

Glycols – Freeze Protection and Additives for Corrosion Control

Are you aware that glycols are used in many industrial plants? In food plants their main applications include secondary cooling and heating, deicing, defrosting, dehumidifying, and winterizing pipes. It can also be used in process heat exchange units and in enclosed cooling loop operations.

Differences between Propylene and Ethylene Glycol: There are two major types of glycols that are used in the industry for these applications, propylene glycol and ethylene glycol. There major differences between propylene and ethylene glycols are viscosity and toxicity. Ethylene glycols are less viscous and therefore generally provide superior heat transfer efficiency and better low temperature performance. However, in applications where toxicity is a concern such as food plants, propylene glycol fluids are used because of their low acute oral toxicity vs. the moderate acute oral toxicity of ethylene glycols. Examples include applications where contact with drinking water is possible, food processing applications where accidental contact with food or beverage products could occur, and where propylene glycol use are mandated by law.

Freeze and Burst Protection: During the winter times, maintenance and engineering departments are worried about the low temperatures and system integrity. Burst protection is sufficient if the system will remain dormant when the temperature is below the freezing point of the solution. Freeze protection is required in systems where fluid must be pumped at the lowest anticipated temperature. See the freeze point vs. glycol concentration chart below.

Inhibitors: Corrosion control can be a major concern when glycols are diluted to obtain maximum freeze protection. There are food grade corrosion inhibitors that are incorporated and blended with the propylene glycol to prevent metal corrosion. For this typically ASTM D4627-92 "Iron Chip Corrosion for Water-Dilutable Metalworking Fluids" is used. See the corrosion test particle results below.

Corrosion Protection at Varying Concentrations



Hydri-Chill FG 50%, 35%, and 25% (fig. 1)



Un-inhibited propylene glycol 50%, 35%, and 25% (fig. 2)



Hydrate Heat-X EG (fig. 3)

Freeze Point vs. Glycol Concentration

Freezing Point		Wt% Propylene Glycol	Vol % Propylene Glycol	Vol % DOWFROST	Vol % DOWFROST HD	Boiling Point		Degree Brix	Refractive Index 22°C
°F	°C					°F @ 760 mm Hg	°C @ 0.96 Barr		
32.0	0.0	0.0	0.0	0.0	0.0	212	100	0.0	0.3328
29.1	-1.6	5.0	4.8	5.0	5.1	212	100	4.8	1.3383
26.1	-3.3	10.0	9.6	10.0	10.2	212	100	8.4	1.3438
22.9	-5.1	15.0	14.5	15.1	15.4	212	100	12.9	1.3495
19.2	-7.1	20.0	19.4	20.3	20.6	213	101	15.4	1.3555
18.3	-7.6	21.0	20.4	21.3	21.7	213	101	16.0	1.3567
17.6	-8.0	22.0	21.4	22.4	22.8	213	101	16.7	1.3579
16.6	-8.6	23.0	22.4	23.4	23.8	213	101	17.4	1.3591
15.6	-9.1	24.0	23.4	24.5	24.9	213	101	18.4	1.3603
14.7	-9.6	25.0	24.4	25.5	26.0	214	101	19.0	1.3615
13.7	-10.2	26.0	25.3	26.5	26.9	214	101	19.6	1.3627
12.6	-10.8	27.0	26.4	27.6	28.1	214	101	20.2	1.3639
11.5	-11.4	28.0	27.4	28.6	29.1	215	102	20.8	1.3651
10.4	-12.0	28.0	28.4	29.7	30.2	215	102	21.4	1.3663
9.2	-12.7	30.0	29.4	30.7	31.3	216	102	22.0	1.3675
7.9	-13.4	31.0	30.4	31.8	32.3	216	102	22.7	1.3687
6.6	-14.1	32.0	31.4	32.8	33.4	216	102	23.6	1.3698
5.3	-14.8	33.0	32.4	33.9	34.5	216	102	24.4	1.3710
3.9	-15.6	34.0	33.5	35.0	35.6	216	102	25.3	1.3621
2.4	-16.4	35.0	34.4	36.0	36.6	217	103	26.1	1.3733
0.8	-17.3	36.0	35.5	37.1	37.8	217	103	26.9	1.3744
-0.8	-18.2	37.0	36.5	38.2	38.8	217	103	30.2	1.3756
-2.4	-19.1	38.0	37.5	39.2	39.9	218	103	30.7	1.3767
-4.2	-20.1	39.0	38.5	40.3	41.0	218	103	31.3	1.3779
-6.0	-21.1	40.0	39.6	41.4	42.1	219	104	31.8	1.3790
-7.8	-22.1	41.0	40.6	42.4	43.2	219	104	29.6	1.3802
-9.8	-23.2	42.0	41.6	43.5	44.3	219	104	30.2	1.3813
-11.8	-24.3	43.0	42.6	44.5	45.3	219	104	30.7	1.3825
-13.9	-25.5	44.0	43.7	45.7	46.5	219	104	31.3	1.3836
-16.1	-26.7	45.0	44.7	46.7	47.6	220	104	31.8	1.3847
-18.3	-27.9	46.0	45.7	47.8	48.6	220	104	32.4	1.3858
-20.7	-29.3	47.0	46.8	48.9	49.8	220	104	33.0	1.3870
-23.1	-30.6	48.0	47.8	50.0	50.9	221	105	33.5	1.3881
-25.7	-32.1	49.0	48.9	51.1	52.0	221	105	34.1	1.3892
-28.3	-33.5	50.0	49.9	52.2	53.1	222	106	34.7	1.3903
-31.0	-35.0	51.0	50.9	53.2	54.1	222	106	35.5	1.3914
-33.8	-36.6	52.0	51.9	54.3	55.2	222	106	35.9	1.3924
-36.7	-38.2	53.0	53.0	55.4	56.4	223	106	36.6	1.3935
-39.7	-39.8	54.0	54.0	56.5	57.4	223	106	37.2	1.3945
-42.8	-41.6	55.0	55.0	57.5	58.5	223	106	38.0	1.3956
-46.0	-43.3	56.0	56.0	58.5	59.6	223	106	38.5	1.3966
-49.3	-45.2	57.0	57.0	59.6	60.6	224	107	39.0	1.3977
-52.7	-47.1	58.0	58.0	60.6	61.7	224	107	39.6	1.3987
-56.2	-49.0	59.0	59.0	61.7	62.8	224	107	40.1	1.3998
-59.9	-51.1	60.0	60.0	62.7	63.8	225	107	40.6	1.4008

Reach out to the **RITE team** for more information on glycols for freeze protection and corrosion control.