

# Ground Loop Design

## Borehole Design Project Report - 11/8/2022



<b>Project Name:</b> Democritus Racing Team	
<b>Designer Name:</b> Eneroots	
<b>Date:</b> 11/8/2022	<b>Project Start Date:</b> 11/8/2022
<b>Client Name:</b>	
<b>Address Line 1:</b>	
<b>Address Line 2:</b>	
<b>City:</b>	<b>Phone:</b>
<b>State:</b>	<b>Fax:</b>
<b>Zip:</b>	<b>Email:</b>

### Calculation Results

Design Method:	Design Day	COOLING	HEATING
Total Length (m):		200.0	200.0
Borehole Number:		2	2
Borehole Length (m):		100.0	100.0
Ground Temperature Change (°C):		+0.1	+0.1
Unit Inlet (°C):		27.0	11.8
Unit Outlet (°C):		32.6	8.6
Total Unit Capacity (kW):		9.3	10.5
Peak Load (kW):		7.5	5.0
Peak Demand (kW):		2.4	1.8
Heat Pump COP:		3.8	3.7
System COP:		3.2	2.8
System Flow Rate (L/min):		24.2	16.1

### Input Parameters

Fluid		Soil	
Flow Rate	11.4 (L/min)/3.5kW	Ground Temperature:	16.0 °C
Fluid:	100% Water	Thermal Conductivity:	2.09 W/(m*K)
Specific Heat (Cp):	4.180 kJ/(K*kg)	Thermal Diffusivity:	0.090 m^2/day
Density (rho):	999.6 kg/m^3		
Piping			
Pipe Type:	1 in. (25 mm) - SDR11		
Flow Type:	Turbulent		
Pipe Resistance:	0.062 m*K/W		
U-Tube Configuration:	Single		
Radial Pipe Placement:	Along Outer Wall		
Borehole Diameter:	114.0 mm		
Grout Thermal Conductivity:	1.19 W/(m*K)		
Borehole Thermal Resistance:	0.124 m*K/W		

### Input Parameters (Cont.)

Pattern		Modeling Time Period		
Vertical Grid Arrangement:	2 x 1	Prediction Time:	50.0 years	
Borehole Number:	2	Long Term Soil Temperatures:		
Borehole Separation:	6.0 m		<i>Cooling:</i> 16.1 °C	
Bores Per Circuit	1		<i>Heating:</i> 16.1 °C	
Fixed Length Mode	On			
Grid File	None			
File:				
Default Heat Pumps		Optional Hybrid Loads		
Manufacturer:	WaterFurnace		Cooling	Heating
Series:	Envision NSKW Hydronic (50Hz)	Geo Peak (%)	100%	100%
Design Heat Pump Inlet Load Temperatures:		Geo Total (%)	100%	100%
	<i>Cooling (WB)</i> <i>Heating (DB)</i>	Hybrid Peak (%)	0 %	0 %
Water to Air:	19.4 °C    21.1 °C	Hybrid Total (%)	0 %	0 %
Water to Water:	12.0 °C    37.0 °C			
Extra kW		Loads File		
Pump Power	0.4 kW		<i>Quote.zon</i>	
Cooling Tower Pump:	0.0 kW			
Cooling Tower Fan:	0.0 kW			
Additional Power	0.0 kW			