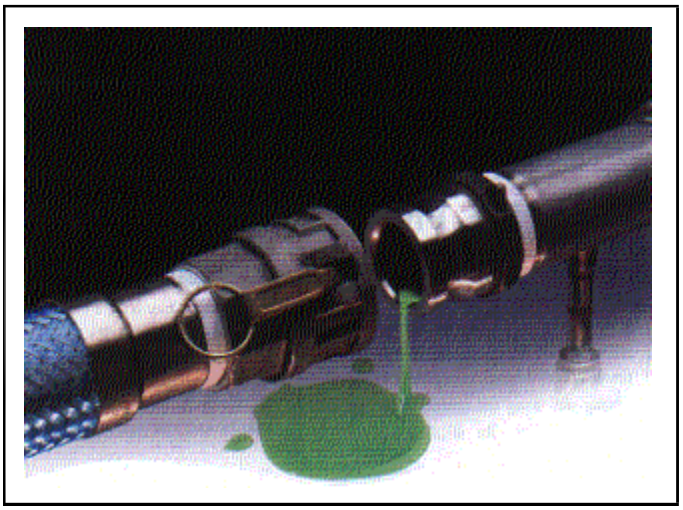
HVAC
Anti-Freeze Technologies



Kem Canada Mfg
1875 Drew Rd., Mississauga, Ontario L5S 1J5
905.456.9444 fax: 9447 www.kemmfg.com

doc: / 5816HVAC

Index

Kem Canada Mfg

4 Blair Drive, Brampton, Ontario L6T 2H5 905.456.9444 fax: 9447 www.kemmfg.com

Glycols are colourless, odourless liquids, whose viscosities increase with increasing molecular weights. Glycols have higher viscosities than water and they are less volatile. Both ethylene and propylene glycols have little tendency towards crystallization when they are cooled. They generally freeze to form glassy solids, without sharply defined freeze points. The freeze points are taken at the point where crystallization is first observed, even though most of the material may still be in the form of a highly viscous liquid.

Mixtures of water and glycol freeze. Mixtures, like pure glycol freeze below the point of water, and have an extremely low tendency to crystallize. They solidify over a wide temperature range. Because of their good heat exchange properties, glycols have acquired considerable importance as heat transfer media and coolants. They may be used undiluted, but in most cases, it is preferable to use them mixed with water. Because glycols lower the freeze point, it is possible to produce aqueous heat transfer media for use as down as low as -20C and to provide customization frost proofing media down as low as -50C.

“SHRINKAGE” is a term associated with the known glycol affinity for water. When glycols are mixed with water, the resultant volume is less than the to starting volumes. For example, the shrinkage of a 50/50 ethylene glycol - water mix solution is 1.31%.

“BURST PROTECTION” is the term associated with the reduction of the expansion factor when a glycol and water solution freezes. Substantially less glycol is required to prevent bursting of he pipes than to prevent freezing. Major system equipment manufacturers recommend 10 to 30% glycol to provide burst protection.

Heat transfer efficiency is reduced when glycol is introduced into a system. Water is a very efficient heat transfer fluid, while glycol exhibits less efficiency than water, the final solution being dependent upon temperatures and glycol concentrations. In order to improve the scope of the application of the glycol and water mixtures, inhibitor packages are added, which reduce the corrosion attack and provide stabilization against oxygen attack.

Glycol Type	**General Use Characteristics**
ethylene glycol	main use as anti-freeze compounds
diethylene glycol	drying medium for gases and intermediate raw material
triethylene glycol	low toxicity bacteriocidal solvent
tetraethylene glycol	solvent and plasticizer
propylene glycol	non toxic anti-freeze and intermediate raw material
dipropylene glycol	oil solvent, hydraulic fluid, dye manufacturing
tripropylene glycol	ink solvent, lubricant, intermediate raw material

back to glycol menu

Glycol E-100	A full strength, nitrite inhibited ethylene glycol.
Glycol E-100M	A full strength molybdate inhibited ethylene glycol.
Coil Glycol E	Pre-mixed nitrite inhibited, ethylene glycol.
Coil Glycol E30	Pre-mixed nitrite inhibited, ethylene glycol.
Coil Glycol E60	Pre-mixed nitrite inhibited, ethylene glycol.
Coil Glycol M	Pre-mixed molybdate inhibited, ethylene glycol.
Coil Glycol P60	Pre-mixed phosphate inhibited, propylene glycol.
Coil Glycol P100	Full strength phosphate inhibited, propylene glycol.
KT # 290	Full strength propylene glycol.
CSL # 202	Supplemental nitrite inhibitor.
CSL # 255	Supplemental molybdate inhibitor.
KT # 107	Supplemental phosphate inhibitor.

back to index

Kem Canada Mfg
4 Blair Drive, Brampton, Ontario L6T 2H5 905.456.9444 fax: 9447 www.kemmfg.com

Glycol - Freeze Protection Chilled Water Coils

Kemtreet

- Many plants have central air conditioning systems that use numerous air handlers to comfort control the indoor environment. Outside air intakes on air handlers may expose chilled water coils to freezing temperatures while they are non functioning in the winter months. Automatic thermostatically controlled dampers are often installed to reduce this danger, however, accumulations of snow and ice can prevent proper damper operation and subject coils to freezing. Under these conditions, coils eventually rupture and cause water damage to the air handler.

- The air handler chilled water coils should be isolated from the main circuit by a valving arrangement to prevent potential freezing problems. Exposed coils should be drained and left dry; the valve should be left open all winter. It is not always possible to drain the coils completely because of low sections, pockets or u-bends that trap water. Flushing with an anti-freeze solution of 50% water and 50% inhibited ethylene glycol, through the drained coils, using an electric transfer pump, eliminates water pockets. Low areas are filled with the anti-freeze solution and freezing problems are prevented. Solution not trapped in low spots is flushed out, collected and re-used, until it becomes too dilute. Pure 100% glycol should not be used for flushing because it freezes at about -10F (-23 C).

- When the isolated chilled water coils are connected to the main system in the spring, any residual glycol contaminates the chilled water. The degree of contamination depends on several factors, including glycol stability and the inhibitors present. System water inhibitors may be incompatible with the glycol and cause corrosive reactions or sedimentation. Even if the inhibitors are compatible with glycol, stability of a glycol solution exposed to atmosphere for six months or more is questionable. The solution often decomposes and forms corrosive acidic conditions when mixed with chilled water in the spring.

- Biological fouling can also occur. bacterial slime and other micro organisms grow by feeding on the organic carbohydrates of the glycol or some ingredients in the corrosion inhibitors. The system eventually becomes fouled. All coils with glycol freeze protection should be flushed with water two or three times to ensure that all residual glycol is washed out of the coils, before they are reconnected to the main chilled water system in the spring.

back to glycol menu

Glycol - Heat Pump Loops

Kemtreet

- Heat Pump Loops are closed chilled - heating water systems utilizing individual compressors in areas, rooms or zones, rather than a central chiller. These systems pick up heat and exchange it through an evaporative condensing unit. During the winter months, the evaporative condenser is shut down and a primary heating source provides the heat. The water system may still flow through the evaporative condenser for periodic cooling. Under such conditions the addition of glycol is required for burst protection. Depending upon locale, the glycol may be designed from 10 to 50 percent to protect.

- These types of system experience a variety of problems associated with the glycol addition. There are invariably some leaks in large systems, which creates a loss of volume over time. If the system has an automatic make up (to water), the glycol can be diluted over time. Many of these systems have been retrofitted to utilize an automatic glycol feed system, whereby the make up is fed from a premixed glycol batch tank, directly to the system.

- Breakdown of glycol is common. Bacterial contamination of the system may occur in a similar fashion to that of the A/C coils during storage. Inhibitor levels may be attacked and replenishment may serve to further feed the growth of micro organisms. At times it is necessary to shock the system with a microbiocide specific to the organism.

- Sludging and fouling also occur on a regular basis. Sludging can be attributed to the breakdown of glycol, while fouling may be the result of metallic oxide particles resultant from any corrosive attack on the multi metal systems. Owing to the cost of glycol (up to 50% by volume) flushing the system on a regular basis may be cost prohibitive. Evaluation of the glycol water system typically reveals many clues to the nature of these problems and to some alternatives to flushing.

- Filtration and additive packages are a means to conserving the glycol within the system. Filtration is based on a by pass micron filter unit, across the recirculation pumps. These units typically divert 5 percent of the system flow through the by pass to the filter, then back into the system. This removes suspended particles on a continuous basis. The additive packages are blended inhibitors for various systems, including passivating and noble film products. Depending upon the type, blend and quantitative levels of existing inhibitors, additive packages supplement the system where breakdown, dilution or degradation have occurred.

- An adjunct to the flushing of the system is the riser blowdown method. At the bottom of the risers, flush out or blown down vales are usually installed during construction to capture system sedimentation. These valves can be flushed out with minimal loss to the system volume. The flushing of these valves releases the accumulation of debris.

- Proper system flushings are more extensive and elaborate than initially viewed. It is ineffective to simply dump the system then flush with water, if the system is fouled. The nature of the fouling should be determined, along with the fouling constituents. Site or laboratory analysis can determine the effectiveness of various cleaning compounds against organic debris, biomass, metallic oxides, etc.

- System clean ups are designed in accordance with the fouling characteristics. Typical procedures should include the addition of various cleaning agents, anti-foulants, wetting agents, run times for penetration, kill, dispersion or chelation, followed by a comprehensive flush out and rinse cycle.

- Recharge of systems would include precise volumetric calculations for glycol addition, inhibitor fortification, anti microbial preservation, accompanied by a detailed analysis of system behavior and parameters. The maintenance operator would then have an operational reference point from which to start.

- Maintenance programs should include system analysis, filtration and riser blow down.

back to glycol menu

Glycol - Ramp Heating Systems

Kemtreet

- Underground parking lots may utilize a ramp heating system to prevent adherence of snow and ice during the winter months. The most prevalent type is the hot water heating glycol system. These are recirculating hot water heating systems piped beneath the concrete ramps, designed to generate radiant heat to the ramps. These heating systems utilize a tube in shell heat exchanger, deriving heat from a main heating system. A separate recirculation pump is used. Glycol is added to the ramp heating system to provide freeze or burst protection to the piping coils beneath the ramp. Depending upon the exposure, severity of local winter conditions, historical amounts of snow and ice, the glycol percentage is adjusted up to 50 percent glycol / water ratio.

- These system experience similar problems to those of larger glycol systems: breakdown of glycol and system fluid loss. The glycol should be checked on a yearly basis to ensure adequate freeze protection, inhibitor level and pH. Sufficient reservoir glycol / water in the expansion tank should also be verified.

- Older systems that have not been properly inhibited or maintained may be affected by oxides of corrosion by products, glycol sludging and inhibitor depletion. Caution should be observed to ensure the compatability of inhibitor packages from glycol source to source.

- Clean up procedures may include the flushing of the system, replenishment of the glycol, and chemical cleaning of the heat exchanger, if necessary.

back to glycol menu

Glycol - Ethylene Freeze Points

Kemtreet

% by Volume	% by Weight	Freeze Pt degrees F	Freeze Pt degrees C	Specific Gravity
0	0	32	0	1.000
1	1.1	32	0	1.000
2	2.3	31	-1	1.002
3	3.4	30	-1	1.004
4	4.5	29	-2	1.006
5	5.7	29	-2	1.007
6	6.8	28	-2	1.009
7	8.0	28	-2	1.010
8	9.0	27	-3	1.012
9	10.1	26	-3	1.014
10	11.2	25	-4	1.016
11	12.4	24	-4	1.017
12	13.5	23	-5	1.019
13	14.6	22	-6	1.020
14	15.5	21	-6	1.022
15	16.6	20	-7	1.024
16	17.7	20	-7	1.025
17	18.8	19	-7	1.027
18	19.9	18	-8	1.029
19	20.8	17	-8	1.030
20	21.9	16	-9	1.032
21	23.0	15	-9	1.034
22	24.0	14	-10	1.035
23	25.1	13	-11	1.037
24	26.1	11	-12	1.038
25	27.2	11	-11	1.040
26	28.2	9	-12	1.041
27	29.3	7	-13	1.043
28	30.3	5	-15	1.044
29	31.3	4	-15	1.046
30	32.1	3	-16	1.047
31	33.1	1	-17	1.049

32	34.2	0	-17	1.050
33	35.2	-1	-17	1.052
34	36.2	-3	-19	1.054
35	37.2	-4	-20	1.055
36	38.2	-5	-21	1.057
37	39.2	-7	-22	1.058
38	40.2	-9	-22	1.060
39	41.2	-11	-24	1.061
40	42.2	-13	-25	1.063
41	43.2	-15	-26	1.064
42	44.2	-17	-27	1.066
43	45.2	-19	-28	1.067
44	46.2	-21	-29	1.068
45	47.2	-23	-30	1.070
46	48.2	-25	-31	1.071
47	49.2	-27	-33	1.073
48	50.2	-29	-34	1.074
49	51.2	-31	-35	1.075
50	52.2	-34	-36	1.077
51	53.1	-37	-36	1.07
52	54.1	-40	-40	1.080
53	55.1	-43	-42	1.081
54	56.1	-46	-43	1.082
55	57.0	-49	-45	1.084
56	58.0	-51	-46	1.085
57	59.0	-53	-47	1.086
58	60.0	-56	-49	1.088
59	60.9	-58	-50	1.089
60	61.9	-60	-51	1.090

Kem Canada Mfg

4 Blair Drive Brampton, Ontario L6T 2h5

905.456.9444 fax: 9447 www.kemmfg.com

TRL 37	Sub zero release agent.
TRL 103	Windshield washer anti-freeze concentrate.
TRL 104	Liquid de-icer.
TRL 125	Arctic hydraulic oil, multi-grade.
TRL 151	Arctic gear oil, multi-grade.
TRB 555	Aerosol de-icer.
TRG 484	Freezer grease.
TRL 1150	Sub zero cleaner.
Kemelt Blue Blazer	Granular de-icing compound.

back to index

Kem Canada Mfg
4 Blair Drive, Brampton, Ontario L6T 2H5 905.456.9444 fax: 9447 www.kemmfg.com