

# Heat transfer applications using 3M™ Novec™ Engineered Fluids

Balancing the demand for thermal management performance with worker safety and low environmental impact has never been more important. 3M recognizes your need for a long-term heat transfer fluid with low greenhouse gas emissions and has meticulously engineered the solution – a comprehensive portfolio of 3M™ Novec™ Engineered Fluids. You can reduce greenhouse gas emissions by up to 99 percent in your application by replacing perfluorocarbon (PFC) or perfluoropolyether (PFPE) heat transfer fluids with Novec fluids. Now that’s a sustainable solution.

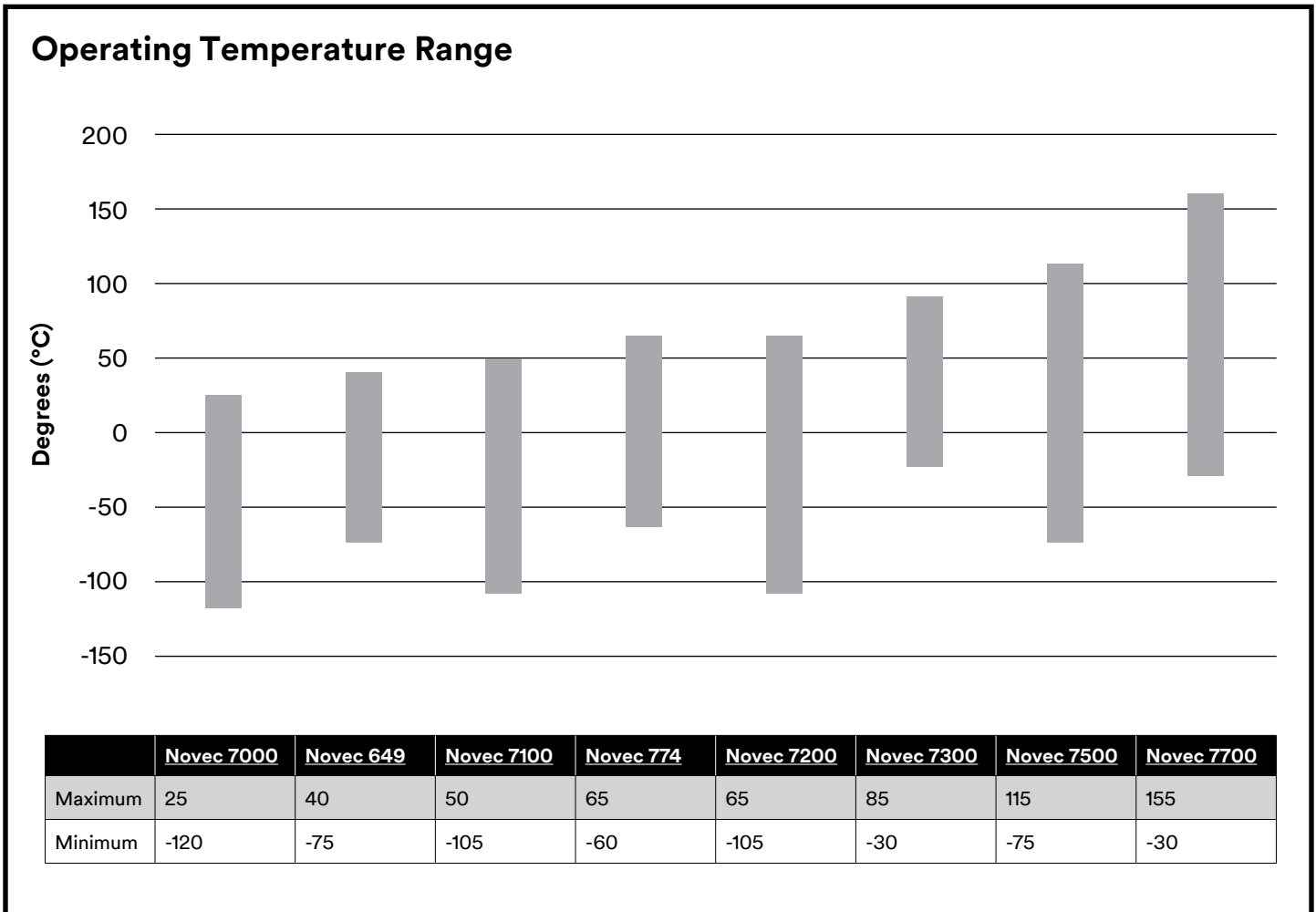
Properties	Unit	3M™ Novec™ Engineered Fluids							
		7000	649	7100	774	7200	7300	7500	7700
Boiling Point	°C	34	49	61	74	76	98	128	167
Pour Point	°C	-122	-108	-135	-78	-138	-38	-100	-50
Molecular Weight	g/mol	200	316	250	366	264	350	414	528
Critical Temperature	°C	165	169	195	195	210	243	261	290
Critical Pressure	Mpa	2.48	1.88	2.23	1.71	2.01	1.88	1.55	1.41
Vapor Pressure	kPa	65	40	27	15.7	16	5.9	2.1	<0.1
Heat of Vaporization	kJ/kg	142	88	112	90	119	102	89	83
Liquid Density	kg/m <sup>3</sup>	1400	1600	1510	1660	1420	1660	1614	1797
Coefficient of Expansion	K <sup>-1</sup>	0.0022	0.0018	0.0018	0.0015	0.0016	0.0013	0.0013	0.0011
Kinematic Viscosity	cSt	0.32	0.40	0.38	0.52	0.41	0.71	0.77	2.52
Absolute Viscosity	cP	0.45	0.64	0.58	0.87	0.58	1.18	1.24	4.54
Specific Heat	J/kg-K	1300	1103	1183	1130	1220	1140	1128	1040
Surface Tension	mN/m	12.4	10.8	13.6	12.3	13.6	15.0	16.2	18
Solubility of Water in Fluid	ppm by weight	~60	20	95	20	92	67	45	14
Solubility of Fluid in Water	ppm or ppb by weight	<5 ppm	-	12 ppm	-	<5 ppm	<295 ppb	<4 ppb	<1 ppb
Dielectric Strength Range, 0.1" gap	kV	>25	>40	>25	>40	>25	>25	>25	>25
Dielectric Constant @ 1kHz	-	7.4	1.8	7.4	1.9	7.3	6.1	5.8	6.7
Volume Resistivity	Ohm-cm	10 <sup>8</sup>	10 <sup>12</sup>	10 <sup>8</sup>	10 <sup>12</sup>	10 <sup>8</sup>	10 <sup>11</sup>	10 <sup>8</sup>	10 <sup>11</sup>
Global Warming Potential <sup>a</sup>	GWP	530	<1	297	<1	57	310	100	436

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

<sup>a</sup> GWP-100 year ITH, CO<sub>2</sub> = 1.0, per IPCC 2013, with the exception of Novec 7100 fluid, which notes IPCC 2007.

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Recommended Operating Temperature Range for Pumped Single Phase Systems\*



\*For two phase systems, contact your 3M technical service representative.

We are confident that 3M has the right solution for your heat transfer application. To learn more about 3M™ Novec™ Engineered Fluids, visit [3M.com/Novec](http://3M.com/Novec). You can also explore our other perfluorocarbon liquids for heat transfer, 3M™ Fluorinert™ Electronic Liquids, on [3M.com/Electronics](http://3M.com/Electronics).

Have questions? Need technical assistance? Contact your 3M technical service representative. We're here to help.

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 60-5002-0809-9  
 7/2016