled nylon inner core conductive material.

## Critical Heat Flux

The critical heat flux of Opteon™ SF10 specialty fluid was estimated at 16 W/cm<sup>2</sup>, but the actual value in use will depend on heater geometry and operating conditions. For applications >12 W/cm<sup>2</sup>, consult your local Opteon™ specialty fluids representative.

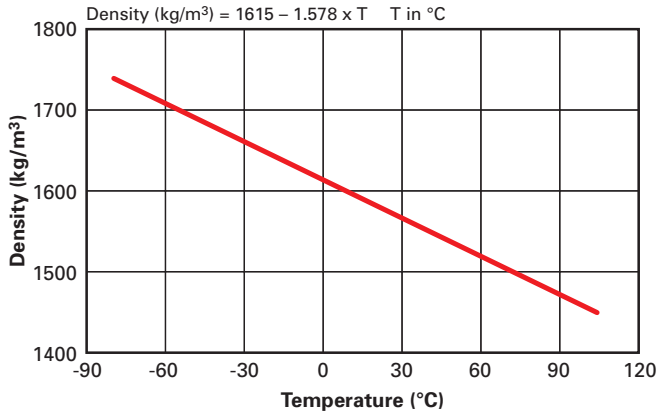
## Vapor Pressure

Please refer to the following equation to predict vapor pressure as a function of temperature.



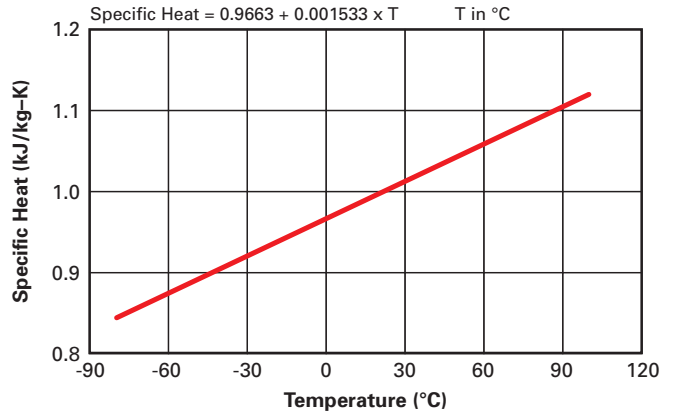
### Liquid Density

The temperature dependence of liquid density for Opteon™ SF10 specialty fluid is shown below.



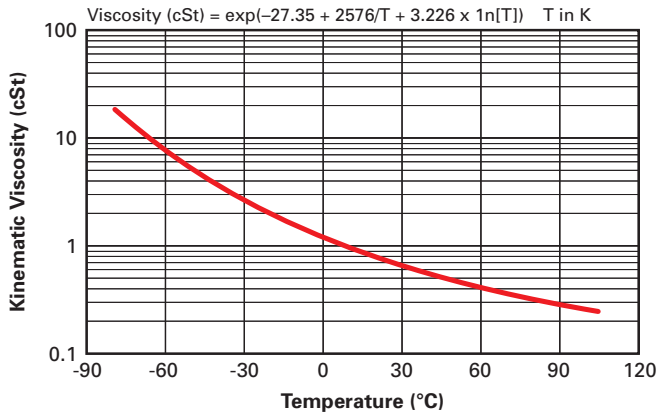
### Liquid Specific Heat

The temperature dependence of liquid specific heat for Opteon™ SF10 specialty fluid is shown below.



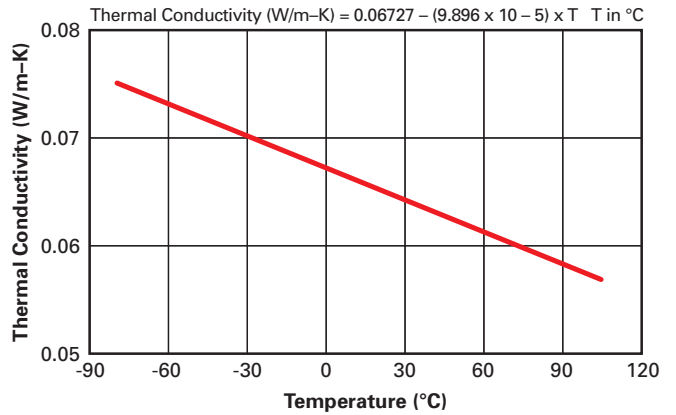
### Liquid Viscosity

The temperature dependence of liquid viscosity for Opteon™ SF10 specialty fluid is shown below.



### Liquid Thermal Conductivity

The temperature dependence of liquid thermal conductivity for Opteon™ SF10 specialty fluid is shown below.



For more information on the Opteon™ family of refrigerants, or other refrigerants products, visit [opteon.com](http://opteon.com) or call (800) 235-7882.

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