Opteon™ SF33

Specialty & Two-Phase Direct-to-Chip Fluid

Technical Information

Introduction

Opteon™ SF33 (HFO-1336mzz-Z) is a proprietary hydrofluoroolefin (HFO) specialty and two-phase direct-to-chip fluid with zero ozone depletion potential (ODP) and very low global warming potential (GWP) of 2, 100-yr ITH. It's a clear, colorless, nonflammable, thermally stable, low toxicity, and environmental friendly fluid developed for liquid cooling, cleaning, drying, and carrier fluid industrial solvent applications. The fluid has a boiling point of 33.4 °C (91.4 °F) and is appropriate for replacing PFCs, HCFCs, PFPEs, HFCs, and HFEs in industrial solvent applications.

Typical Applications

- Metal degreasing, electronics cleaning, precision cleaning, and rinsing agent
- Aerosol solvent
- Heat transfer fluid (e.g., two-phase direct-to-chip)

Physical, Environmental, and Safety Properties

Property	Units	Opteon™ SF33
Chemical Structure	-	Cis-$CF_3CH=CHCF_3$
Molecular Weight	g/mol	164
Boiling Point	°C (°F)	33.4 (92.1)
Freezing Point	°C (°F)	-107 (-160.6)
Density at 25 °C (77 °F)	g/cm^3	1.36
Viscosity at 25 °C (77 °F)	cP	0.38
Kb Value	-	11.3
Dipole Moment	D	2.9688
Hansen Solubility Parameters	$MPa^{1/2}$	∂_d 13.9 ∂_p 3.5 ∂_h 2.1
Vapor Pressure at 25 °C (77 °F)	MPa	0.07
Flash Point, CC, ASTM D56	°C (°F)	None
Flash Point, OC, ASTM D1310	°C (°F)	None
Vapor Flammability, ASTM E681	%vol	None
Water Solubility	ppm	560
Critical Temperature	°C (°F)	171.3 (340.3)
Critical Pressure	MPa	2.9
Critical Density	g/cm^3	0.471
Heat of Vaporization at BP	kJ/kg	166
Liquid Thermal Conductivity at 25 °C (77 °F)	W/m-k	0.077
Liquid Specific Heat at 25 °C (77 °F)	kJ/kg-k	1.2
Surface Tension	N/m	0.013
Dielectric Constant	-	32
Resistivity	ohm-cm	10^8
Break Down Voltage	kV	10
Global Warming Potential (GWP)	100-yr ITH	2
Ozone Depletion Potential (ODP)	-	0
Occupational Exposure Limit (OEL)	ppm	500

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LOW GWP ©

Temperature-Dependent Properties

Temperature, °C (°F)	Pressure, MPa	Liquid Density, kg/m³	Liquid Viscosity, cP
-30 (-22)	0.0044441	1515.3	0.90765
-25 (-13)	0.0061359	1502.2	0.82347
-20 (-4)	0.0083332	1489.1	0.75125
-15 (5)	0.011146	1476.1	0.68869
-10 (14)	0.014697	1463.0	0.63404
-5 (23)	0.019125	1449.9	0.58594
0 (32)	0.024582	1436.7	0.54330
5 (41)	0.031237	1423.5	0.50529
10 (50)	0.039271	1410.3	0.47119
15 (59)	0.048882	1396.9	0.44045
20 (68)	0.060278	1383.5	0.41260
25 (77)	0.073686	1370.0	0.38726
30 (86)	0.089343	1356.3	0.36409
35 (95)	0.10733	1335.3	0.28679

Material Compatibility

Metals

Opteon™ SF33 is compatible with most metals. Exposures to stainless steel, copper, brass, and aluminum at 100 °C (212 °F) for 2 weeks showed good stability as summarized below. Opteon™ SF33 is not compatible with strong bases; therefore, contact with highly basic process materials is not recommended. Contact with strong Lewis acids, such as aluminum trichloride, alkali and alkaline earth metals, powdered metals, and powdered metal salts, is also not recommended.

Metal	Weight Loss	Surface Appearance	Solvent Appearance	Fluoride IC
Aluminum	None	No Change	Clear, Colorless	<0.5 ppm
Copper	None	No Change	Clear, Colorless	<0.5 ppm
Brass	None	No Change	Clear, Colorless	<0.5 ppm
Stainless Steel	None	No Change	Clear, Colorless	<0.5 ppm
Carbon Steel	None	No Change	Clear, Colorless	<0.5 ppm

Plastics

Opteon™ SF33 is compatible with most plastics. Exposures to most plastics at room temperature for 2 weeks showed good compatibility. Consult with your local Chemours specialty fluids representative to help answer questions about specific materials compatibility in your application.

Symbol	Material	% Weight Change	% Volume Change	% Hardness Change
ABS	Acrylonitrile-Butadiene-Styrene	-0.1	-0.6	0.0
HIPS	High Impact Polystyrene	0.3	-0.4	-2.9
PET	Poly (Ethylene Terephthalate)	0.0	0.7	-1.2
PS	Polystyrene	-0.4	0.9	0.0
PVC	Polyvinyl Chloride	0.0	0.0	0.0
CPVC	Chlorinated Polyvinyl Chloride	0.0	-0.3	0.0
PTFE	Fluorocarbon	1.1	0.3	-17.2
ETFE	Fluorocarbon	0.7	0.0	12.9
POM	Acetal	0.1	-1.2	-1.3
PEEK	Polyetheretherketone	0.0	0.2	0.0
LCP	Polyester	0.0	-0.4	-1.5
PEI	Polyetherimide	-0.1	0.0	0.0
PVDF	Polyvinylidene Fluoride	0.0	-0.3	0.0
PP	Polypropylene	0.3	-0.5	0.0
HDPE	High Density Polyethylene	0.0	0.3	3.3

Elastomers

Exposures to most elastomers at room temperature for 2 weeks show compatibility. Some reversible swelling is expected with partially fluorinated elastomers. Consult with your local Chemours specialty fluids representative to help answer questions about specific materials compatibility in your application.

Symbol	Material	% Weight Change	% Volume Change	% Hardness Change
NR	Natural Rubber	4.4	1.9	0.0
CR	Polychloroprene	0.8	0.1	0.0
NBR	Acrylonitrile Butadiene	15.3	2.6	-13.6
FKM	Fluoroelastomer	7.9	-3.4	-2.9
T	Thiokol	0.3	6.7	-6.1
IIR	Isobutylene Isoprene	0.3	13.1	-13.3
EPDM	Ethylene Propylene Terpolymer	1.4	5.5	-7.1
CSM	Chlorosulfonated Polyethylene	0.2	0.8	-1.3

Storage and Handling

Opteon™ SF33 is thermally stable and does not oxidize or degrade during storage. It exhibits no closed or open cup flash point and is not classified as a flammable liquid by NFPA or DOT. Store in a clean, dry area; protect from freezing temperatures; and don't allow stored product to exceed 46 °C (115 °F) to prevent leakage or potential rupture from pressure and expansion. Drum pumps are recommended to dispense fluid from its container. Vapor degreasing equipment with vapor containment technology are required to enable safe and economical use of the solvent. The fluid is a pure component material and easily recoverable by off-line and in-line distillation equipment, such as a vapor degreaser. Spent solvent that cannot be recycled should be tested to ensure proper classification for waste disposal. Additional safety information can be found in the Safety Data Sheet (SDS).

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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