Ground Source Heat Pump Rebate Program

Design Template Guidelines

For Contractors

2019
## Table of Contents

- Overview and Key Contacts ...............................................................................................................3
- Documentation Stage..........................................................................................................................4
- Design Conditions ..............................................................................................................................4
- Ground Heat Exchanger Site Plan ........................................................................................................5
  - Vertical Loop..................................................................................................................................5
  - Horizontal or Open Loop ....................................................................................................................7
- Ground Heat Exchanger Piping Schematic ...........................................................................................8
  - Vertical Loop..................................................................................................................................8
  - Horizontal or Open Loop ....................................................................................................................9
- Ground Heat Exchanger System Specifications ..................................................................................10
- Ground Loop Interior Piping Schematic .............................................................................................11
- Hydronic (Water-to-Water) Piping Schematic ....................................................................................13
- Domestic Hot Water ..........................................................................................................................15
- Equipment Schedule ..........................................................................................................................16
- Electrical Drawing ................................................................................................................................17
- GSHP Design Templates – EXAMPLE 1 .............................................................................................22
- GSHP Design Templates – EXAMPLE 2 .............................................................................................39
Overview and Key Contacts

The New York State Energy Research and Development Authority (NYSERDA) maintains the integrity of the Ground Source Heat Pump (GSHP) Rebate Program through an independent standards and quality assurance team. The quality assurance system has several components, including review of applicants’ professional qualifications and credentials, establishment of program standards, performance of design reviews and comprehensive field and/or photo inspections of the loop filed and the completed installations. Field inspection includes verification of contracted scope of work, accuracy of site analysis, comparison of installation to submitted design drawings, and the delivered quality of the GSHP installation.

This document provides instructions and recommendations on how to complete the GSHP Design Templates. NYSERDA developed the templates to help you achieve the following objectives:

- Clarify the information required to be submitted as part of the design review and loop field and post-installation inspections
- Facilitate the participants’ collection and presentation of required information
- Facilitate the participants’ collection and submittal of information to authorities having jurisdiction in order to apply for required building permits

If you have any questions, please contact either of the following:

- Elizabeth Markham via telephone at (518) 862-1090 ext. 3386 or via email at elizabeth.markham@nyserda.ny.gov

- Rick Sehein at (518) 862-1090 ext. 3356 or via email at rick.sehein@nyserda.ny.gov.
**Documentation Stage**

Indicate whether the information provided on this form represents the design or are as-built conditions by checking the appropriate box. Information provided at the design stage should be updated once the installation is complete to represent as-built conditions.

- Design
- As-built

**Design Conditions**

Specify design conditions. The information provided should match the heating and cooling load calculations and loop design software outputs as uploaded with the rebate application.

<table>
<thead>
<tr>
<th>Heating design temperatures</th>
<th>Cooling design temperatures</th>
</tr>
</thead>
<tbody>
<tr>
<td>Outdoor 99% dry bulb: _____ °F</td>
<td>Outdoor 1% dry bulb: _____ °F</td>
</tr>
<tr>
<td>Indoor set point: _____ °F</td>
<td>Indoor set point: _____ °F</td>
</tr>
</tbody>
</table>

ACCA location used: ____________________________________________

| Building peak heating load: _____ Btu/h |
| Building peak cooling load: _____ Btu/h |

GSHP sized for: [ ] Heating [ ] Cooling

Design entering temperatures of heat transfer fluid to heat pump

- Min (in heating mode): _____ °F
- Max (in cooling mode): _____ °F

Estimated formation (rock/soil) thermal conductivity: _____ Btu/hr-ft-°F

Source:
- Soil/geological survey – Source: ____________________________________________
- Drill log (please attach)
- FTC test (please attach)
- Other: ____________________________________________
Ground Heat Exchanger Site Plan

During the design stage, the site plan should indicate the location and dimensions of any trenches and planned bores/wells. It should also indicate the location of all existing utilities and services on the property.

- Call 811 to identify the location of any underground utilities or services on the site prior to digging. This includes electric, gas, water, communications, and sewer. Indicate the location of each of these on the site plan as well as the minimum distance to the ground heat exchanger field.
- If there are other obstacles on the property, such as water well, septic system, fuel tank, cistern, driveway, trees, or wetlands, mark these and any associated lines to the house on the site plan.

After installation, the site plan should indicate the precise location and dimensions of all ground heat exchanger components relative to a fixed structure (e.g., building).

Manufacturers of direct exchange systems generally engineer the heat exchanger. Where the manufacturer has generated plans for their designs, submitting the manufacturer’s plans in lieu of templates is acceptable.

<table>
<thead>
<tr>
<th>Utility</th>
<th>Minimum Distance to Bore/Well/Loop Field</th>
</tr>
</thead>
<tbody>
<tr>
<td>Electric</td>
<td>_____ ft _____ in</td>
</tr>
<tr>
<td>Gas</td>
<td>_____ ft _____ in</td>
</tr>
<tr>
<td>Communications</td>
<td>_____ ft _____ in</td>
</tr>
<tr>
<td>Water</td>
<td>_____ ft _____ in</td>
</tr>
<tr>
<td>Sewer</td>
<td>_____ ft _____ in</td>
</tr>
<tr>
<td>Other:</td>
<td>_____ ft _____ in</td>
</tr>
<tr>
<td>Other:</td>
<td>_____ ft _____ in</td>
</tr>
<tr>
<td>Other:</td>
<td>_____ ft _____ in</td>
</tr>
</tbody>
</table>

Vertical Loop

Indicate on the template or attach a plan showing the location of the bores or wells relative to the house, property line, and any underground utilities. Indicate North. Add or cross out bores/wells on the template if there are fewer or more than four bores/wells. Show bore spacing on the plan.
In the table following the plan, list the depth of each bore and the precise location using triangulated locations ‘A’ and ‘B’ and/or GPS coordinates.

For as-built drawings, list the precise location using triangulated locations ‘A’ and ‘B’ and/or GPS coordinates and actual depth of each bore/well in the following table.

<table>
<thead>
<tr>
<th>Bore/Well</th>
<th>Depth (ft)</th>
<th>Method 1</th>
<th>Method 2</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td>Distance to A (ft-in)</td>
<td>Distance to B (ft-in)</td>
</tr>
<tr>
<td>1</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>2</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>3</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>4</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Dx Anode</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
Horizontal or Open Loop

Indicate the total number of trenches, the length, width, and depth of each trench and the minimum spacing between trenches. For direct exchange systems also include the location of corrosion protection (anodes) on the plan.

Loop Field Outer Dimensions: _____ ft long × _____ ft wide

Number of Trenches: __________

Individual Trench Dimensions: __________ ft deep × ______ ft wide × ______ ft

Minimum Trench Spacing: _______ ft

Supply/Return Trench Dimensions: __________ ft deep × ______ ft wide × ______ ft long

Dx Systems – Anode Distance from House: _______________ ft
Ground Heat Exchanger Piping Schematic

Fill out the relevant template or attach a schematic of the loop field piping. This will be used to verify pump head pressure and compliance with IGSHPA’s recommendation for loop field configuration. On the schematic, include the material, pipe size and dimension ratio, and total (round-trip) length of the ground loop, the header, and the supply/return piping.

Vertical Loop
## Ground Heat Exchanger System Specifications

Provide the grout used and the thermal conductivity once mixed as per design and identify the type and concentration of antifreeze used and the denaturant if the antifreeze is ethanol.

For as-built conditions, provide information on actual numbers used. For loop field volume, include the volume of the manifold and the heater to the heat pump and expansion tank if present.

<table>
<thead>
<tr>
<th>Grout type: ____________________________</th>
<th>Grout thermal conductivity (mixed): ____________________________ Btu/hr-ft-°F</th>
</tr>
</thead>
</table>

<table>
<thead>
<tr>
<th>Antifreeze type:</th>
<th>Ethanol denaturant:</th>
</tr>
</thead>
<tbody>
<tr>
<td>☐  Propylene glycol (CAS No. 57-55-6)</td>
<td>☐  Denatonium benzoate (CAS No. 3734-33-6)</td>
</tr>
<tr>
<td>☐  Methanol (CAS No. 67-56-1)</td>
<td>☐  Ethyl acetate (CAS No. 141-78-6)</td>
</tr>
<tr>
<td>☐  Ethanol (CAS No. 64-17-5)</td>
<td>☐  Isopropanol (CAS No. 67-63-0)</td>
</tr>
<tr>
<td>☐  Other (Specify: ____________)</td>
<td>☐  Pine oil (CAS No. 8002-09-3)</td>
</tr>
<tr>
<td></td>
<td>☐  Tertiary butyl alcohol (CAS No. 75-65-0)</td>
</tr>
</tbody>
</table>

| Antifreeze concentration: ____________% | =__________ containers |
|                                      | ×__________gallons per container |
|                                      | ÷__________gallons in loop field |
|                                      | × 100%                           |
Ground Loop Interior Piping Schematic

Complete the relevant template or furnish a schematic of the interior piping from the ground heat exchanger to the heat pump.

Provide piping material, dimensions, and insulation specifications for all piping. Provide the flow center (pump pack) and/or pump manufacturer and model, number of pumps, and rated pumping power for the flow center.

Draw in all other system elements present on the indoor portion of the loop, such as additional piping, ball valves, isolation valves, P/T ports, expansion tanks, make-up water, and air separators.

Pressurized flow center
Non-pressurized (standing column) flow center

Pipe:
Material: 
Size: ________ in
DR: 
Insulation: ________ in

Non-Pressurized Flow Center
Flow Center Make/Model: ________________________
Pump Make/Model: ________________________
Rated Power: ________ W
☐ Per pump ☐ Total
Number of Pumps: ________

From Ground Heat Exchanger

To Ground Heat Exchanger

Heat Pump

Pipe:
Material: 
Size: ________ in
DR: 
Insulation: ________ in
Hydronic (Water-to-Water) Piping Schematic

For water-to-water systems, provide piping schematic. Mark up one of the templates provided (add or cross out system elements as needed) or attach a separate schematic.

The schematic should indicate all system elements, including pumps, valves, expansion tanks, buffer tanks, air separators, P/T ports, zones for radiant heating and distributed water-to-air cooling, and air handler units. It should also indicate the hydronic piping material, size, and insulation, and antifreeze specifications if present in the hydronic system.

Antifreeze Type: ______________

Antifreeze Concentration: ____________%
Hydronic Arrangement B
Domestic Hot Water

If heat pump system provides domestic hot water heating (via dedicated hot water generation or supplemental hot water generation desuperheater), provide details of the domestic hot water system. Include specifications for the water heater and any storage (preheat) tank.

Storage (preheat) tank

Manufacturer: ___________________ Model: ____________ Capacity: _____ gallons
Plumbing: __________________________________________
Pipe material: ___________________________ Fittings: __________ Port location: __________
Insulation: ________ in

Water heater

Manufacturer: ___________________ Model: ____________ Capacity: _____ gallons
Plumbing: __________________________________________
Pipe material: ___________________________ Fittings: __________ Port location: __________
Insulation: ________ in

Fuel: ☐ Electric ☐ Natural Gas ☐ Propane
☐ Other: __________________________


# Equipment Schedule

List all major equipment in the project as applies.

## Heat Pump Compressor Unit(s)

<table>
<thead>
<tr>
<th>Manufacturer</th>
<th>Model Number</th>
<th>Number of Units</th>
<th>Load / Zone</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

## Hydronic Buffer Tank

<table>
<thead>
<tr>
<th>Manufacturer</th>
<th>Model Number</th>
<th>Capacity (gallons)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

## Hydronic Expansion Tank(s)

<table>
<thead>
<tr>
<th>Manufacturer</th>
<th>Model Number</th>
<th>Max. Pressure (psi)</th>
<th>Location</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

## Hydronic Pumps or Valves

<table>
<thead>
<tr>
<th>Manufacturer</th>
<th>Model Number</th>
<th>Number of Units</th>
<th>Load / Zone</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

## Hydronic Air Handler(s)

<table>
<thead>
<tr>
<th>Manufacturer</th>
<th>Model Number</th>
<th>Number of Units</th>
<th>Load / Zone</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
Electrical Drawing

Fill in the blanks in the relevant electrical drawing template, depending on whether a supplementary disconnect is required and whether auxiliary heat is present and requires separate electrical protection.

Provide the required electrical protection as per manufacturer specifications: whether a fuse and/or an HACR circuit breaker is specified and the maximum rated amps of the overcurrent protection device. Specify the conductor and fuse/breaker to be installed on site. The wire size selected should also be able to carry the minimum circuit ampacity (MCA) as specified by the manufacturer and comply with any manufacturer-specified minimum rating for overcurrent protection devices.

If the heat pump requires additional protection (e.g., separate protection for each stage), or if the project has multiple heat pumps with varying protection needs, attach the electrical drawings as a separate page.

The plan should be compliant with the National Electric Code (NEC) and any local codes. For more details on NEC requirements, see NEC 240 Overcurrent Protection and NEC 424.19 Disconnecting Means.

Electrical panel within sight of heat pump compressor unit

---

Electrical Panel

- **Breaker Size:** ___ Amps
- **Ground Bus**

Heat Pump Compressor Unit

- **Required protection (mfg):**
  - [ ] Fuse
  - [ ] HACR circuit breaker
- **Maximum:** ___ Amps

Conductor size:
- [ ] American Wire Gauge (AWG)
- [ ] circular mils

Conductor type:
- [ ] Copper
- [ ] Aluminum
Supplementary disconnect within sight of heat pump compressor unit

Electrical Panel

- Breaker Size: _____ Amps
- Ground Bus

Connect to

Heat Pump Compressor Unit

- Required protection (mfg):
  - ☐ Fuse
  - ☐ HACR circuit breaker
- Maximum: _____ Amps

Conductor size: _____
- ☐ American Wire Gauge (AWG)
- ☐ circular mils

Conductor type:
- ☐ Copper
- ☐ Aluminum

Electrical panel within sight of heat pump compressor unit, with auxiliary heat

Electrical Panel

- Breaker Size: _____ Amps
- Ground Bus

Connect to

Auxiliary Heat

- Required protection (mfg):
  - ☐ Fuse
  - ☐ HACR circuit breaker
- Maximum: _____ Amps

Connect to

Heat Pump Compressor Unit

- Required protection (mfg):
  - ☐ Fuse
  - ☐ HACR circuit breaker
- Maximum: _____ Amps

Conductor size: _____
- ☐ American Wire Gauge (AWG)
- ☐ circular mils

Conductor type:
- ☐ Copper
- ☐ Aluminum
Supplementary disconnect within sight of heat pump compressor unit, with auxiliary heat

- Conductor size: _____
  - American Wire Gauge (AWG)
  - circular mils
- Conductor type: _____
  - Copper
  - Aluminum

**Electrical Panel**
- Breaker Size: _____ Amps
- Ground Bus

**Auxiliary Heat**
- Required protection (mfg):
  - ☐ Fuse
  - ☐ HACR circuit breaker
- Maximum: _____ Amps

**Heat Pump Compressor Unit**
- Required protection (mfg):
  - ☐ Fuse
  - ☐ HACR circuit breaker
- Maximum: _____ Amps

**Conductor size: _____**
- American Wire Gauge (AWG)
- circular mils
**Conductor type: _____**
- Copper
- Aluminum
**Service Clearance**

Indicate the minimum service clearance required as per manufacturer specifications around the heat pump equipment. Provide additional service clearance dimensions as required for separate equipment to be installed (e.g., air handler unit, desuperheater).

It is recommended that a copy of all schematics and specifications be furnished to the owner along with the required manual for operations and maintenance.
## GSHP Design Templates – EXAMPLE 1

### Documentation Stage

- [✓] Design
- [ ] As-built

### Design Conditions

Specify design conditions used in Manual J and loop design software.

<table>
<thead>
<tr>
<th>Heating design temperatures</th>
<th>Cooling design temperatures</th>
</tr>
</thead>
<tbody>
<tr>
<td>Outdoor 99% dry bulb: 17 °F</td>
<td>Outdoor 1% dry bulb: 89 °F</td>
</tr>
<tr>
<td>Indoor set point: 69 °F</td>
<td>Indoor set point: 72 °F</td>
</tr>
</tbody>
</table>

ACCA location used: New York LaGuardia AP

<table>
<thead>
<tr>
<th>Building peak heating load: 36,345 Btu/h</th>
</tr>
</thead>
<tbody>
<tr>
<td>Building peak cooling load: 28,744 Btu/h</td>
</tr>
</tbody>
</table>

GSHP sized for: [✓] Heating  [ ] Cooling

Design entering temperatures to heat transfer fluid to heat pump

<table>
<thead>
<tr>
<th>Min (in heating mode): 30 °F</th>
</tr>
</thead>
<tbody>
<tr>
<td>Max (in cooling mode): 63 °F</td>
</tr>
</tbody>
</table>

Estimated formation (rock/soil) thermal conductivity: 1.4 Btu/hr-ft-°F

Source:

- [ ] Soil/geological survey – Source: 
- [ ] Drill log (please attach)
- [ ] FTC test (please attach)
- [ ] Other: 

---

22
### Ground Heat Exchanger Site Plan

Indicate which underground utilities and obstacles exist on the property and the minimum distance of each to the ground heat exchanger.

<table>
<thead>
<tr>
<th>Utility</th>
<th>Minimum Distance to Bore/Well/Loop Field</th>
</tr>
</thead>
<tbody>
<tr>
<td>Electric</td>
<td>&gt;30 ft _______ in</td>
</tr>
<tr>
<td>Gas</td>
<td>____________ ft ___________ in</td>
</tr>
<tr>
<td>Communications</td>
<td>____________ ft ___________ in</td>
</tr>
<tr>
<td>Water</td>
<td>19 ft ___________ in</td>
</tr>
<tr>
<td>Sewer</td>
<td>&gt;25 ft _______ in</td>
</tr>
<tr>
<td>Other: tree</td>
<td>&gt;20 ft _______ in</td>
</tr>
</tbody>
</table>

Show the location of the ground heat exchanger relative to the house, property line, and underground services on the appropriate ground heat exchanger plan or attach a plan showing the equivalent detail.

- [ ] Vertical Loop

Show the location of the bores or wells relative to the house, property line, and any underground utilities. Include bore spacing.
For as-built drawings, list the precise location and actual depth of each bore/well in the following table.

<table>
<thead>
<tr>
<th>Bore/Well</th>
<th>Depth (ft)</th>
<th>Distance to A (ft-in)</th>
<th>Distance to B (ft-in)</th>
<th>GPS Coordinates</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>249</td>
<td></td>
<td></td>
<td>21'-0”</td>
</tr>
<tr>
<td>2</td>
<td>255</td>
<td></td>
<td></td>
<td>30'-0”</td>
</tr>
<tr>
<td>3</td>
<td>250</td>
<td></td>
<td></td>
<td>35'-3”</td>
</tr>
<tr>
<td>4</td>
<td>252</td>
<td></td>
<td></td>
<td>39'-10”</td>
</tr>
<tr>
<td>Dx Anode</td>
<td>N/A</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
Horizontal or Surface Water Loop

Attach a plan showing the location of loop field relative to the house, property line, and underground services.

Loop Field Outer Dimensions: __________ ft long × __________ ft wide

Number of Trenches: __________

Individual Trench Dimensions: __________ ft deep × __________ ft wide × __________ ft long

Minimum Trench Spacing: __________ ft

Supply/Return Trench Dimensions: __________ ft deep × __________ ft wide × __________ ft long

Dx Systems – Anode Distance from House: __________ ft
Ground Heat Exchanger Piping Schematic

Outline the loop field piping layout and specifications.

☑️ Vertical Loop
Horizontal or Surface Water Loop

Ground Heat Exchanger Piping Schematic: Horizontal/Pond

Heat Exchanger Pipe:
- **Material:**
- **Size:** _____ in
- **Dx He. Line:** _____ in
- **EI:** _____
- **Dx Gas Line:** _____ in
- **Total Length:** _____ ft

Header Pipe:
- **Material:**
- **Size:** _____ in
- **Dx Heq. Line:** _____ in
- **DI:** _____
- **Dx Gas Line:** _____ in
- **Total Length:** _____ ft
## Ground Heat Exchanger System Specifications

<table>
<thead>
<tr>
<th>Grout type:</th>
<th>Geogrout Co. A-2</th>
</tr>
</thead>
<tbody>
<tr>
<td>Grout thermal conductivity (mixed):</td>
<td>1.14 Btu/hr-ft°F</td>
</tr>
</tbody>
</table>

### Antifreeze Type:
- [x] Propylene glycol (CAS No. 57-55-6)
- [ ] Methanol (CAS No. 67-56-1)
- [ ] Ethanol (CAS No. 64-17-5)
- [ ] Other (Specify: ____________)

### Ethanol Denaturant:
- [x] Denatonium benzoate (CAS No. 3734-33-6)
- [ ] Ethyl acetate (CAS No. 141-78-6)
- [ ] Isopropanol (CAS No. 67-63-0)
- [ ] Pine oil (CAS No. 8002-09-3)
- [ ] Tertiary butyl alcohol (CAS No. 75-65-0)

### Antifreeze Concentration:
- 20 %

\[
\text{Containers} = \frac{\text{gallons per container} \times \text{gallons in loop field}}{\text{containers}} \times 100\%
\]
Ground Loop Interior Piping Schematic

Outline the pipe layout and specifications, and system elements in the ground loop interior piping. Indicate the location of any other equipment on the indoor portion of the loop.

☑ Pressurized flow center

Pipe:
- Material: HDPE 3608
- Size: 1.25 in
- DR: SDR 11
- Insulation: 1/2 in

Pressurized Flow Center
- Flow Center Make/Model: GeoFlo GPM-2 Foam Insul.
- Pump Make/Model: Grundfos U26-99
- Rated Power: 245 W
  - ☑ Per pump  ☐ Total
  - Number of Pumps: 2

Heat Pump

Pipe:
- Material: Reinf. Rubber hose
- Size: 1.25 in
- DR: N/A
- Insulation: 1/2 in
Non-pressurized (standing column) flow center

Pipe:
- Material: ____________
- Size: ____________ in
- DR: ____________
- Insulation: ____________ in

From Ground Heat Exchanger

Non-Pressurized Flow Center
- Flow Center Make/Model: ____________
- Pump Make/Model: ____________
- Rated Power: _______ W
  - [ ] Per pump  [ ] Total
- Number of Pumps: _______

To Ground Heat Exchanger

Heat Pump

Pipe:
- Material: ____________
- Size: ____________ in
- DR: ____________
- Insulation: ____________ in
Hydronic Piping Schematic

For water-to-water systems, provide a schematic indicating all system elements.

Antifreeze Type: propylene glycol

Antifreeze Concentration: 20%

- [x] Hydronic Arrangement A

- [ ] Hydronic Arrangement B
Domestic Hot Water

Provide details of the heat pump system.

☐ Storage (preheat) tank
   Manufacturer: American Water Heater Company
   Model: PVG62-75T75-3PV
   Capacity: 75 gallons

   Plumbing
   Pipe material: copper
   Fittings: hose barb kit
   Port location: side, bottom
   Insulation: AP Armaflex½"

☐ Water heater
   Manufacturer: AO Smith
   Model: HPTU-50N 120
   Capacity: 50 gallons

   Plumbing
   Pipe material: copper
   Fittings: hose barb kit
   Port location: top
   Insulation: AP Armaflex½"

Fuel: ☑ Electric ☐ Natural Gas ☐ Propane ☐ Other: __________________________

32
## Equipment Schedule

### Heat Pump Compressor Unit(s)

<table>
<thead>
<tr>
<th>Manufacturer</th>
<th>Model Number</th>
<th>Number of Units</th>
<th>Load / Zone</th>
</tr>
</thead>
<tbody>
<tr>
<td>GeoStar</td>
<td>111H072TL151C00S0</td>
<td>1</td>
<td>Whole House</td>
</tr>
</tbody>
</table>

### Hydronic Buffer Tank

<table>
<thead>
<tr>
<th>Manufacturer</th>
<th>Model Number</th>
<th>Capacity (gallons)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Caleffi</td>
<td>Thermocon NAS20050</td>
<td>50</td>
</tr>
</tbody>
</table>

### Hydronic Expansion Tank(s)

<table>
<thead>
<tr>
<th>Manufacturer</th>
<th>Model Number</th>
<th>Max. Pressure (psi)</th>
<th>Location</th>
</tr>
</thead>
<tbody>
<tr>
<td>Flexcon</td>
<td>FLEX2PRO HTX30</td>
<td>100</td>
<td>Hydronic Loop</td>
</tr>
<tr>
<td>Amtrol</td>
<td>Extrol EX-30</td>
<td>100</td>
<td>Buffer Tank</td>
</tr>
</tbody>
</table>

### Hydronic Pumps or Valves

<table>
<thead>
<tr>
<th>Manufacturer</th>
<th>Model Number</th>
<th>Number of Units</th>
<th>Load / Zone</th>
</tr>
</thead>
<tbody>
<tr>
<td>Grundfos</td>
<td>UP 26-116 F</td>
<td>4</td>
<td>Each Zone</td>
</tr>
</tbody>
</table>

### Hydronic Air Handler(s)

<table>
<thead>
<tr>
<th>Manufacturer</th>
<th>Model Number</th>
<th>Number of Units</th>
<th>Load / Zone</th>
</tr>
</thead>
<tbody>
<tr>
<td>N/A</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
**Electrical Drawing**

Complete the relevant drawing to demonstrate compliance with National Electric Code.

- Electrical panel within sight of heat pump compressor unit

**Electrical Panel**

- Breaker size: _____ Amps
- Ground Bus

**Heat Pump Compressor Unit**

- Required protection (mfg):
  - [ ] Fuse
  - [ ] HACR circuit breaker
- Maximum: _____ Amps

**Conductor size:**

- [ ] American Wire Gauge (AWG)
- [ ] Circular mils

**Conductor type:**

- [ ] Copper
- [ ] Aluminum
Supplementary disconnect within sight of heat pump compressor unit

**Electrical Panel**

- Breaker Size: ___ Amps
- Ground Bus

**Heat Pump Compressor Unit**

- Required protection (mfg):
  - Fuse
  - HACR circuit breaker

- Maximum: ______ Amps

**Conductor**

- Size: ___
  - American Wire Gauge (AWG)
  - Circular mils

- Type:
  - Copper
  - Aluminum
Electrical panel within sight of heat pump compressor unit, with auxiliary heat

- Conductor size: 
  - American Wire Gauge (AWG) 
  - circular mils
- Conductor type:
  - Copper
  - Aluminum

**Electrical Panel**

- Breaker Size: ____ Amps

**Auxiliary Heat**

- Required protection (mfg):
  - Fuse
  - HACR circuit breaker
- Maximum: ____ Amps

**Heat Pump Compressor Unit**

- Required protection (mfg):
  - Fuse
  - HACR circuit breaker
- Maximum: ____ Amps

**Conductor size:**

- American Wire Gauge (AWG)
- circular mils

**Conductor type:**

- Copper
- Aluminum
Supplementary disconnect within sight of heat pump compressor unit, with auxiliary heat

Conductor size: 10
- American Wire Gauge (AWG)
- circular mils

Conductor type:
- Copper
- Aluminum

Electrical Panel
- 30 Amps

Ground Bus

Disconnect

Auxiliary Heat
Required protection:
- Fuse
- HACR circuit breaker
Maximum: 30 Amps

Heat Pump Compressor Unit
Required protection:
- Fuse
- HACR circuit breaker
Maximum: 60 Amps
Service Clearance

Indicate minimum service clearance required around the heat pump equipment.

Above: 36 in
Rear: 12 in
Left: 36 in
Right: 36 in

Front: 36 in
## GSHP Design Templates – EXAMPLE 2

### Documentation Stage

- [ ] Design
- [x] As-built

### Design Conditions

Specify design conditions used in Manual J and loop design software.

<table>
<thead>
<tr>
<th>Heating design temperatures</th>
<th>Cooling design temperatures</th>
</tr>
</thead>
<tbody>
<tr>
<td>Outdoor 99% dry bulb: 3 °F</td>
<td>Outdoor 1% dry bulb: 86 °F</td>
</tr>
<tr>
<td>Indoor set point: 70 °F</td>
<td>Indoor set point: 75 °F</td>
</tr>
</tbody>
</table>

ACCA location used: [Syracuse Hancock IAP](#)

Building peak heating load: 49,090 Btu/h
Building peak cooling load: 13,777 Btu/h

GSHP sized for: [Heating] [Cooling]

Design entering temperatures of heat transfer fluid to heat pump

| Min (in heating mode): 30 °F | Max (in cooling mode): 63 °F |

Estimated formation (rock/soil) thermal conductivity: 1.7 Btu/hr-ft-°F

Source:

- [ ] Drill log (please attach)
- [ ] FTC test (please attach)
- [ ] Other: ________________________________
Ground Heat Exchanger Site Plan

Indicate which underground utilities and obstacles exist on the property and the minimum distance of each to the ground heat exchanger.

<table>
<thead>
<tr>
<th>Utility</th>
<th>Minimum Distance to Bore/Well/Loop Field</th>
</tr>
</thead>
<tbody>
<tr>
<td>Electric</td>
<td>&gt;85 ft________ in</td>
</tr>
<tr>
<td>Gas</td>
<td><em><strong><strong>ft</strong></strong></em>___ in</td>
</tr>
<tr>
<td>Communications</td>
<td>&gt;100 ft________ in</td>
</tr>
<tr>
<td>Water</td>
<td>&gt;100 ft________ in</td>
</tr>
<tr>
<td>Sewer</td>
<td>&gt;25  ft________ in</td>
</tr>
<tr>
<td>Other:</td>
<td><em><strong><strong>ft</strong></strong></em>___ in</td>
</tr>
</tbody>
</table>

Show the location of the ground heat exchanger relative to the house, property line, and underground services on the appropriate ground heat exchanger plan, or attach a plan showing the equivalent detail.
For as-built drawings, list the precise location and actual depth of each bore/well in the following table.

<table>
<thead>
<tr>
<th>Bore/Well</th>
<th>Depth (ft)</th>
<th>Method 1</th>
<th>Method 2</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td>Distance to A (ft-in)</td>
<td>Distance to B (ft-in)</td>
</tr>
<tr>
<td>1</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>2</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>3</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>4</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Dx Anode</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
Horizontal or Surface Water Loop

Loop Field Outer Dimensions: 300 ft long × 45 ft wide

Number of Trenches: 4

Individual Trench Dimensions: 8 ft deep × 3 ft wide × 300 ft long

Minimum Trench Spacing: 10 ft

Supply/Return Trench Dimensions: 8 ft deep × 3 ft wide × 165 ft long

Dx Systems – Anode Distance from House: _____________

N/A ft
Ground Heat Exchanger Piping Schematic

Outline the loop field piping layout and specifications.

- Vertical Loop

**Bore/Well Pipe:**
- Material: 
- Size: _________ in
- DR: 
- Depth: _________ ft

**Header Pipe:**
- Material: 
- Size: _________ in
- DR: 
- Total Length: _________ ft

**Supply/Return Pipe:**
- Material: 
- Size: _________ in
- DR: 
- Total Length: _________ ft
☑ Horizontal or Surface Water Loop

Ground Heat Exchanger Piping Schematic: Horizontal/Pond – EXAMPLE 2

---

**Heat Exchanger Pipe:**

- Material: **HDPE 3608**
- Size: **3/4 in**
- DX Liquid Line: **N/A in**
- DR: **11**
- DX Gas Line: **N/A in**
- Total Length: **4 x 600 ft**

---

**Header Pipe:**

- Material: **HDPE 3608**
- Size: **1-1/4 in**
- DX Liquid Line: **N/A in**
- DR: **11**
- DX Gas Line: **N/A in**
- Total Length: **650 ft**

---
## Ground Heat Exchanger System Specifications

<table>
<thead>
<tr>
<th>Grout type: ☑ Groutco M1</th>
<th>Grout thermal conductivity (mixed): 1.25 Btu/hr-ft-°F</th>
</tr>
</thead>
</table>

<table>
<thead>
<tr>
<th>Antifreeze type:</th>
<th>Ethanol denaturant:</th>
</tr>
</thead>
<tbody>
<tr>
<td>☐ Propylene glycol (CAS No. 57-55-6)</td>
<td>☐ Denatonium benzoate (CAS No. 3734-33-6)</td>
</tr>
<tr>
<td>☑ Methanol (CAS No. 67-56-1)</td>
<td>☑ Ethyl acetate (CAS No. 141-78-6)</td>
</tr>
<tr>
<td>☐ Ethanol (CAS No. 64-17-5)</td>
<td>☐ Isopropanol (CAS No. 67-63-0)</td>
</tr>
<tr>
<td>☐ Other (Specify: ____________)</td>
<td>☐ Pine oil (CAS No. 8002-09-3)</td>
</tr>
<tr>
<td></td>
<td>☐ Tertiary butyl alcohol (CAS No. 75-65-0)</td>
</tr>
</tbody>
</table>

| Antifreeze concentration: ☑ 12 % | = ___________ containers |
|                                | × ___________ gallons per container |
|                                | ÷ ___________ gallons in loop field |
|                                | × 100% |
Ground Loop Interior Piping Schematic

Outline the pipe layout and specifications, and system elements in the ground loop interior piping. Indicate the location of any other equipment on the indoor portion of the loop.

- Pressurized flow center

**Pipe:**

Material: ____________
Size: _______________ in
DR: ________________
Insulation: ___________ in

**Pressurized Flow Center**

Flow Center Make/Model: 
________________________________________
Pump Make/Model: 
________________________________________
Rated Power: _______ W
☐ Per pump  ☐ Total
Number of Pumps: _______

**Heat Pump**
☑ Non-pressurized (standing column) flow center

**Pipe:**
- Material: HDPE 3608
- Size: 1-1/4 in
- DR: SDR-11
- Insulation: 1/2 in

**Non-Pressurized Flow Center**
- Flow Center Make/Model: GeoFlo NP2
- Pump Make/Model: Grundfos UPS26-99U
- Rated Power: 150 W
  - Per pump: Yes, Total: No
  - Number of Pumps: 2

**Heat Pump**

**Pipe:**
- Material: Copper
- Size: 1-1/4 in
- DR: N/A
- Insulation: 1/2 in
Hydronic (Water-to-Water) Piping Schematic

For water-to-water systems, provide a schematic indicating all system elements.

Antifreeze Type: propylene glycol
Antifreeze Concentration: 18%

☐ Hydronic Arrangement A

☑ Hydronic Arrangement B
Domestic Hot Water

Provide details if heat pump system provides domestic hot water heating.

☐ Storage (preheat) tank

Manufacturer: ____________________
Model: ___________________________
Capacity: ______ gallons

Plumbing:
Pipe material: ____________________
Fittings: _________________________
Port location: _____________________
Insulation: ____ in

☐ Water heater

Manufacturer: ____________________
Model: ___________________________
Capacity: ______ gallons

Plumbing:
Pipe material: ____________________
Fittings: _________________________
Port location: _____________________
Insulation: ____ in

Fuel: ☐ Electric ☐ Natural Gas ☐ Propane ☐ Other: ____________________________
## Equipment Schedule

### Heat Pump Compressor Unit(s)

<table>
<thead>
<tr>
<th>Manufacturer</th>
<th>Model Number</th>
<th>Number of Units</th>
<th>Load / Zone</th>
</tr>
</thead>
<tbody>
<tr>
<td>Geohydro</td>
<td>AWW-048-2XL3</td>
<td>1</td>
<td>Whole house</td>
</tr>
</tbody>
</table>

### Hydronic Buffer Tank

<table>
<thead>
<tr>
<th>Manufacturer</th>
<th>Model Number</th>
<th>Capacity (gallons)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Hydrobuffer</td>
<td>SGW-50</td>
<td>50</td>
</tr>
</tbody>
</table>

### Hydronic Expansion Tank(s)

<table>
<thead>
<tr>
<th>Manufacturer</th>
<th>Model Number</th>
<th>Max. Pressure (psi)</th>
<th>Location</th>
</tr>
</thead>
<tbody>
<tr>
<td>ExpTank Inc</td>
<td>ET-30</td>
<td>100</td>
<td>Main hydronic loop</td>
</tr>
</tbody>
</table>

### Hydronic Pumps or Valves

<table>
<thead>
<tr>
<th>Manufacturer</th>
<th>Model Number</th>
<th>Number of Units</th>
<th>Load / Zone</th>
</tr>
</thead>
<tbody>
<tr>
<td>Pumpco</td>
<td>59388</td>
<td>1</td>
<td>Main hydronic loop</td>
</tr>
<tr>
<td>Pumpco</td>
<td>23849</td>
<td>4</td>
<td>Individual zones</td>
</tr>
</tbody>
</table>

### Hydronic Air Handler(s)

<table>
<thead>
<tr>
<th>Manufacturer</th>
<th>Model Number</th>
<th>Number of Units</th>
<th>Load / Zone</th>
</tr>
</thead>
<tbody>
<tr>
<td>HydroAHU Company</td>
<td>AHU-29-45-29</td>
<td>4</td>
<td>Individual zones</td>
</tr>
</tbody>
</table>
Electrical Drawing

Complete the relevant drawing to demonstrate compliance with National Electric Code.

☑ Electrical panel within sight of heat pump compressor unit

- Breaker Size: __40__ Amps
- Ground Bus

- Conductor size: __8__
  - American Wire Gauge (AWG)
  - Circular mils
- Conductor type:
  - Copper
  - Aluminum

☐ Supplementary disconnect within sight of heat pump compressor unit

- Breaker Size: __Amps
- Ground Bus

- Conductor size: __Amps
  - American Wire Gauge (AWG)
  - Circular mils
- Conductor type:
  - Copper
  - Aluminum

Heat Pump Compressor Unit

Required protection (mfg):
- Fuse
- HACR circuit breaker

Maximum: __40__ Amps
Electrical panel within sight of heat pump compressor unit, with auxiliary heat

- Conductor size: ______
  - American Wire Gauge (AWG)
  - circular mils
- Conductor type: ______
  - Copper
  - Aluminum

- Electrical Panel
  - Breaker Size: ______ Amps
  - Ground Bus

- Auxiliary Heat
  - Required protection (mfg):
    - Fuse
    - HACR circuit breaker
  - Maximum: ______ Amps

- Heat Pump Compressor Unit
  - Required protection (mfg):
    - Fuse
    - HACR circuit breaker
  - Maximum: ______ Amps

- Conductor size: ______
  - American Wire Gauge (AWG)
  - circular mils
- Conductor type: ______
  - Copper
  - Aluminum
Supplementary disconnect within sight of heat pump compressor unit, with auxiliary heat

- Conductor size: _____
  - American Wire Gauge (AWG)
  - Circular mils
- Conductor type:
  - Copper
  - Aluminum

**Electrical Panel**

Breaker Size: _____ Amps

- Ground Bus

**Disconnect**

**Auxiliary Heat**

Required protection (mfg):
- Fuse
- HACR circuit breaker

Maximum: _____ Amps

**Heat Pump Compressor Unit**

Required protection (mfg):
- Fuse
- HACR circuit breaker

Maximum: _____ Amps

Conductor size: _____
- American Wire Gauge (AWG)
- Circular mils

Conductor type:
- Copper
- Aluminum
Service Clearance

Indicate minimum service clearance required around the heat pump equipment.

Above: 36 in

Rear: 12 in

Left: 12 in

Front: 12 in

Right: 24 in