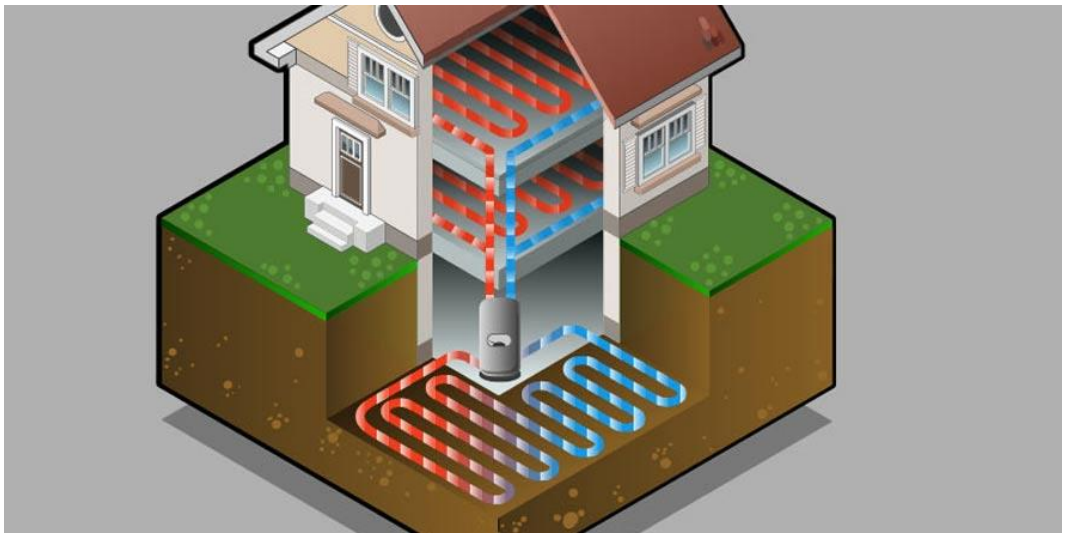
INNO GREEN CHEM

Innogreen GeoPro

Zero Toxicity – Maximum Efficiency- Triazole Free – NSF Certified

TECHNICAL GUIDE 2020

THE SMART SOLUTION FOR HEAT PUMPS



Innogreen GeoPro – The Smart Solution for Heat Pumps

Innogreen GeoPro is a VOC free, triazole free, non-toxic Heat Transfer Fluid developed specifically for use in Closed Loop Ground and Water Source Heat Pumps. The product offers a superior hydraulic performance, heat transfer efficiency and ecological profile than alternative products based on Ethylene Glycol (MEG), Propylene Glycol (MPG) or Ethanol. **Innogreen GeoPro is the only high efficiency, triazole free NSF certified heat pump thermal fluid available on the market.**

- Innogreen GeoPro is based on an intelligent blend of biodegradable, non-toxic base fluids, a biodegradable lubricant, a natural antioxidant and non-toxic corrosion inhibitors. **To demonstrate the safety of Innogreen GeoPro - The formulation has been certified by NSF International**.
- Innogreen GeoPro offers protection against freezing, corrosion and biological fouling in heat pumps systems
- Innogreen GeoPro retains its high fluidity at low circulating temperatures making it easier to pump and achieve turbulent flow - increasing overall system efficiency
- Innogreen GeoPro contains a biodegradable lubricant that reduces stress cracking and degradation of commonly used elastomers in heat pump systems.
- Innogreen GeoPro, in the event of a leak or spill, poses a significantly lower risk to the environment that alternative fluids.

Innogreen GeoPro – Installation Guidelines

- Innogreen GeoPro requires dilution to the freeze protection level required prior to installation (Table 1). Due to the inhibitor technology used - Innogreen GeoPro is compatible with both hard and soft waters. Ready to use solutions are available on request.
- Systems should be cleaned and sanitized prior to the installation of Innogreen GeoPro. Suitable cleaning solutions are available from Innogreen.

- To minimize the risk of biological fouling **Innogreen GeoPro should not be diluted to below 25 % v/v**- Bespoke solutions are available from Innogreen should dilutions lower than 25 % be required.

- Innogreen GeoPro can be used at a maximum circulation temperature of 50 ° C. Innogreen offer prediluted ready to use solutions of GeoPro which can be used at a maximum temperature of 90 ° C.

Note: Innogreen GeoPro should not be used in systems containing galvanized metals

Innogreen GeoPro – Elastomer Compatibility

Innogreen GeoPro is formulated with a biodegradable lubricant which extends the life of metals and elastomers commonly used within heat pump systems. Innogreen GeoPro is compatible with all metals and elastomers commonly used in heat pump systems. *It should be noted that the compatibility of elastomers is not just a function of chemical makeup and elastomer identity but also on the basis of elastomer quality and the use of extenders of fillers used to produce the elastomer. For further information on materials compatibility please contact Innogreen for more information.*

Innogreen GeoPro –Technical Properties

Table 1 GeoPro Dilution & Frost Protection

% V/V	Freeze Point/ °C	Refractive Index
25	-10	1.3652
30	-15	1.3731
40	-20	1.3763
50	-32	1.3860
60	-40	1.3999

Table 2: GeoPro Density Data gcm^{-3}

Temperature ° C	25 % v/v	30 % v/v	40 % v/v
50	1.109	1.115	1.165
40	1.113	1.121	1.168
30	1.117	1.127	1.171
20	1.121	1.133	1.174
10	1.125	1.139	1.177
0	1.129	1.145	1.18
-10	-	1.151	1.183
-15	-	-	1.185

Table 3: GeoPro Kinematic Viscosity Data mm^2/sec

Temperature ° C	25 % v/v	30 % v/v	40 % v/v
50	1.493	1.51	2.377
40	1.42	1.52	2.129
30	1.459	1.528	2.173
20	1.658	1.879	2.437
10	2.017	2.43	3.041
0	2.788	3.241	4.297
-10	-	4.372	6.709
-15	-	-	8.559

Table 4: GeoPro Specific Heat Capacity $kJKg^{-1}K^{-1}$

Temperature ° C	25 % v/v	30 % v/v	40 % v/v
50	3.36	3.32	3.12
40	3.34	3.28	3.11
30	3.32	3.25	3.09
20	3.30	3.22	3.08
10	3.29	3.20	3.07
0	3.28	3.19	3.05
-10	-	3.18	3.04
-15	-	-	3.03
-20	-	-	-

Table 5: GeoPro Thermal Conductivity $Wm^{-1}K^{-1}$

Temperature ° C	25 % v/v	30 % v/v	40 % v/v
50	0.559	0.525	0.481
40	0.549	0.519	0.478
30	0.539	0.513	0.475
20	0.529	0.507	0.472
10	0.519	0.501	0.469
0	0.509	0.495	0.466
-10	-	0.489	0.463
-15	-	-	0.461
-20	-	-	-