The complete heat transfer fluid and antifreeze. Non-toxic, inhibited propylene glycol for chilled water, hydronic and other closed systems.

Glycols

Freez-Kontr'l®

Description

Freez-Kontr'l is a formulation of propylene glycol, dipotassium phosphate corrosion inhibitor and de-ionized water. The fluid is colored blue to aid in leak detection. It has an operating temperature range from below -60°F to 230°F and solutions in water provide freeze protection to below -60°F and burst protection to below -100°F.

Freez-Kontr'l is nearly odorless and the product of choice when contact with potable water is possible. The ingredients used in its manufacture are GRAS (generally recognized as safe), under Title 21, Part 182 of the US Code of Federal Regulations, where accidental or incidental contact with potable water could occur.

Benefits

- Optimum freeze or burst protection
- Fully inhibited to prevent corrosion
- Non-flammable
- Uses renewable resourced propylene glycol
- Low in acute oral toxicity
- Colored blue for easy leak detection

Application

Many commercial and industrial water systems, particularly closed systems, are required to operate while being exposed to varying extremes in temperature. These extremes may approach the freezing point of the water, making it necessary to suppress this freezing point in order to protect the system from freezing or bursting pipes. In other applications, it is necessary for the water to operate at temperatures below its freezing point (thermal storage, ice banks, etc.) or above its boiling point. As a result, suppression of the freezing point or raising of the boiling point becomes a matter of system design.

In all these applications, it is necessary to add a heat transfer solution to the water to achieve the desired operating temperature. In addition, the heat transfer solution should contain a corrosion inhibitor to protect system metal as closed systems are invariably troubled with corrosion in the absence of an inhibitor. Inhibited glycols, ethylene or propylene, are typically the compounds used in these applications.

Packaging

1 gallon bottle	**4188-07 (41880)**
5 gallon bottle	**4188-05 (41885)**
55 gallon bottle	**4188-01 (41888)**

General Specifications

Composition:	Propylene Glycol, Corrosion Inhibitor, Deionized Water.
Color:	Blue
pH 50% Solution:	8.5-9.0
Reserve Alkalinity:	19 ml
Specific Gravity:	1.06-1.07 @ 60°F
Corrosion Protection:	Requires a minimum system concentration of 30% Freez-Kontr'l.

Ethylene vs. Propylene

There are two major differences between ethylene glycols and propylene glycols. One is toxicity and the other is viscosity. Ethylene glycol-based products are less viscous than propylene glycol-based products. Therefore, they can generally provide slightly better heat transfer efficiency and low temperature performance. However, in applications where toxicity is a concern, propylene glycol products are used because of their low acute oral toxicity. Examples are where contact with drinking water is possible or applications in localities where propylene glycol use is mandated by law.

Burst Protection vs. Freeze Protection

Burst protection is adequate if the system will remain dormant when the temperature is below the freezing point of the solution and there is adequate space to accommodate the expansion of the ice/slush mixture while the system is inactive. A HVAC closed chilled water system is an example.

Freez-Kontr'l provides burst protection in the following manner: as the temperature drops below the solution's freezing point, ice crystals begin to form. Because water in the solution freezes first, the remaining glycol solution becomes further concentrated and remains fluid. The combination of ice crystals and glycol results in a flowable slush. Solution volume increases as this slush forms, with the extra volume flowing into available expansion volume in the system. For burst protection. See Table 1.

Table 1 - Percent Volume Freez-Kontr'l Required

Percent Volume of Freez-Kontr'l	Freeze Protection	Burst Protection
100%	below -60°F	-100°F
90%	below -60°F	-87°F
80%	-58°F	-74°F
70%	-35°F	-61°F
60%	-18°F	-48°F
50%	-3°F	-35°F
40%	+8°F	-20°F
30%	+16°F	+5°F

Freeze protection is required where the system's solution must be pumpable at the lowest anticipated temperature and/or where there is little to no room in the system for expansion to accommodate an ice/slush formation.

The required concentration of Freez-Kontr'l to achieve freeze protection will be dependent upon the operating conditions and the lowest expected ambient temperature. Closed chilled water systems that are subjected to prolonged winter shutdown… but which must start-up again while the weather is still cold… may require freeze protection. Freeze protection is also appropriate for closed-loop systems that must be protected in the event of power or pump failure.

To obtain adequate freeze protection, the glycol solution must maintain a freezing point at least 5°F below the lowest anticipated ambient temperature. Table 1 lists some typical concentrations of Freez-Kontr'l versus freezing points. Refer to Figure 1 for a complete list of concentrations of Freez-Kontr'l versus freezing points and boiling points. Figure 2 presents similar data in a chart.

Corrosion Protection

Freez-Kontr'l contains the best available corrosion inhibitor package for use with propylene glycol. It provides optimum corrosion protection for most metals, including copper, steel, brass, etc., and it does in two ways. First, the inhibitors in Freez-Kontr'l passivate the system's metal surfaces, protecting them from attack by oxygen, acidity, etc. And unlike automotive antifreezes which protect by forming thick silica-based gels or films which in turn reduce heat transfer, Freez-Kontr'l's inhibitors do not form films that build up on themselves.

Secondly, the inhibitors in Freez-Kontr'l buffer any acids formed as a result of glycol oxidation. All glycols naturally produce organic acids as degradation products, and this process can be accelerated in the presence of oxygen or heat. Without appropriate inhibitors, these "by-products" could lower pH and contribute to corrosion. Freez-Kontr'l's inhibitors prevent this. Note that a minimum system concentration of 30% Freez-Kontr'l is required for adequate corrosion protection.

Table 2 lists typical data on the corrosion rates of water, uninhibited propylene glycol and Freez-Kontr'l on various metals as determined by the standard screening test, ASTM D1384. Rates in excess of 0.5 mils per year (2.5 for aluminum) are usually considered as evidence of inadequate corrosion protection.

Table 2 - Corrosion Test Results
Weight Loss in Milligrams (Mils Penetration per Year)

	Water	PROPYLENE GLYCOL	FREEZ-KONTR'L
Copper	2 (0.08)	4 (0.16)	1 (0.04)
Solder	99 (3.14)	1095 (34.7)	2 (0.06)
Brass	5 (0.23)	5 (0.20)	2 (0.08)
Mild Steel	212 (9.69)	214 (9.80)	1 (0.04)
Cast Iron	450 (21.2)	345 (16.2)	1 (0.05)
Aluminum	110 (13.2)	15 (1.80)	+3 (+0.36)

Plus (+) indicates weight gain. Do not use on galvanized surfaces.

Usage Guidelines

1. Existing Systems: Entire system should be cleaned and flushed. Since Freez-Kontr'l may or may not be compatible with other fluids in the system, we recommend flushing the system completely. It is also important to clean away rust, scale, sediment, etc.
2. New Systems: These systems may be coated with cutting oils, grease, solder, flux, etc. Therefore, a thorough cleaning of new systems is recommended; Use a low foaming, alkaline cleaner such as Nu-Calgon System Cleaner (4370-08). Rinse thoroughly.
3. Select type of protection needed, burst or freeze protection. Once selected, consult Table 1 on this page or Figure 2 on the next page to identify the percentage (of system volume) that Freez-Kontr'l must comprise to achieve the desired protection. Remember, for freeze protection, you want to maintain a freeze point 5°F below the anticipated ambient temperature.
4. Identify the system's liquid volume.
5. Multiply the listed percentage times the system volume to arrive at the required gallons of Freez-Kontr'l.
6. Drain the system of sufficient water so that the needed Freez-Kontr'l can be added.
7. Dilution with demineralized or deionized water is strongly recommended, particularly in areas with total hardness values greater than 100 ppm. (See make-up water requirements on next page)
8. Circulate for 24 hours and check with a glycol refractometer.
9. Burst protection, a level of protection that is sufficient where the system fluid doesn't have to be pumped at the lowest anticipated temperature, can be achieved with 5-14% less Freez-Therm. Consult Nu-Calgon for details.

Figure 1 - Typical Freezing and Boiling Points of Various Aqueous Solution Concentrations of Freez-Kontr'l.

* Freezing points are below -60°F but true value are not easily determined since solution is extremely viscous.

Volume % Freez-Kontr'l	Freezing Point °F	Boiling Point °F @ 760mm Hg	Refractive Index 22°C
0.0	32.0	212	1.3328
6.8	29.1	212	1.3383
13.7	26.1	212	1.3438
20.7	22.9	212	1.3495
27.7	19.2	213	1.3555
29.1	18.3	213	1.3567
30.5	17.6	213	1.3579
32.0	16.6	213	1.3591
33.4	15.6	213	1.3603
34.9	14.7	214	1.3615
36.2	13.7	214	1.3627
37.7	12.6	214	1.3639
39.1	11.5	215	1.3651
40.6	10.4	215	1.3663
41.9	9.2	216	1.3675
43.4	7.9	216	1.3687
44.8	6.6	216	1.3698
46.3	5.3	216	1.3710
47.9	3.9	216	1.3621
49.2	2.4	217	1.3733
50.7	0.8	217	1.3744
52.1	-0.8	217	1.3756
53.5	-2.4	218	1.3767
54.9	-4.2	218	1.3779
56.6	-6.0	219	1.3790
58.0	-7.8	219	1.3802
59.4	-9.8	219	1.3813
60.9	-11.8	219	1.3825
62.4	-13.9	219	1.3836
63.8	-16.1	220	1.3847
65.3	-18.3	220	1.3858
66.9	-20.7	220	1.3870
68.3	-23.1	221	1.3881
69.8	-25.7	221	1.3892
71.2	-28.3	222	1.3903
72.7	-31.0	222	1.3914
74.2	-33.8	222	1.3924
75.7	-36.7	223	1.3935
77.2	-39.7	223	1.3945
78.6	-42.8	223	1.3956
80.0	-46.0	223	1.3966
81.4	-49.3	224	1.3977
82.8	-52.7	224	1.3987
84.3	-56.2	224	1.3998
85.7	-59.9	225	1.4008
92.8	*	227	1.4058
99.5	*	230	1.4104
100.0	*	237	1.4150

*Note: Make-up water requirements

The use of good quality deionized or demineralized water for dilution with glycols is imperative in closed-loop systems. In addition, the use of softened water is not recommended, due to the possible presence of anions, such as chlorides or sulfates. The water available from publicly owned water treatment facilities or wells has varying degrees of hardness, with much of it containing elevated levels of hard water ions (calcium and magnesium) than are acceptable for dilution of industrially inhibited glycols. These hard water ions will react with the inhibitors and form a solid precipitate, which removes the glycol's inhibitor from solution and creates a film that will coat the inside surfaces of the heat transfer system. This film will reduce heat transfer efficiency in critical components of the system. In addition, by depleting the inhibitor, hard water can accelerate corrosion and pitting of metal surfaces. Another problem with hard water is that it usually contains high levels of chlorides and sulfates. Chlorides and sulfates can also cause pitting and corrosion of metal surfaces.

To ensure the effectiveness of the inhibitors in glycol-based fluids, we recommend system dilution with deionized or demineralized water if the potential supply water exceeds any of the following limits:

100 ppm total hardness

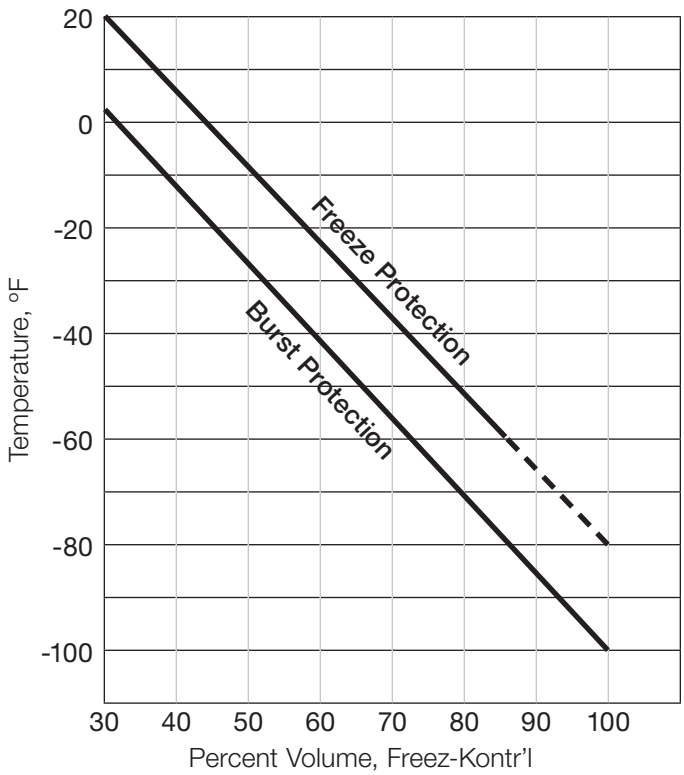
50 ppm calcium

25 ppm magnesium

25 ppm chloride

25 ppm sulfate

Figure 2 - Percent by volume required Freez-Kontr'l to achieve burst protection and freeze protection.



Minimum 30% Freez-Kontr'l is required for adequate corrosion resistance.

Figure 3 - Densities (lb/ft^3) of various solutions of Freez-Kontr'l (percent by volume)

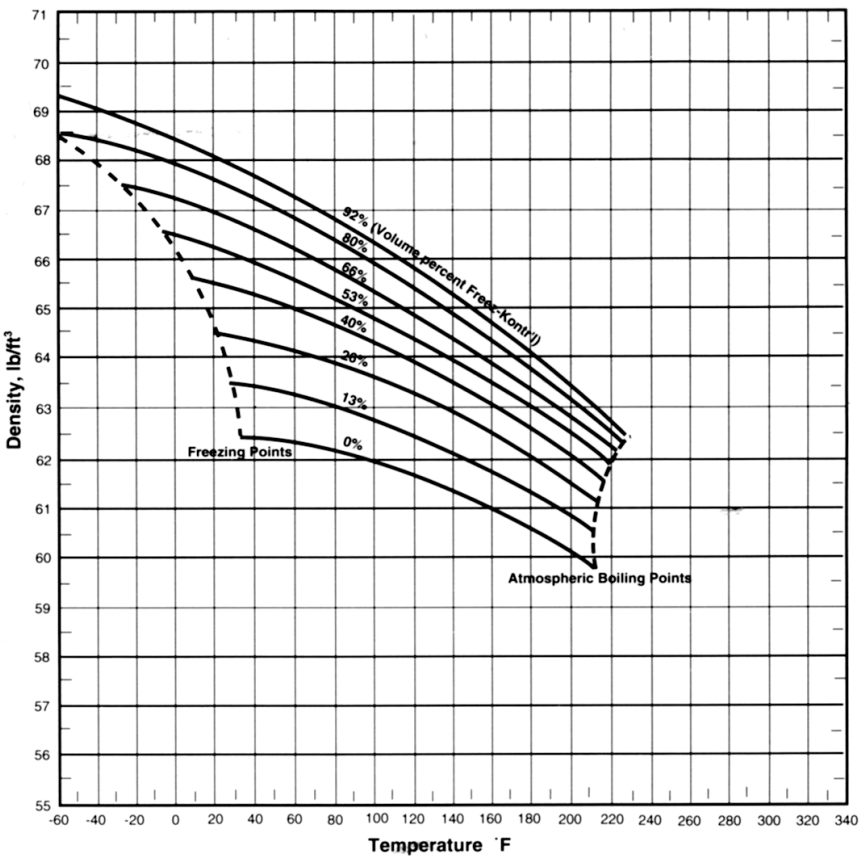
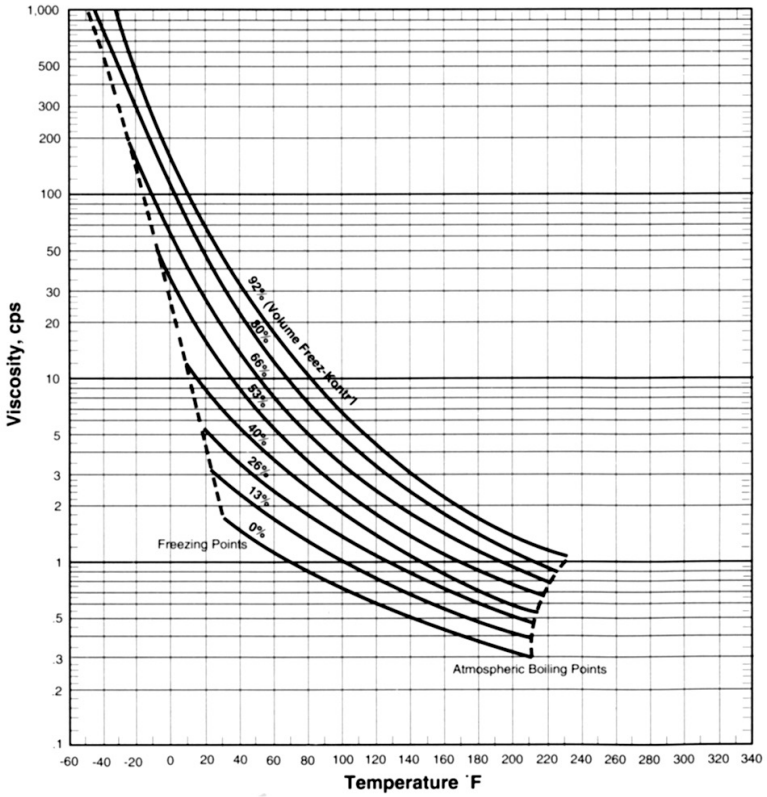


Figure 4 - Viscosities (cps) of Various solutions of Freez-Kontr'l (percent by volume)



Read and understand the product's label and Safety Data Sheet ("SDS") for precautionary and first aid information. The SDS is available on the Nu-Calgon website at www.nucalgon.com.