DOWFROST™ LC Inhibited Propylene Glycol-Based Heat Transfer Fluid

Heat management & corrosion protection in liquid cooled data center applications

Continual advancement of micro-processor technology has led to increasingly higher heat loads incurred by Datacom Equipment Cooling Systems (DECS). As power density increases, conventional air cooling is no longer economically viable as the cost to operate air cooling equipment within a Datacom center exceeds the cost of the equipment being cooled (over a typical three-year equipment life span). This has caused the industry to move toward liquid cooling of DECS. DOWFROST™ LC Heat Transfer Fluid is specifically formulated for liquid cooled, direct-to-chip applications and provides your system with exceptional corrosion protection, even in high surface area copper components. DOWFROST™ LC 25 and DOWFROST™ LC 55 Heat Transfer Fluids can be used in these systems to provide freeze protection and limit corrosion to ensure long life of the system. The DECS may be supplied with coolant from an in-rack Cooling Distribution Unit (CDU) or supplied by an external CDU that services multiple racks.

DOWFROST™ LC Heat Transfer Fluids are formulated with either 25% or 55% propylene glycol which provides freeze protection to either -10°C (14°F) or -40°C (-40°F), depending on the concentration that is used. Both DOWFROST™ LC 25 and DOWFROST™ LC 55 Heat Transfer Fluids are dyed fluorescent yellow to aid in leak detection and contain specially designed additive packages that help prevent corrosion of common metals.

Typical product specifications† of DOWFROST™ LC Heat Transfer Fluids

Fluid Parameter	Units	DOWFROST™ LC 25 Heat Transfer Fluid (PG25)	DOWFROST™ LC 55 Heat Transfer Fluid (PG55)
Propylene Glycol Concentration	Volume %	25	55
Freezing Point	°F	14°F	-40°F
	°C	-10°C	-40°C
pH		8.0-10.5	8.0-10.5
Reserve Alkalinity	mL 0.1N HCl	> 6.0	> 6.0
Thermal Conductivity	W/mK at 50°C	0.485	0.336
Specific Heat	kJ/kg-K at 50°C	3.94	3.43
Viscosity	mPa.sec at 20°C	2.8	8.8
	mPa.sec at 50°C	1.3	2.9
Volume Expansion	% from -40 to 90°C	5.2	7.7
Boiling Point	C° at 760 mmHg	101.4	105
Electrical Conductivity	micromho/cm	> 2,000	> 2,000
Sulfate	ppm	< 10	< 10
Chloride	ppm	< 5	< 5
Total Hardness	ppm as $CaCO_3$	< 20	< 20

†Typical properties, not to be construed as specifications as specifications. Complete specifications are available on request.

Typical properties of DOWFROST™ LC Heat Transfer Fluids

The maximum recommended bulk fluid temperature for DOWFROST™ LC Heat Transfer Fluid is 195°F (90°C), whereas the lowest operating temperature is normally considered 0°F (-20°C) due to the viscosity increases at this temperature and below. The installed fluid should have a freezing point which is at least 5°F (3°C) below the lowest anticipated temperature that the fluid will be exposed to in order to ensure free flow and system integrity during low temperature events. Freeze protection down to -40°F (-40°C) can be obtained using DOWFROST™ LC 55 Heat Transfer Fluid.

Operation above the maximum recommended fluid temperature limits will cause excessive degradation of the PG and will compromise the expected lifetime of the DOWFROST™ LC Heat Transfer Fluid. This will also adversely affect the performance of the DECS.

Regardless of required freezing point, the fluid should not be further diluted as over-dilution of glycol-based fluids reduces the effectiveness of the corrosion inhibitors. Operating below 25% by volume of propylene glycol allows for biodegradation of the glycol by bacteria or fungi which can inadvertently be introduced to your system from dilution water or air vents.

Freezing point and refractive index† versus glycol concentration for DOWFROST™ LC Heat Transfer Fluids

	Freezing point		Propylene glycol		Refractive index	
	°F	°C	Weight %	Volume %	20°C	25°C
DOWFROST™ LC 25 Heat Transfer Fluid	15.6	-9.1	24	23.5	1.3622	1.3613
	14.7	-9.6	25	24.5	1.3634	1.3625
	13.7	-10.2	26	25.5	1.3646	1.3637
	12.6	-10.8	27	26.5	1.3658	1.3649
	11.5	-11.4	28	27.5	1.3670	1.3661
DOWFROST™ LC 55 Heat Transfer Fluid	-36.7	-38.2	53	52.8	1.3949	1.3936
	-39.7	-39.8	54	53.8	1.3960	1.3947
	-42.8	-41.6	55	54.8	1.3971	1.3957
	-46	-43.3	56	55.9	1.3982	1.3968
	-49.3	-45.2	57	56.9	1.3993	1.3979

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Recommended use temperature range:
-20°C to 90°C
0°F to 195°F

Suitable applications:
Datacom Equipment Cooling Systems (DECS)

Physical properties† of DOWFROST™ LC 25 Heat Transfer Fluid

Temp. °C	Density kg/m³	Specific Heat kJ/kg K	Thermal Conductivity W/mK	Viscosity mPa sec	Vapor Pressure kPa
-5	1041.9	3.81	0.425	7.80	0.004
0	1040.5	3.82	0.432	6.32	0.006
5	1038.8	3.83	0.438	5.13	0.009
10	1036.9	3.84	0.444	4.17	0.012
15	1034.9	3.85	0.450	3.42	0.017
20	1032.7	3.87	0.456	2.84	0.023
25	1030.3	3.88	0.462	2.39	0.031
30	1027.8	3.89	0.467	2.05	0.042
35	1025.2	3.9	0.472	1.78	0.055
40	1022.5	3.92	0.476	1.58	0.072
45	1019.7	3.93	0.481	1.41	0.093
50	1016.8	3.94	0.485	1.27	0.119
55	1013.7	3.95	0.488	1.15	0.152
60	1010.6	3.97	0.492	1.04	0.191
65	1007.3	3.98	0.495	0.93	0.239
70	1003.9	3.99	0.497	0.83	0.297
75	1000.4	4.00	0.500	0.75	0.367
80	996.7	4.01	0.502	0.69	0.450

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Physical properties† of DOWFROST™ LC 55 Heat Transfer Fluid

Temp. °C	Density kg/m³	Specific Heat kJ/kg K	Thermal Conductivity W/mK	Viscosity mPa sec	Vapor Pressure kPa
-40	1085.9	2.98	0.280	1413.58	—
-35	1083.9	3.01	0.283	703.58	—
-30	1081.9	3.03	0.287	376.40	—
-25	1079.8	3.06	0.291	214.54	0.001
-20	1077.5	3.08	0.294	129.29	0.001
-15	1075.1	3.11	0.298	81.85	0.002
-10	1072.7	3.13	0.302	54.11	0.002
-5	1070.1	3.16	0.305	37.18	0.004
0	1067.4	3.18	0.309	26.42	0.005
5	1064.7	3.21	0.312	19.36	0.007
10	1061.8	3.23	0.315	14.57	0.010
15	1058.8	3.26	0.318	11.23	0.015
20	1055.7	3.28	0.321	8.84	0.020
25	1052.5	3.30	0.324	7.09	0.027
30	1049.2	3.33	0.327	5.79	0.036
35	1045.8	3.35	0.329	4.80	0.048
40	1042.2	3.38	0.332	4.03	0.062
45	1038.6	3.40	0.334	3.43	0.081
50	1034.9	3.43	0.336	2.95	0.104
55	1031.0	3.45	0.338	2.56	0.132
60	1027.1	3.48	0.339	2.24	0.167
65	1023.0	3.50	0.341	1.98	0.209
70	1018.9	3.53	0.342	1.76	0.260
75	1014.6	3.55	0.343	1.58	0.320
80	1010.2	3.58	0.344	1.42	0.395

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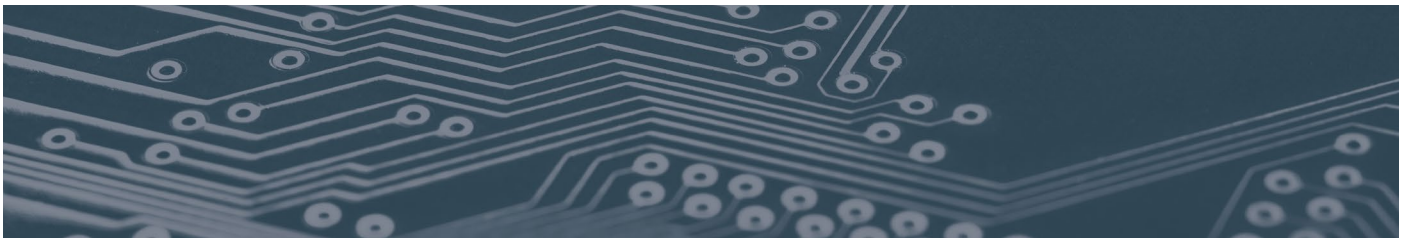

Wetted Materials List for DOWFROST™ LC Heat Transfer Fluid

Metals and Metal Alloys	Compatibility with DOWFROST™ LC Heat Transfer Fluids
Brass with <15% zinc	Acceptable up to at least 90°C
Brass, chrome plated	Acceptable up to at least 90°C
Brass, nickel plated	Acceptable up to at least 90°C
Carbon steel	Acceptable up to at least 90°C
Copper	Acceptable up to at least 90°C
Copper alloys: <15% zinc and lead free	Acceptable up to at least 90°C
Stainless steel, solution treated and passivated	Acceptable up to at least 90°C
Elastomers, Plastics and Other Materials	**Compatibility with DOWFROST™ LC Heat Transfer Fluids**
Acrylonitrile butadiene rubber (NBR)	Caution: Most compositions of this polymer are not recommended above 40°C
Polyoxymethylene (POM)	Not recommended above 30°C
Ethylene Propylene Diene Monomer (EPDM)[1]	Acceptable up to at least 75°C
Fluoroelastomer (FKM)	Caution: Some compositions of this polymer are not recommended above 40°C
Fluorinated Ethylene Propylene (FEP)	Acceptable up to at least 90°C
Polyamide (PA)	Caution: Most compositions of this polymer are not recommended above 40°C
Polychloroprene (CR)	Caution: Some compositions of this polymer are not recommended above 40°C
Polyethylene (PE)	Acceptable up to at least 75°C
Polyphenylene Sulfide (PPS)	Acceptable up to at least 60°C
Polytetrafluoroethylene (PTFE)	Acceptable up to at least 90°C
Polypropylene (PP)	Acceptable up to at least 75°C
Polysulfone or Polyphenylsulfone (PSU, PPSU)	Acceptable up to at least 75°C
Silicone	Caution: Most compositions of this polymer are not recommended above 40°C

*High density polyethylene (HDPE), Loctite 567 (thread sealant), Poly ether ether ketone (PEEK) are also acceptable for use. Please confirm temperature rating with manufacturer.
[1]Initial data suggests that peroxide-cured EPDM is more robust than sulfur-cured EPDM.

For additional guidance, please refer to our DOWFROST™ LC Heat Transfer Fluid Engineering & Operating Guide.

All piping materials must be known to be compatible with the DOWFROST™ LC Heat Transfer Fluid to prevent excessive corrosion or incompatibility of system components. The compatibility of the fluid with specific elastomeric or plastic materials used for tanks, piping, tubing, pumps, valves, gaskets, mechanical pump seals, valve packings, O-rings, etc. must be verified by the component material supplier before use. Substantial variation exists for specific elastomers with respect to maximum allowable exposure temperatures.

Original Equipment Manufacturers (OEMs) of the DECSs may publish a “Wetted Materials List” which summarizes the types of materials which are compatible with various heat transfer fluids. Consult with your OEM for specific information about acceptable materials.

About Dow

Dow (NYSE: DOW) combines global breadth; asset integration and scale; focused innovation and materials science expertise; leading business positions; and environmental, social and governance leadership to achieve profitable growth and help deliver a sustainable future. The Company's ambition is to become the most innovative, customer centric, inclusive and sustainable materials science company in the world. Dow's portfolio of plastics, industrial intermediates, coatings and silicones businesses delivers a broad range of differentiated, science-based products and solutions for its customers in high-growth market segments, such as packaging, infrastructure, mobility and consumer applications. Dow operates manufacturing sites in 31 countries and employs approximately 37,800 people. Dow delivered sales of approximately $57 billion in 2022. References to Dow or the Company mean Dow Inc. and its subsidiaries. For more information, please visit www.dow.com or follow @DowNewsroom on Twitter.

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