

Data Center Immersion Cooling Applications with 3M™ Fluorinert™ Electronic Liquids

3M™ Fluorinert™ Electronic Liquids have set the industry standard for direct-contact electronics cooling for over 60 years. These extremely inert, fully-fluorinated liquids have exceptionally high dielectric strength and excellent material compatibility. Fluorinert liquids are clear, odorless, non-flammable, non-oil-based, low in toxicity, and non-corrosive and offer a wide temperature operating range and high thermal and chemical stability. Fluorinert liquids also have low dielectric constants making them ideal for single-phase and two-phase data center immersion cooling applications.

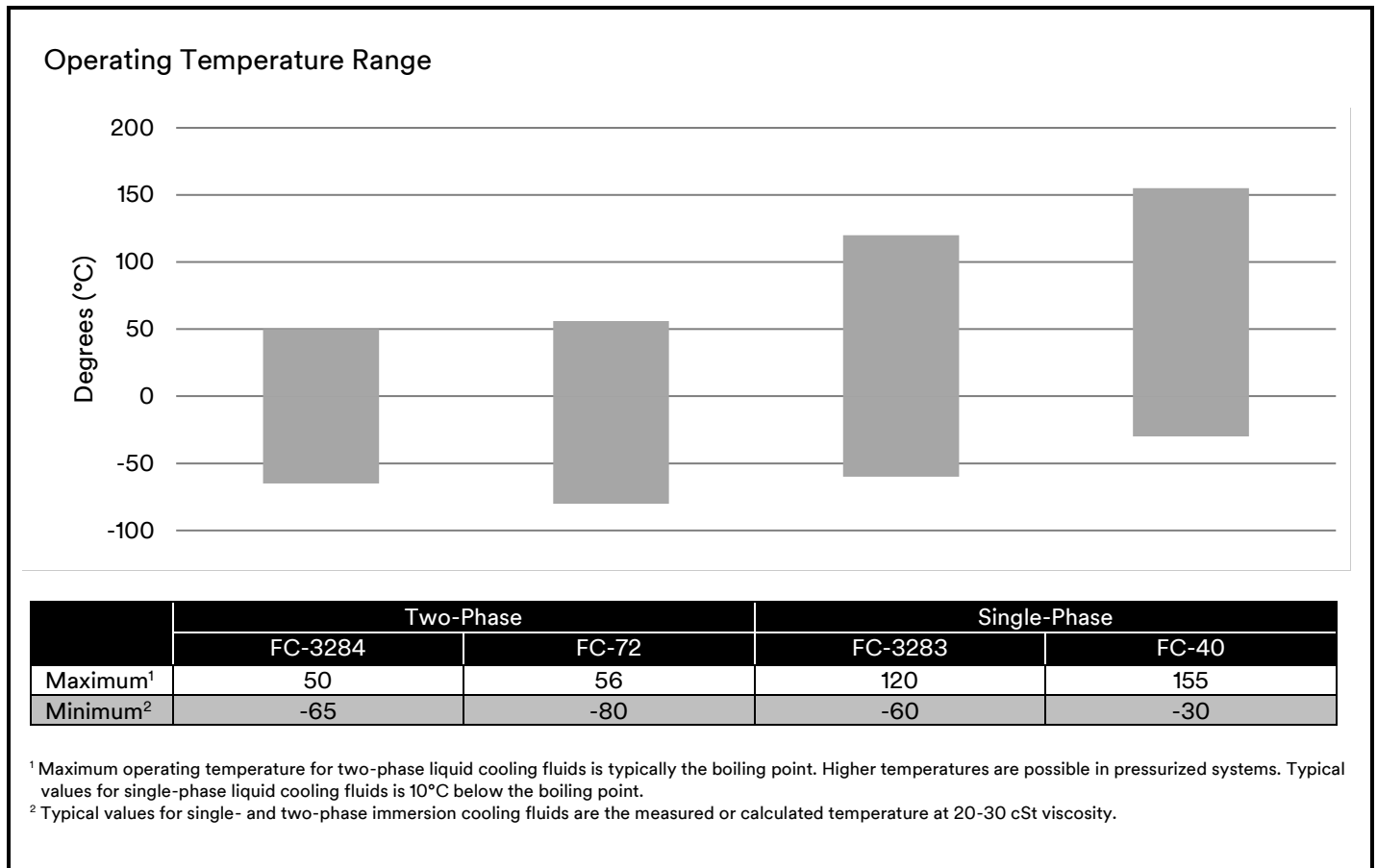
Properties	Unit	3M™ Fluorinert™ Electronic Liquids			
		Recommended products for two-phase immersion cooling applications		Recommended products for single-phase immersion cooling applications	
		FC-3284	FC-72	FC-3283	FC-40
Boiling Point	°C	50	56	128	165
Pour Point	°C	-73	-90	-65*	-57
Molecular Weight	g/mol	299	338	521	650
Critical Temperature	°C	161	176	235	270
Critical Pressure	MPa	1.94	1.83	1.22	1.18
Vapor Pressure	kPa	35	30	1.4	0.29
Heat of Vaporization	kJ/kg	105	88	78	68
Liquid Density	kg/m ³	1710	1680	1820	1855
Coefficient of Expansion	K ⁻¹	0.0016	0.0016	0.0014	0.0012
Kinematic Viscosity	cSt	0.42	0.38	0.75	2.2
Absolute Viscosity	cP	0.71	0.64	1.4	4.1
Specific Heat	J/kg-K	1100	1100	1100	1100
Thermal Conductivity	W/m-K	0.062	0.057	0.066	0.065
Surface Tension	mN/m	13	10	15	16
Solubility of Water in Fluid	ppm by weight	14	10	7	<7
Dielectric Strength Range, 0.1" Gap	kV	>40	>40	>40	>40
Dielectric Constant @ 1 kHz	-	1.9	1.8	1.9	1.9
Volume Resistivity	Ohm-cm	10 ¹⁵	10 ¹⁵	10 ¹⁵	10 ¹⁵

Not for specification purposes. All values @ 25°C unless otherwise specified.

* Fluid is considered super cooled at this temperature. Talk to a Tech Service Engineer for more information.

Data Center Liquid Cooling Applications using 3M™ Fluorinert™ Electronic Liquids

Recommended Operating Temperature Range



To learn more about how 3M fluids can help enable your data center liquid cooling applications, visit 3M.com/immersioncooling.

To learn more about 3M™ Fluorinert™ Electronic Liquids visit 3M.com/Fluorinert. You can also explore our other data center liquid cooling fluids, 3M™ Novec™ Engineered Fluids, at 3M.com/Novec.

Regulatory: For regulatory information about these products, contact your 3M representative.

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