

Interstate Chemical Company
Hermitage, PA

INTERCOOL BIO-GREEN
A NEW FULLY INHIBITED
HEAT TRANSFER FLUID
MADE FROM A RENEWABLE ENERGY
SOURCE

INTERCOOL BIO-GREEN

“A Green Heat Transfer Fluid”

- **Intercool Bio-Green** is a **non toxic** blend of 1,3 propanediol (**Susterra™**) made from renewable sources.
- **Susterra™**, developed jointly by **DuPont Tate and Lyle**, is produced from a proprietary fermentation process using **corn sugar** instead of petroleum-based feedstock's.
- The production of **Susterra™** consumes **40% less energy** and **reduces greenhouse gas emissions** by 20% versus petroleum based propylene glycol.
- **Susterra's™** toxicity is comparable to propylene glycol.
- **Intercool Bio-Green: a Fully inhibited Green Heat Transfer Fluid !**

INTERCOOL BIO-GREEN

Excellent Heat Transfer Properties

- Improved viscosities at lower temperatures.
- Less pumping pressure at lower temperatures.
- Higher Boiling Point (214 Celsius) than Ethylene Glycol (197.6 Celsius)
- **Susterra™** resists degradation better than petroleum based ethylene glycol in high temperature applications.
- **INTERCOOL BIO-GREEN** has the heat transfer efficiency of ethylene glycol with the toxicity benefits of propylene glycol
- **INTERCOOL BIO-GREEN: a new Green coolant** with excellent heat transfer characteristics.
- **THE PERFECT FIT FOR ANY NEW COOLANT PROJECTS!**

Intercool Bio-Green Applications

- Stationary Diesel Engines
- HVAC Systems
- Ice Rinks
- Geothermal Systems
- Solar Systems
- Heat Recovery Systems
- Ice Storage Systems
- Snow Melt Systems
- Drilling Equipment
- Natural Gas Well-Head Heaters
- Vapor Recovery Systems

Glycol Physical Properties Comparison

	Ethylene Glycol 1,2 ethanediol	Propylene Glycol 1,2 propanediol	<i>INTERCOOL Bio Green</i> 1,3 propanediol
CAS #	107-21-1	57-55-6	504-63-2
Structure	HO-CH ₂ -CH ₂ -OH	H ₃ C-CH-CH ₂ -OH OH	HO-CH ₂ -CH ₂ -CH ₂ -OH
Molecular Weight	62.07	76.1	76.09
Form	Colorless Liquid	Colorless Liquid Mild Odor	Liquid
Boiling Point (°C)	197.6	187.3	214
Melting Point (°C)	-12.7	-60	-24
Density (g/ml @ 20 °C)	1.1155	1.0381	1.053
Vapor Pressure (mm Hg @ 20 °C)	0.06	<0.1	0.08
Solubility	Soluble in water, acetone & CH ₃ OH	Completely soluble in water and alcohol	Soluble in water, alcohol and ether

Freeze Points of Selected Dilutions (In degrees Fahrenheit)

% Glycol	Ethylene Glycol	Propylene Glycol	<i>Intercool Bio-Green</i> 1,3 Propanediol
30%	3	9	9.4
40%	-13	-6	-4.1
50%	-34	-27	-20.5

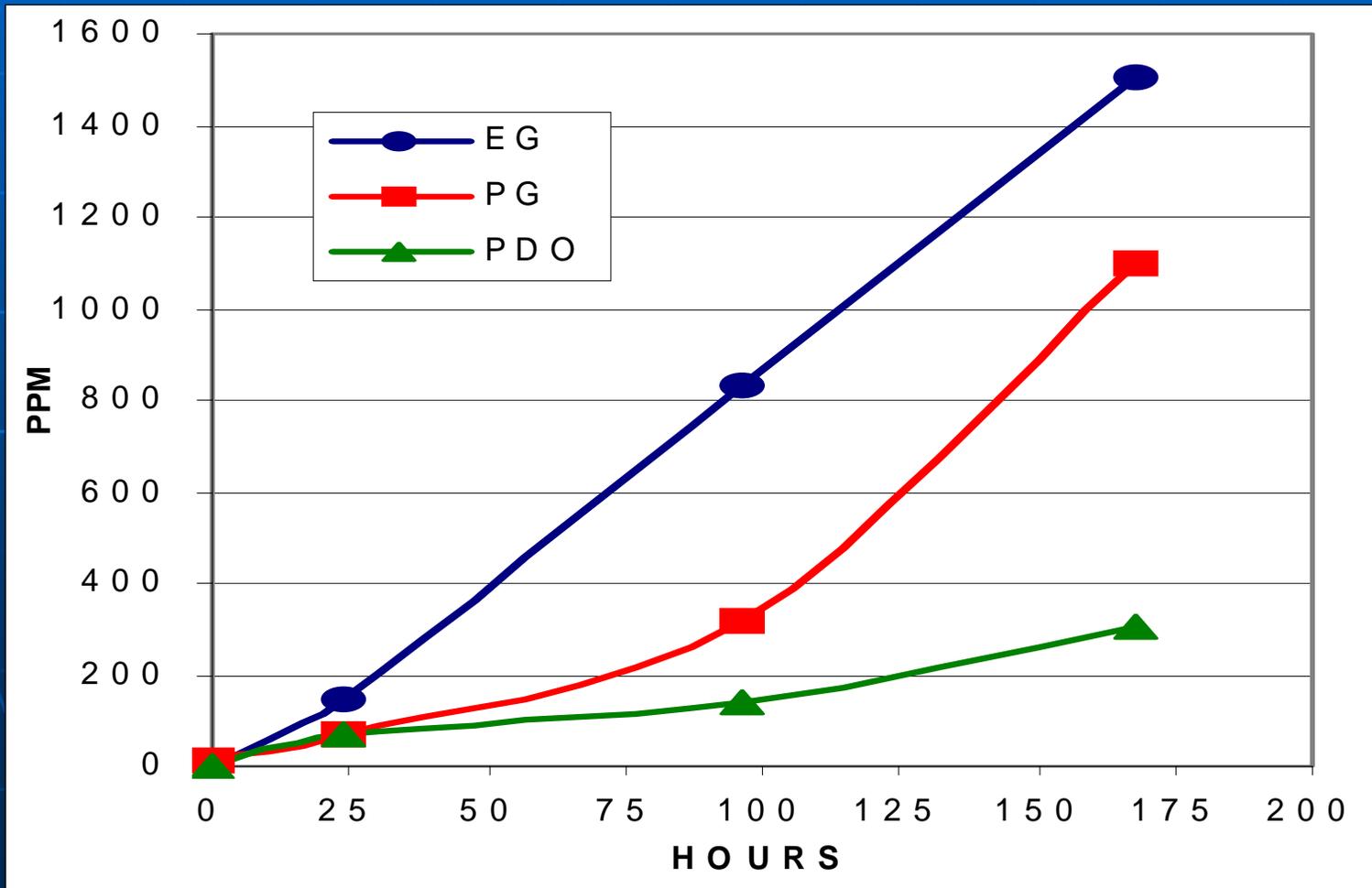
Boiling Points of Selected Dilutions (in degrees Fahrenheit)

% Glycol	Ethylene Glycol	Propylene Glycol	<i>Intercool Bio-Green</i> 1,3 propanediol
30%	218	216	220
40%	221	218	221
50%	225	222	223

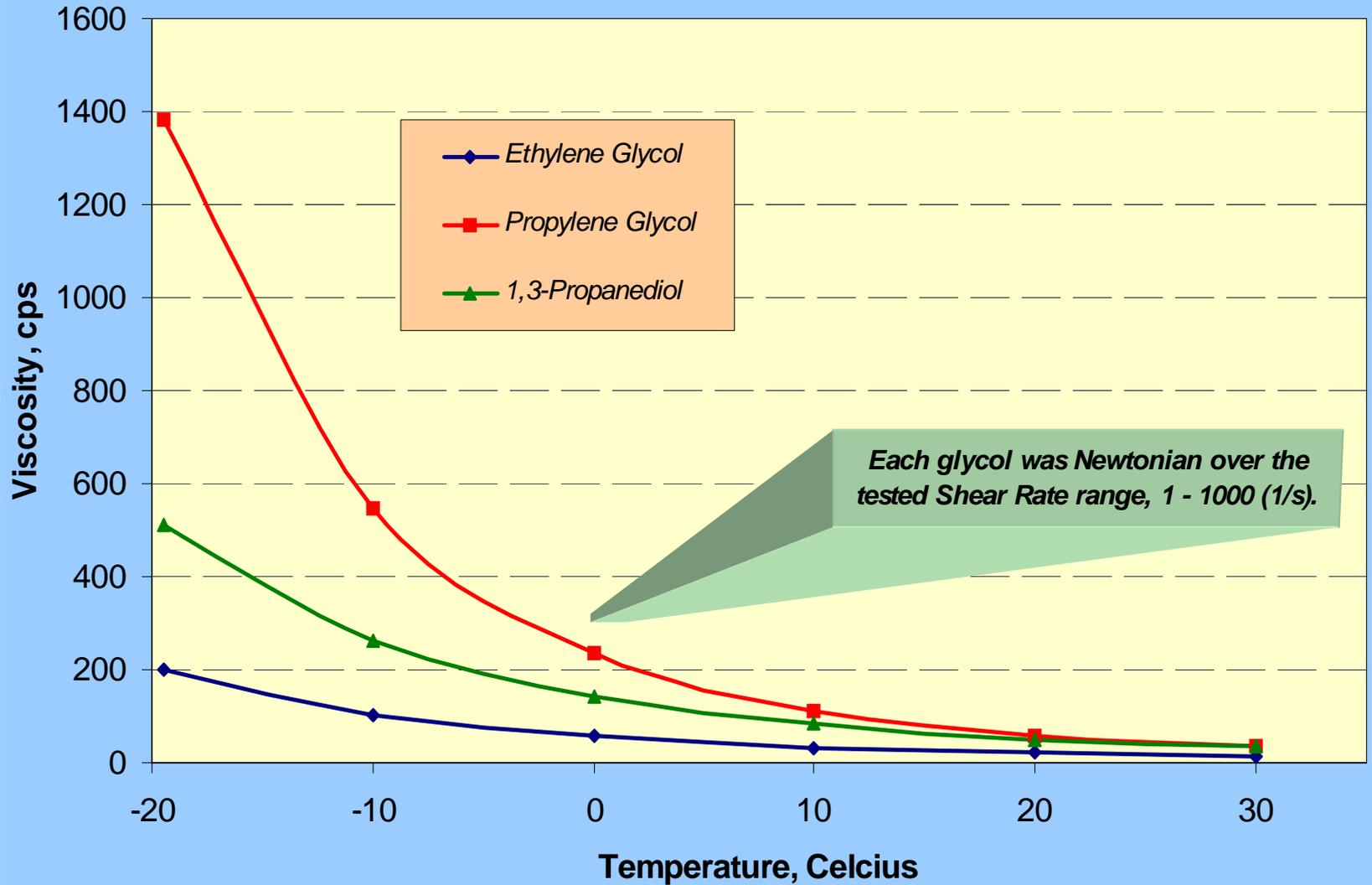
INTERCOOL® BIOGREEN

Glycol Degradation Comparison

Testing measured the concentration of acids formed under constant pressure and temperature by ion chromatography



Glycol Viscosity Comparison



INTERCOOL® BIOGREEN

Comparison of Pumping Pressure – PG vs. PDO

At -10 C, a 40% PG/ 60% water solution requires 2.4 X's the pumping energy as a 40% PDO/60% water solution.

<i>Thermophysical Properties at -10 C</i>	40.5 wt % (~14 mol %) 1,2-propanediol	40 wt % (13.6 mol %) 1,3-propanediol
Absolute Viscosity (cP)	24.48 ¹	16.5 ²
Density (g/ml)	1.05 ¹	1.06 ³
Specific Heat (kJKg ⁻¹ K ⁻¹)	3.602 ¹	3.495 ⁴
Thermal Conductivity (Wm ⁻¹ K ⁻¹)	.374 ¹	0.39 ⁵
Kinematic Viscosity (cSt) ⁶	23.3	15.5
Fp (C)	-20 ¹	-20 ⁷

$$PPR_{12} = (v_1 / v_2)^{1.95} (\rho_1 / \rho_2)^{-0.05} (k_1 / k_2)^{-2.3} (Cp_1 / Cp_2)^{-1.05}$$

PPR₁₂ at -10 C, using the thermophysical properties from above, describes the amount of energy needed to pump fluid 1 relative to fluid 2 in order to get the same heat transfer performance.

Fluid 1 = 1,2-propanediol

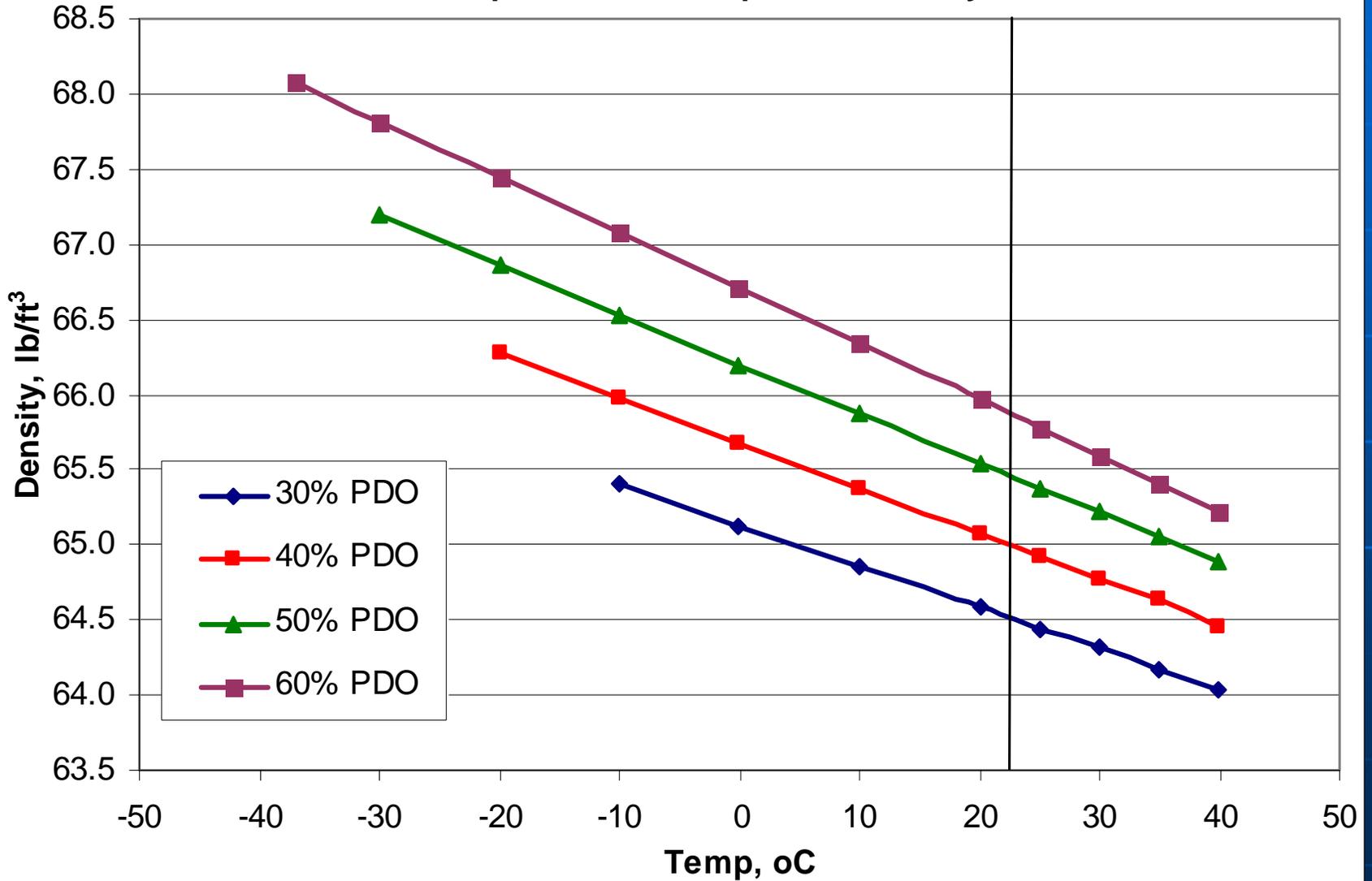
Fluid 2 = 1,3-propanediol

$$PPR_{12} \text{ at } -10 \text{ C} = 2.4$$

This PPR₁₂ equation comes from substituting appropriate values in equation 9 of the following paper:
Sherwood, G, "Secondary Heat Transfer Systems and the Application of a New Hydrofluoroether," Alternatives the 1995 International CFC and Halon Conference.

INTERCOOL® BIOGREEN DENSITY

1,3-Propanediol - Extrapolated Density



Interstate Chemical Heat Transfer Fluids Products, Technical Support and Contact Information

- As a major producer of Heat Transfer Fluids, Interstate Chemical offers a full line of inhibited EG, PG, or PDO based coolants in many dilutions.
- Interstate sources its raw materials from many major producers including Equistar, DuPont Tate and Lyle, and Shell to insure quality and reliability of supply.
- We offer a complete package of inhibitors to meet our customer's coolant needs.
- Our technical support and services are outstanding. Our technical support staff is readily available to answer our customer's questions.
- We offer ***Free (Semi annual) Analytical Testing*** for our customers to insure their coolants are operating at peak efficiency.
- We offer a variety of packaging including pails, drums, liquibins, and bulk tankers.
- Interstate is ISO certified and a member of NACD.
- Contact us at our toll free number: **1-888-422-2930** for product literature and information about our services.