



Opteon™ Sinera

Heat Transfer Fluid

Technical Information

Introduction

Opteon™ Sinera heat transfer fluid is a clear, colorless, nonflammable, thermally stable, heat transfer fluid developed in response to a global market demand for a low environmental impact thermal management technology. Opteon™ Sinera heat transfer 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™ Sinera heat transfer 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™ Sinera heat transfer fluid include single phase heat transfer fluid for semiconductor manufacturing, brine coolant, dielectric fluid, 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).

Safety, Toxicity, and Environmental

Opteon™ Sinera heat transfer 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™ Sinera heat transfer fluid is 500 ppm. It is not a skin or eye irritant in laboratory tests. In environmental tests, Opteon™ Sinera heat transfer fluid exhibited low concern for aquatic life. Results of extensive toxicity testing are available in the Safety Data Sheet.

Environmental Properties

Property	Opteon™ Sinera Heat Transfer Fluid
Ozone Depletion Potential (ODP)	0
Global Warming Potential (GWP) 100-yr ITH	2.5
Atmospheric Lifetime	<10 days
Volatile Organic Compound	Not yet determined

General Material Compatibility

Opteon™ Sinera heat transfer 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™ Sinera heat transfer 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*	Units	Opteon™ Sinera Heat Transfer Fluid	Novec® HFE-7200	Novec® HFE-7500	Novec® HFE-7300	Novec® FC-3283	Novec® FC-77	Galden HT-110	Galden HT-135
Molecular Weight	g/mol	362	264	414	350	521	399	580	610
Boiling Point	°C (°F)	110 (230)	76 (169)	128 (262)	98 (208)	128 (262)	95 (203)	110 (230)	135 (275)
Freezing Point	°C (°F)	< -90 (< -130)	-138 (-216)	-100 (-148)	-38 (-36)	-50 (-58)	-127 (-197)	-100 (-148)	-100 (-148)
Critical Temperature	°C (°F)	240 (464)	210 (410)	261 (502)	243 (469)	235 (455)	238 (460)	N.D.	N.D.
Critical Pressure	MPa	1.7	2.01	1.55	1.88	1.22	2.47	N.D.	N.D.
Liquid Density	g/cm ³	1.58	1.42	1.61	1.66	1.82	1.79	1.71	1.72
Liquid Viscosity	cSt	0.71	0.41	0.77	0.71	0.7	0.8	0.77	1.00
Liquid Specific Heat	kJ/kg-K	1.0	1.22	1.13	1.14	1.04	1.1	0.001	0.001
Liquid Thermal Conductivity	W/m-K	0.065	0.068	0.065	0.062	0.066	0.063	0.065	0.065
Surface Tension	Dyn/cm	18	13.6	16.2	15	15	15	16	17
Vapor Pressure	kPa	2.9	16	2.1	5.9	1.4	6.6	2.3	1.1
Heat of Vaporization	kJ/kg	115	119	89	102	78	86	71	67
Solubility in Water	ppm	<1	<20	<3	<1	<5	<5	<10	<10
Water Solubility	ppm	80	92	45	67	7	14	14	14
Flash Point, CC ASTM D56	°C (°F)	None	None	None	None	None	None	None	None
Dielectric Constant at 1 kHz		5.48	7.3	5.8	6.1	1.9	1.9	1.92	1.92
Resistivity	Ohm-cm	10 ⁹⁻¹¹	10 ⁸	10 ⁸	10 ¹¹	10 ¹⁵	10 ¹⁵	10 ¹⁵	10 ¹⁵
Occupational Exposure Limits	ppm	500	200	100	100	N.D.	N.D.	N.D.	N.D.
Global Warming Potential (GWP) 100-yr ITH		2.5	59	100	200	>8,600	>7,000	>10,000	>10,000

N.D. refers to no reference data available.

*Unless otherwise stated, reported properties are at 25 C (77 F).

Storage and Handling

Opteon™ Sinera heat transfer 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™ Sinera heat transfer fluids are 6 and 15 kg net weight in HDPE containers.

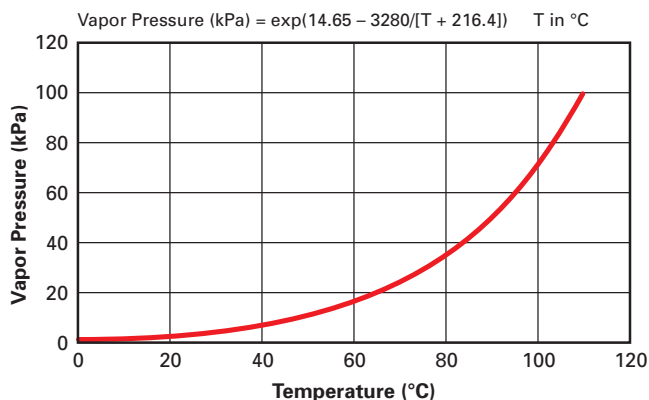
When pumping or transferring Opteon™ Sinera heat transfer fluid from a drum or pail, a braided stainless steel hose is recommended. If a flexible hose is desired, a static charge dissipation hose is recommended, i.e., one constructed with carbon black-filled nylon inner core conductive material.

Critical Heat Flux

The critical heat flux of Opteon™ Sinera heat transfer fluid was estimated at 16 W/cm², but the actual value in use will depend on heater geometry and operating conditions. For applications >12 W/cm², consult your local Opteon™ specialty fluids representative.

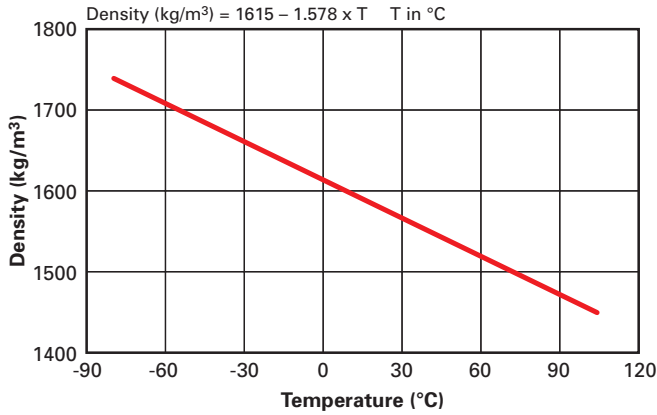
Vapor Pressure

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



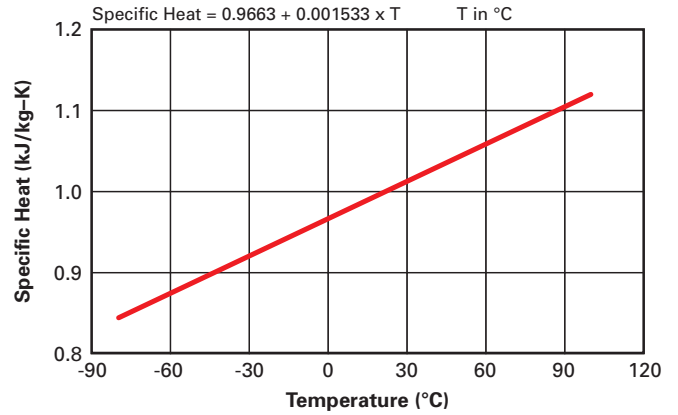
Liquid Density

The temperature dependence of liquid density for Opteon™ Sinera heat transfer fluid is shown below.



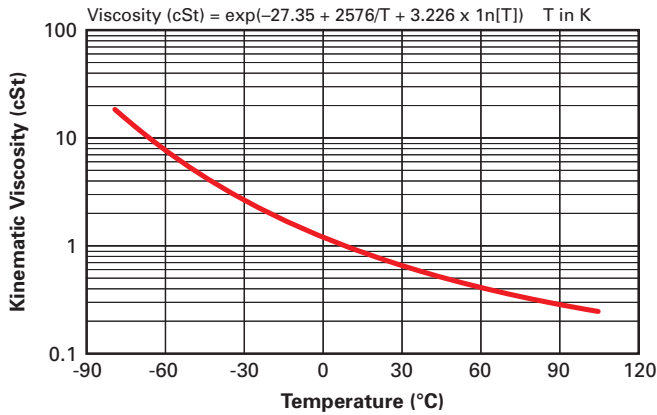
Liquid Specific Heat

The temperature dependence of liquid specific heat for Opteon™ Sinera heat transfer fluid is shown below.



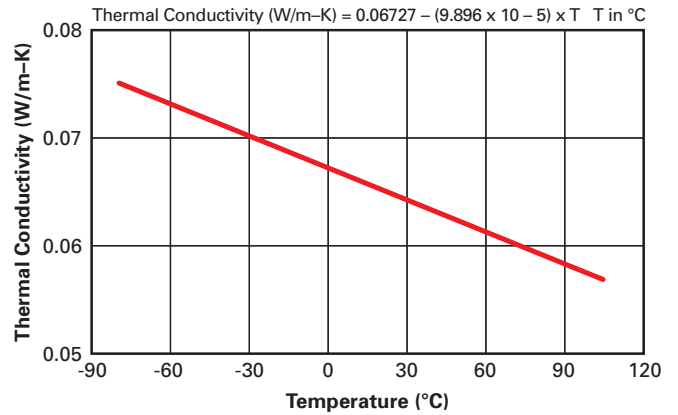
Liquid Viscosity

The temperature dependence of liquid viscosity for Opteon™ Sinera heat transfer fluid is shown below.



Liquid Thermal Conductivity

The temperature dependence of liquid thermal conductivity for Opteon™ Sinera heat transfer fluid is shown below.



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

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