



Fermilab

Particle Physics Division

Mechanical Department Engineering Note

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Title: Electrical Conductivity of the Working Fluid in the Monsoon
Crate Cooling System

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monsoon crate cooling system.

Applicable Code: none

Electrical Conductivity of the Working Fluid in the Monsoon Crate Cooling System

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The document shows the method used in calculating the electrical conductivity the propylene glycol, deionized water, and bleach mixture. A small amount of bleach is added to prevent bacteria growth in the cooling system fluid. The values found for the solution were found for 100% concentration of that particular fluid.

The total volume required to fill the lines of the system is 0.0227 m³ or 6 gallons. It was found that ½ teaspoon of Clorox bleach can be added to 5 gallons of water for purification purposes. Thus, for 6 gallons¹ 3/5 of a teaspoon is needed to disinfect the lines. The system is typically filled with a 30% propylene glycol, 70% deionized water, and a small amount of bleach. The table below lists the values needed for the calculation.

Name	Conductivity [S]	Resistance [kΩ]	Density [kg/m ³]	Mass [g]
Deionized Water ²	1 x 10 ⁻⁶	1000	1000	70349
Propylene Glycol ³	10 x 10 ⁻⁶	100	1033	158904
Clorox Bleach ⁴	.148	6.7 x 10 ⁻³	1110	4
Mixture Properties using Eq. 1	<u>9.82 x 10⁻⁶</u>	<u>101.8</u>	<u>1022</u>	<u>229257</u>

$$(m\gamma)_{total} = (m\gamma)_{water} + (m\gamma)_{glycol} + (m\gamma)_{bleach}$$

Equation 1

where ‘ γ ’-[S] is the conductivity of the substance in its pure form. Plugging in the values into the equations above and solving for γ_{total} , the electrical conductivity and density are found.

¹ Doc DB: *Crate Cooling System Cabinet Enclosed Heat Exchanger Unit Specification*. (3819-v3)

² Myron L Company: *Application Bulletin Deionized Water*

³ The Dow Chemical Company: *Propylene Glycol, Industrial Grade*

⁴ California State: *2008 Project Summary* (Prj. # J1824)