Ground Source Heat Pump Rebate Program

Design Template Guidelines

For Contractors

2019

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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.

Heating design temperatures Outdoor 99% dry bulb:_____°F Indoor set point:_____°F	Cooling design temperatures Outdoor 1% dry bulb:_____°F Indoor set point:_____°F
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).

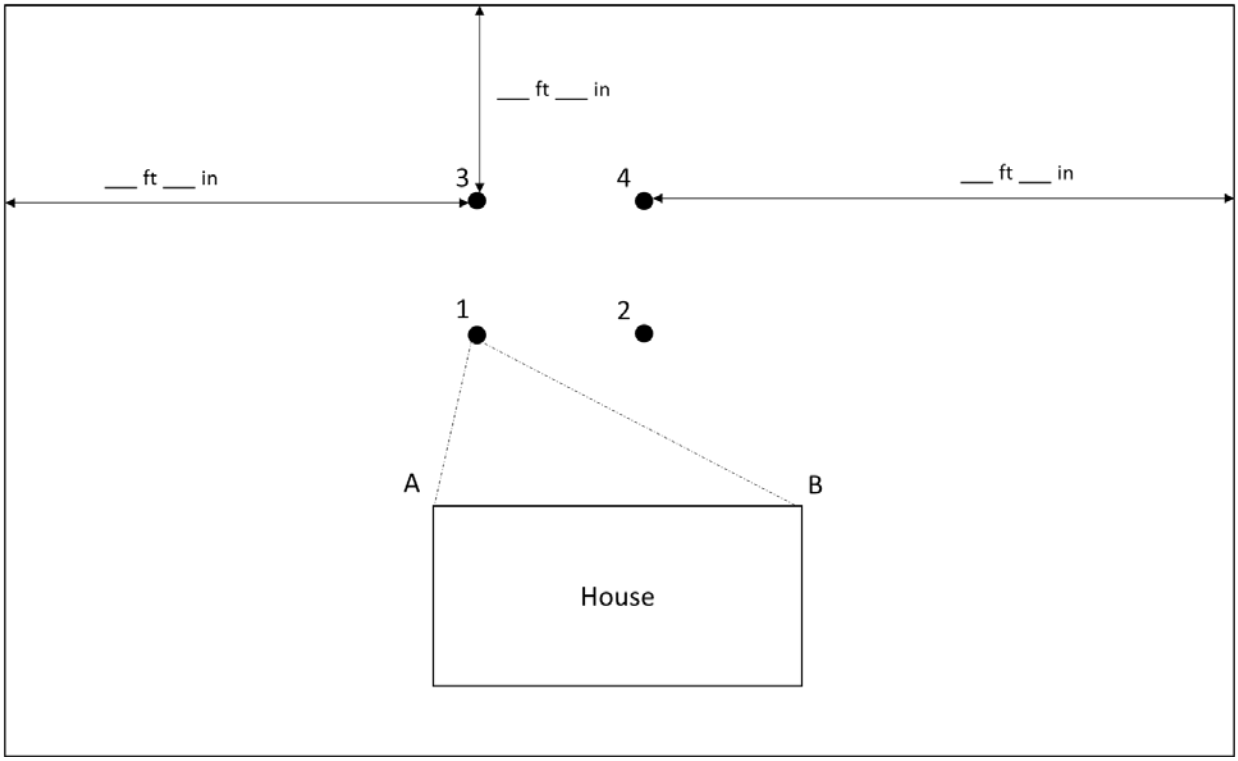
Manufacturers of direct exchange systems generally engineer the heat exchanger. Where the manufacturer has generated plans for their designs, submitting the manufacturer's plans in lieu of templates is acceptable.

Utility	**Minimum Distance to Bore/Well/Loop Field**
❑ Electric	_____ ft ____in
❑ Gas	_____ ft ____in
❑ Communications	_____ ft ____in
❑ Water	_____ ft ____in
❑ Sewer	_____ ft ____in
❑ Other: _____	_____ ft ____in
❑ Other: _____	_____ ft ____in
❑ Other: _____	_____ ft ____in

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.

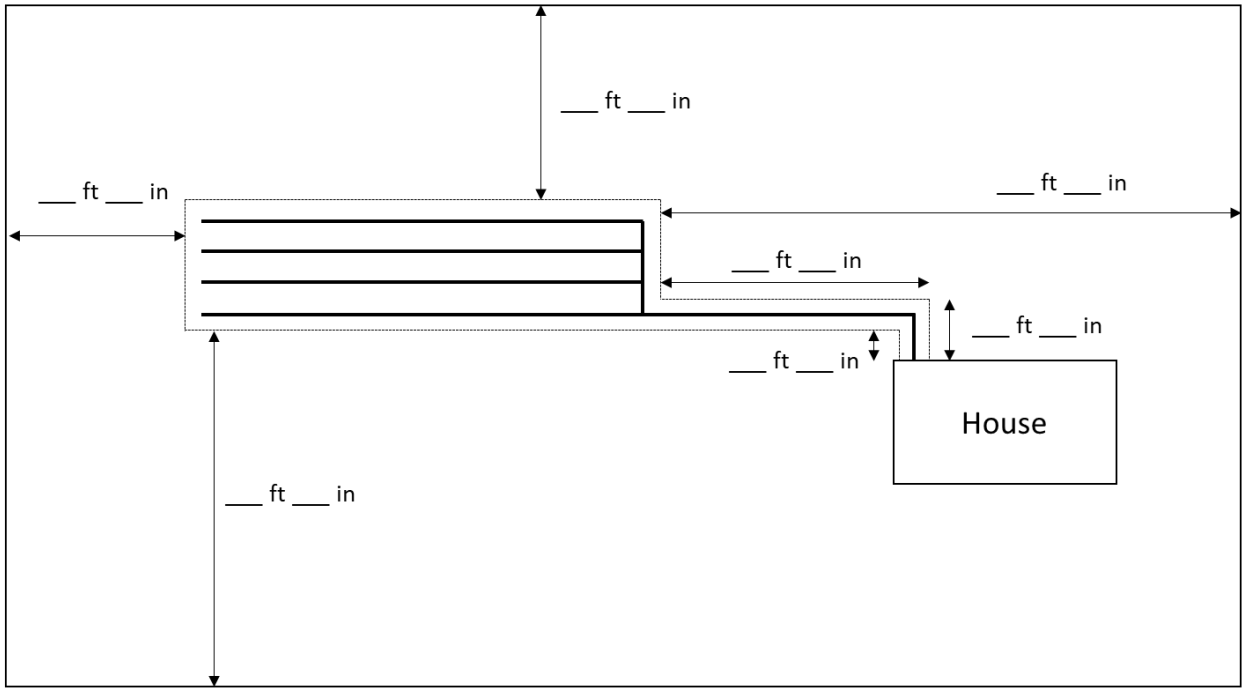


For as-built drawings, list the precise location using triangulated locations 'A' and 'B' and/or GPS coordinates and actual depth of each bore/well in the following table.

Bore/Well	Depth (ft)	Method 1		Method 2
		Distance to A (ft-in)	Distance to B (ft-in)	GPS Coordinates
1				
2				
3				
4				
Dx Anode				

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 long Minimum Trench Spacing:_____ft

Supply/Return Trench Dimensions:_____ft deep ×_____ft wide ×_____ft long

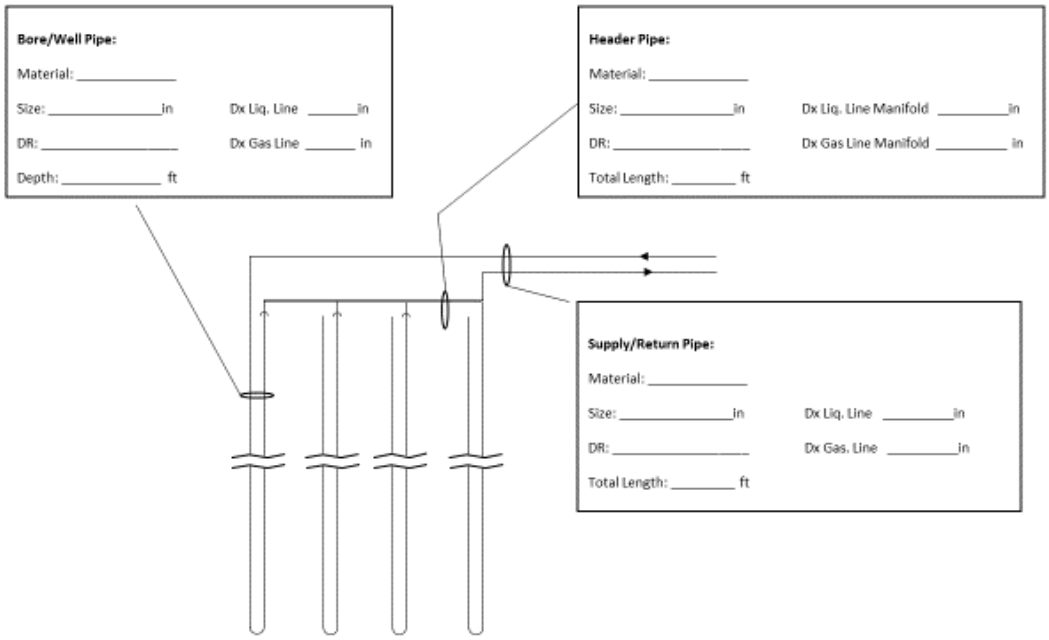
Dx Systems – Anode Distance from House:_____ft

Ground Heat Exchanger Piping Schematic

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.

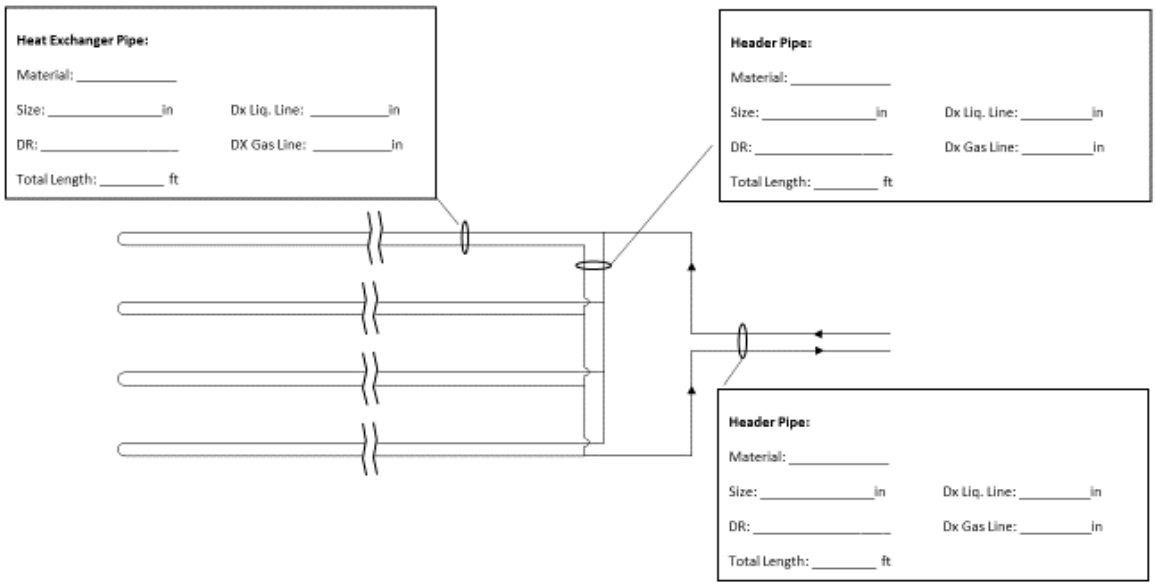
Vertical Loop

Ground Heat Exchanger Piping Schematic: Vertical



Horizontal or Open Loop

Ground Heat Exchanger Piping Schematic: Horizontal/Pond



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>
<tr><td colspan="2">Grout type:_____ Grout thermal conductivity (mixed):_____Btu/hr-ft-</td></tr>
<tr><td>Antifreeze type:
❑ Propylene glycol (CAS No. 57-55-6)
❑ Methanol (CAS No. 67-56-1)
❑ Ethanol (CAS No. 64-17-5)
❑ Other (Specify: _____)</td><td>Ethanol denaturant:
❑ 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)</td></tr>
<tr><td>Antifreeze concentration:_____%</td><td>=_____containers
×_____gallons per container
÷_____gallons in loop field
× 100%</td></tr>
</table>

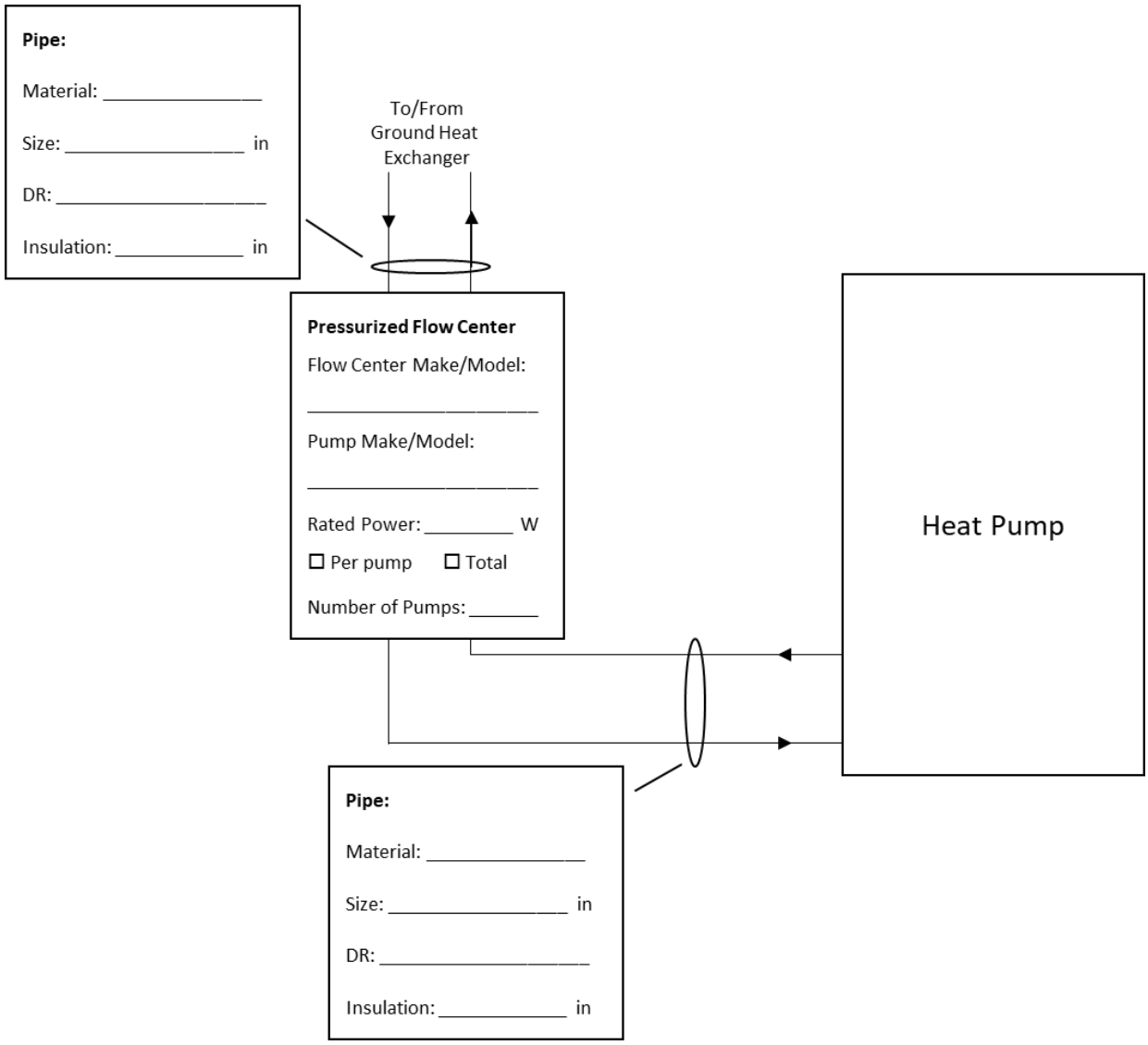
Ground Loop Interior Piping Schematic

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

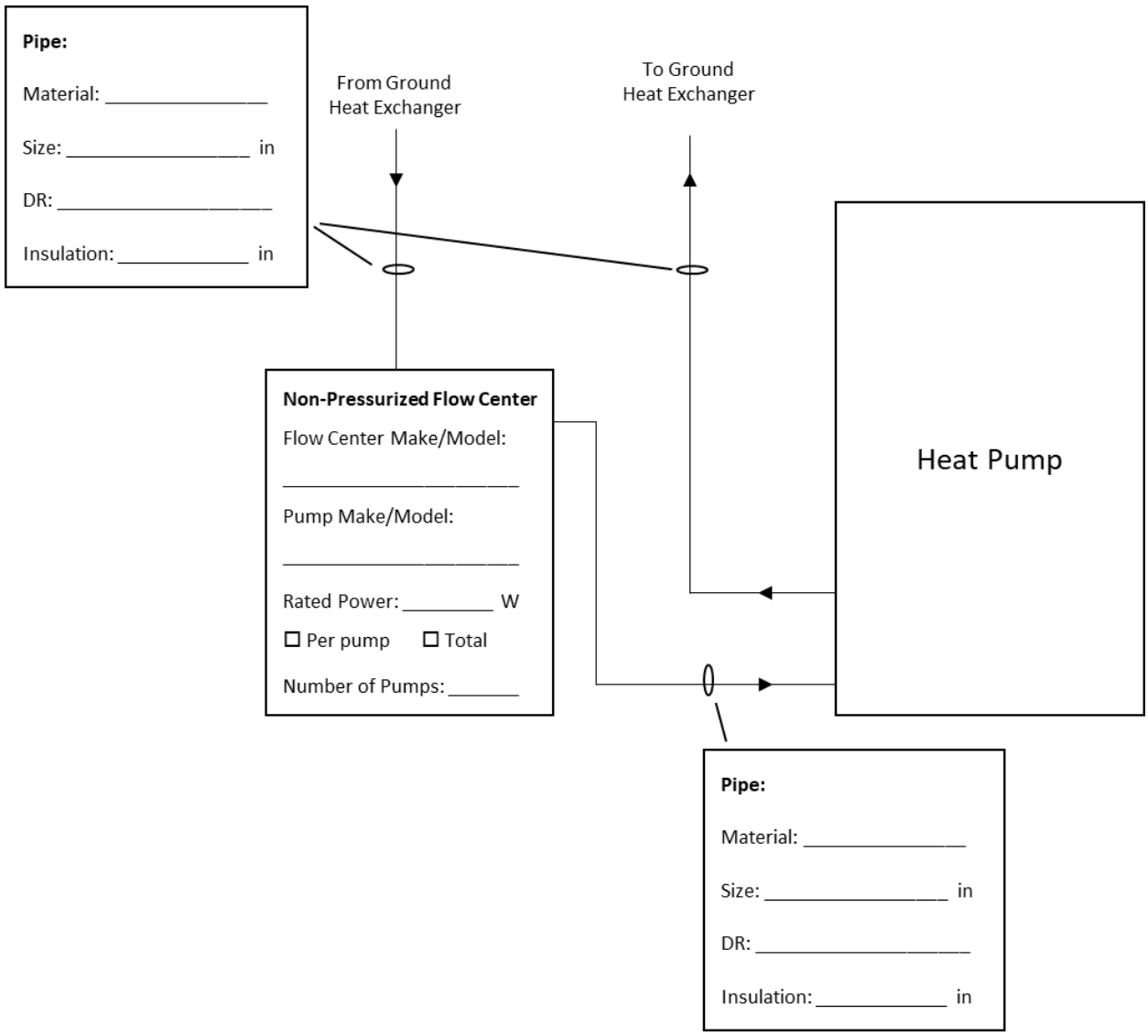
Provide piping material, dimensions, and insulation specifications for all piping. Provide the flow center (pump pack) and/or pump manufacturer and model, number of pumps, and rated pumping power for the flow center.

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



Hydronic (Water-to-Water) Piping Schematic

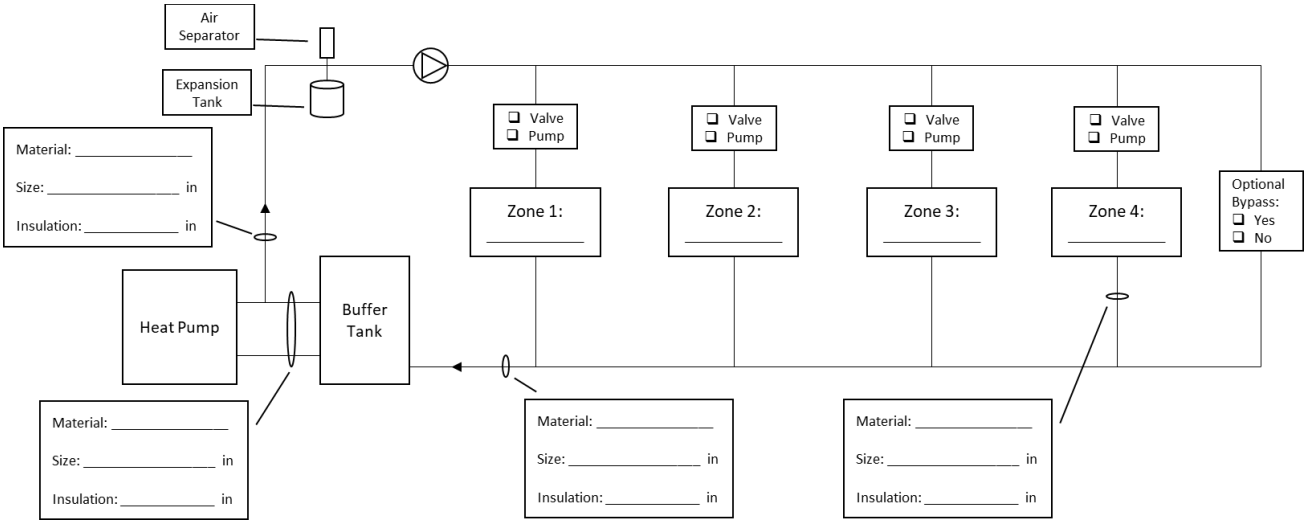
For water-to-water systems, provide piping schematic. Mark up one of the templates provided (add or cross out system elements as needed) or attach a separate schematic.

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.

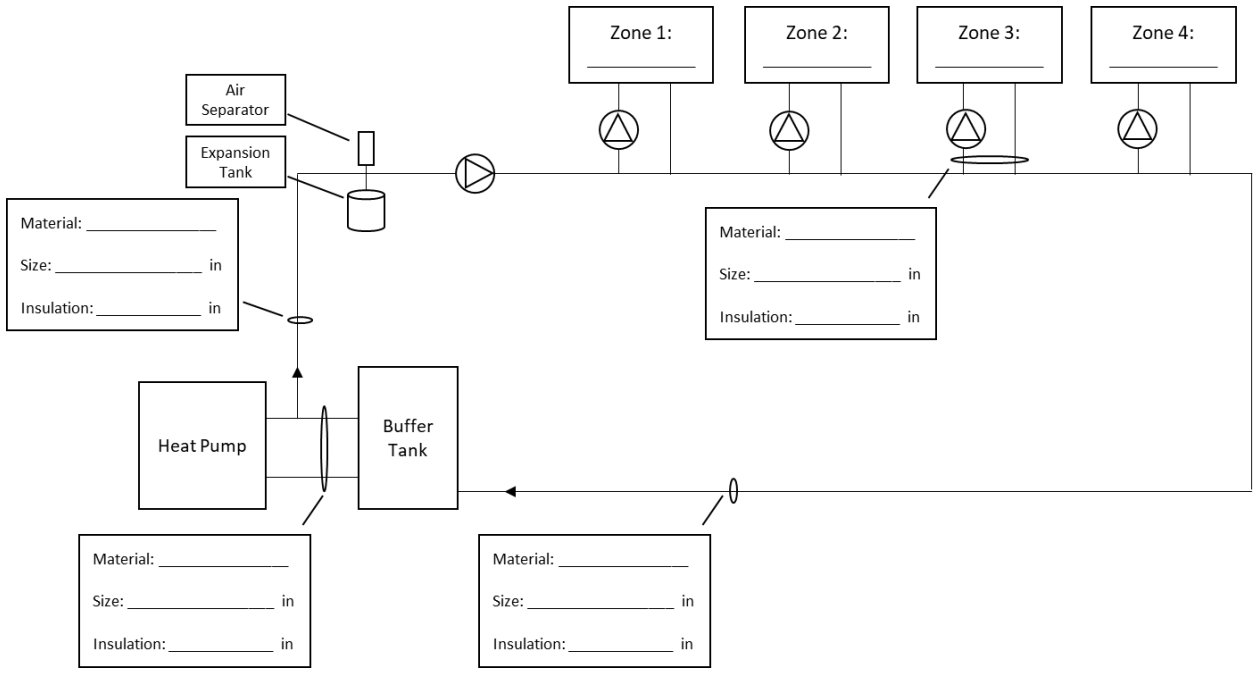
Antifreeze Type:_____

Antifreeze Concentration:_____%

Hydronic Arrangement A



Hydronic Arrangement B



Domestic Hot Water

If heat pump system provides domestic hot water heating (via dedicated hot water generation or supplemental how 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)

Manufacturer	Model Number	Number of Units	Load / Zone

Hydronic Buffer Tank

Manufacturer	Model Number	Capacity (gallons)

Hydronic Expansion Tank(s)

Manufacturer	Model Number	Max. Pressure (psi)	Location

Hydronic Pumps or Valves

Manufacturer	Model Number	Number of Units	Load / Zone

Hydronic Air Handler(s)

Manufacturer	Model Number	Number of Units	Load / Zone

Electrical Drawing

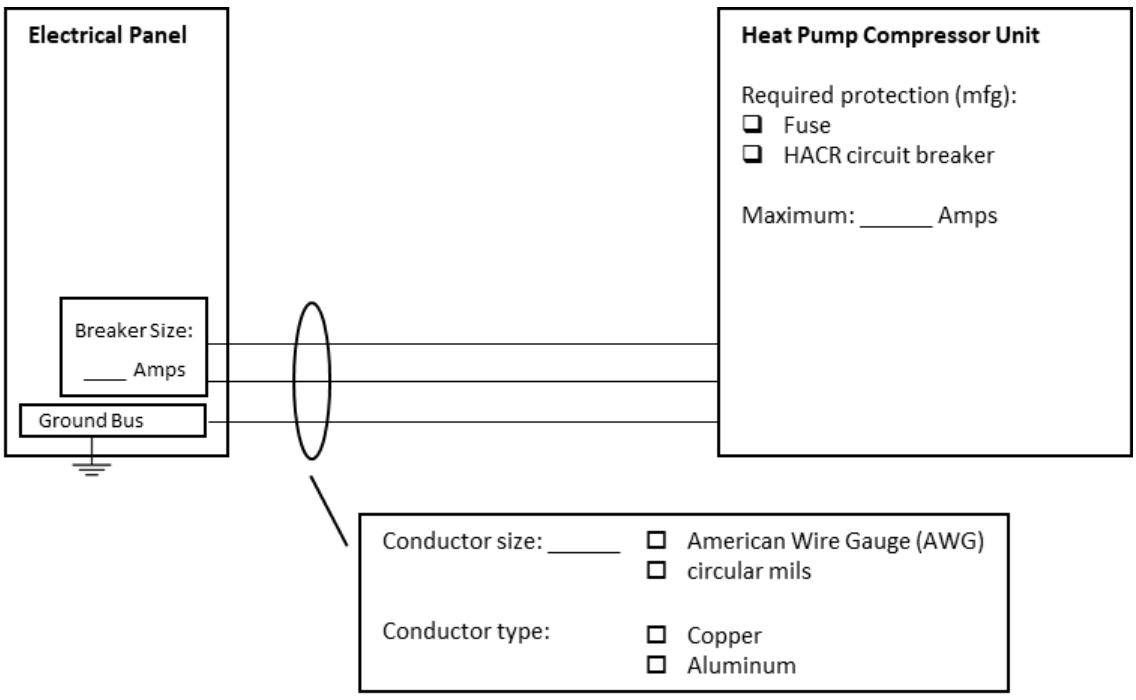
Fill in the blanks in the relevant electrical drawing template, depending on whether a supplementary disconnect is required and whether auxiliary heat is present and requires separate electrical protection.

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.

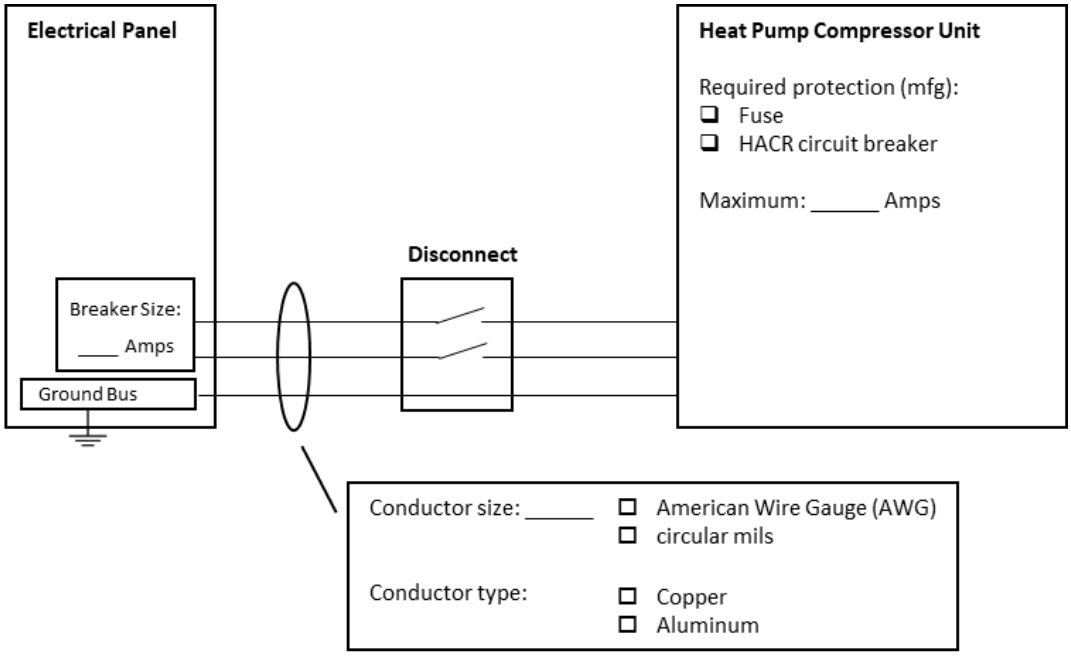
If the heat pump requires additional protection (e.g., separate protection foreach stage), or if the project has multiple heat pumps with varying protection needs, attach the electrical drawings as a separate page.

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.

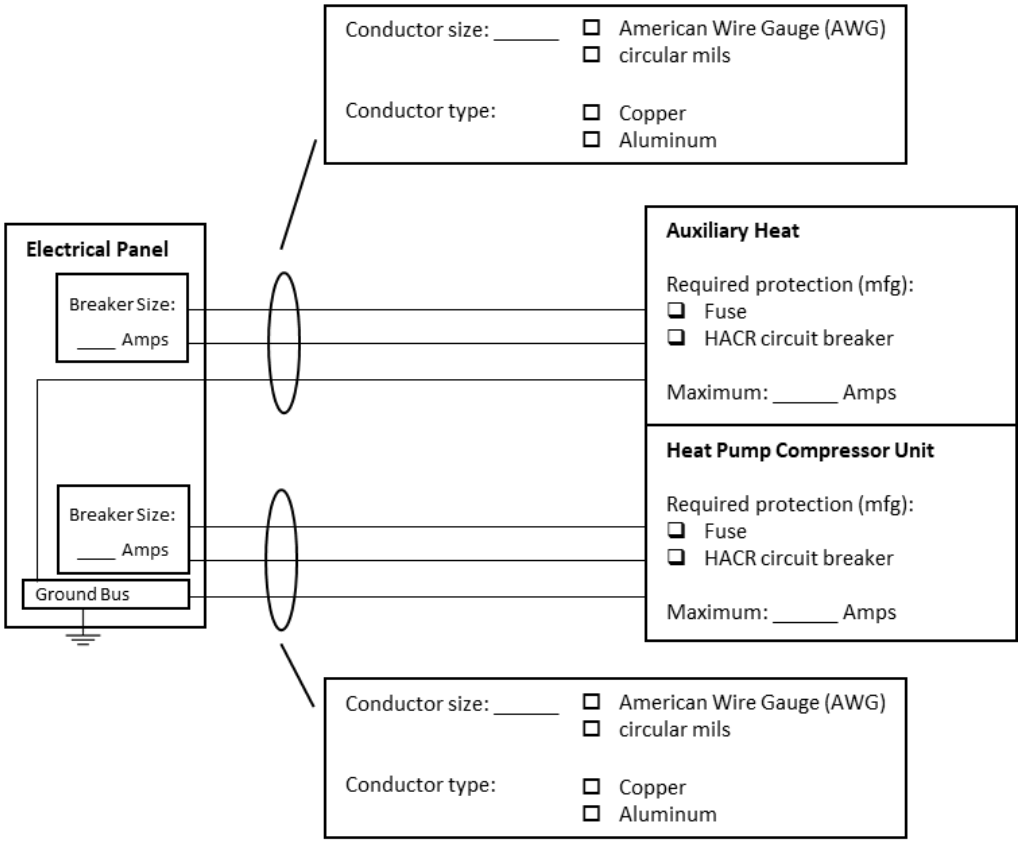
Electrical panel within sight of heat pump compressor unit



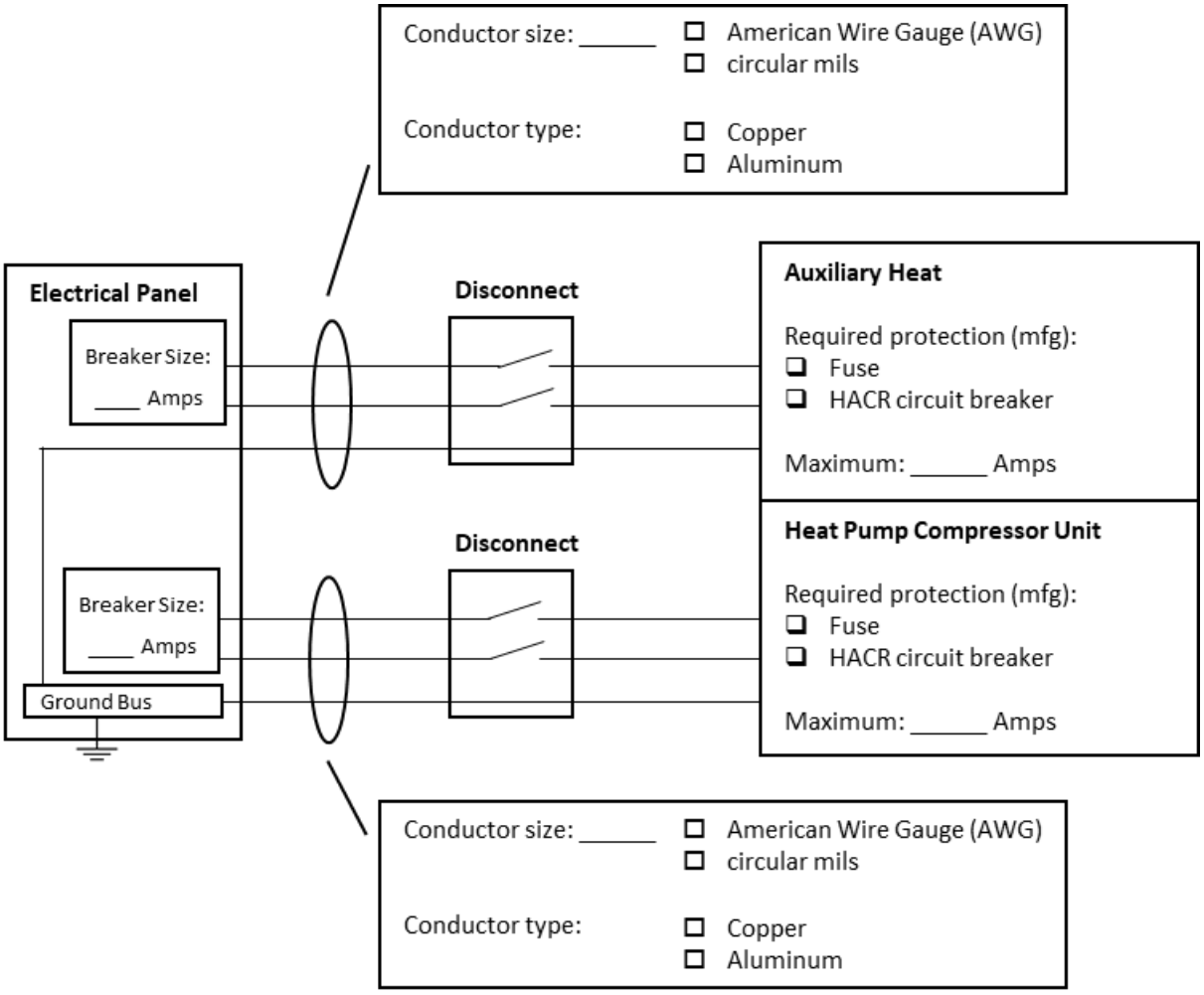
Supplementary disconnect within sight of heat pump compressor unit



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



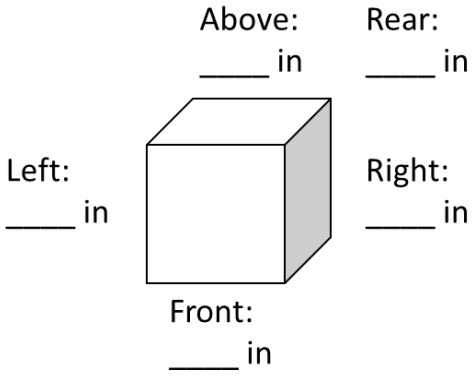
Supplementary disconnect within sight of heat pump compressor unit, with auxiliary heat



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

(EXAMPLES)

GSHP Design Templates – EXAMPLE 1

Documentation Stage

☑ Design

❒ As-built

Design Conditions

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

Heating design temperatures	Cooling design temperatures
Outdoor 99% dry bulb: 17 °F	Outdoor 1% dry bulb: 89 °F
Indoor set point: 69 °F	Indoor set point: 72 °F
ACCA location used: New York LaGuardia AP	

Building peak heating load: 36,345 Btu/h

Building peak cooling load: 28,744 Btu/h

GSHP sized for: ☑ Heating ☐ Cooling

Design entering temperatures to heat transfer fluid to heat pump

Min (in heating mode): 30 °F

Max (in cooling mode): 63 °F

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

Source:

- ☐ Soil/geological survey – Source: _____
- ❒ Drill log (please attach)
- ☐ FTC test (please attach)
- ☐ Other: _____

Ground Heat Exchanger Site Plan

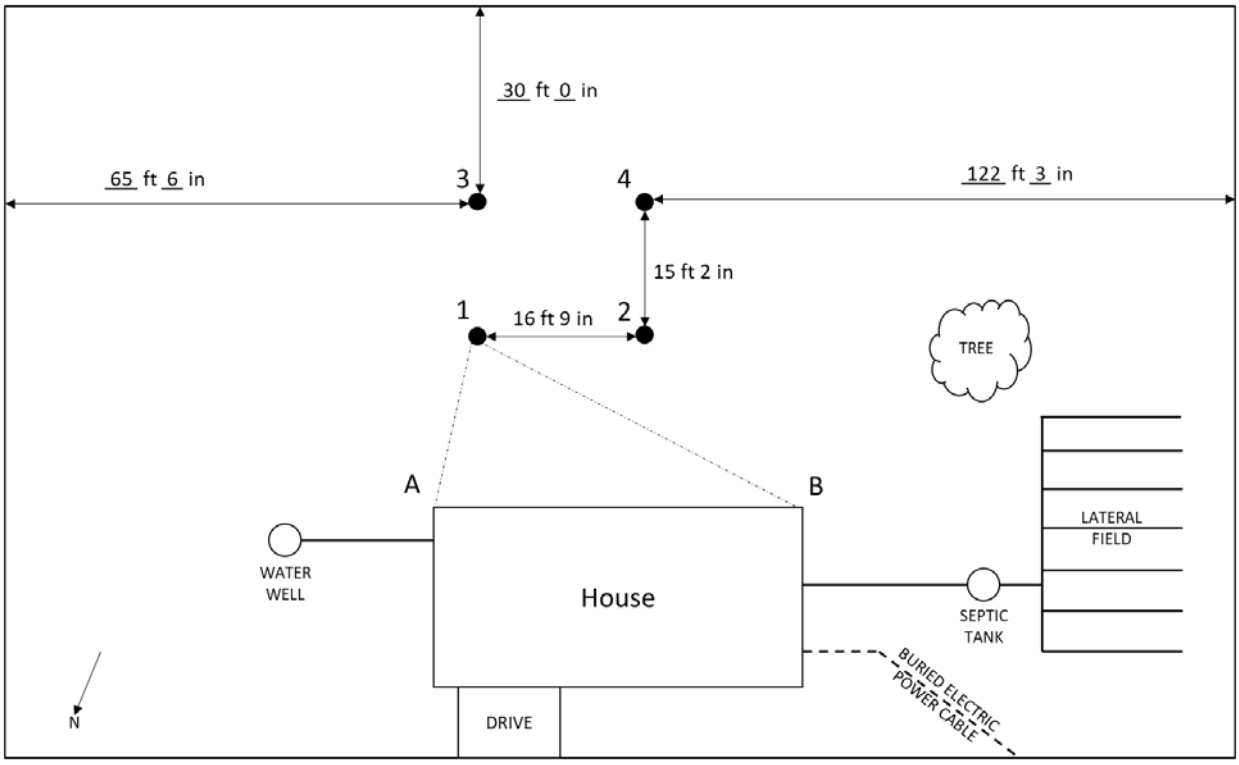
Indicate which underground utilities and obstacles exist on the property and the minimum distance of each to the ground heat exchanger.

Utility	Minimum Distance to Bore/Well/Loop Field
❑ Electric	_>30_ ft_____in
❑ Gas	_____ ft _in
❑ Communications	_____ ft _in
❑ Water	19 ft 6 in
❑ Sewer	_>25_ ft_____in
❑ Other: tree_____	_>20_ ft_____in

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.

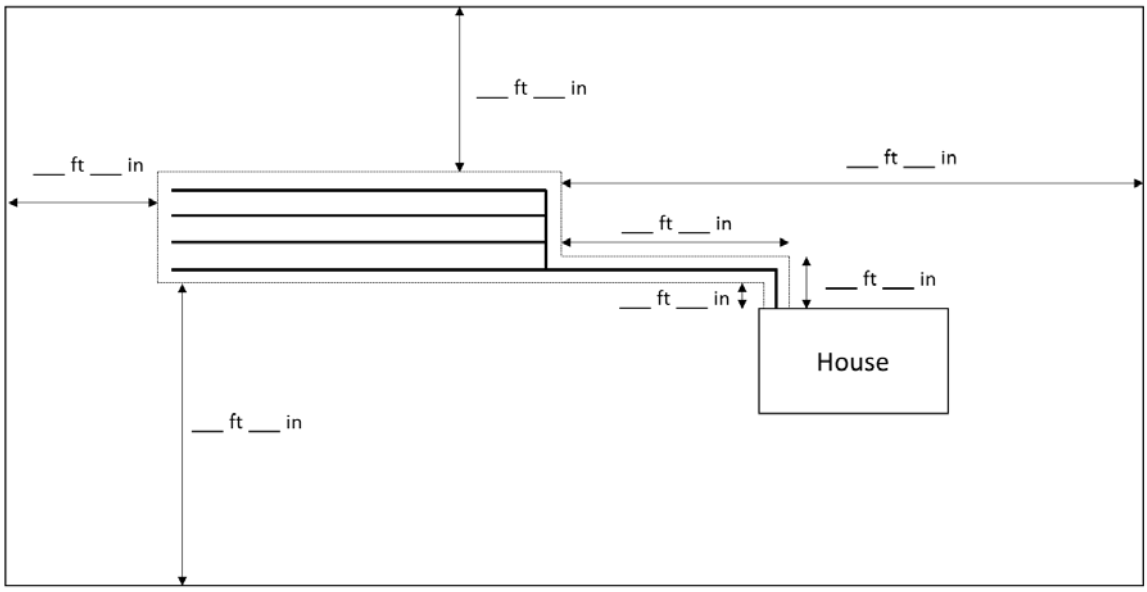


For as-built drawings, list the precise location and actual depth of each bore/well in the following table.

Bore/Well	Depth (ft)			M
		Distance to A (ft-in)	Distance to B (ft-in)	GPS Coordinates
1	249			21’-0”
2	255			30’-0”
3	250			35’-3”
4	252			39’-10”
Dx Anode	N/A			

❑ 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

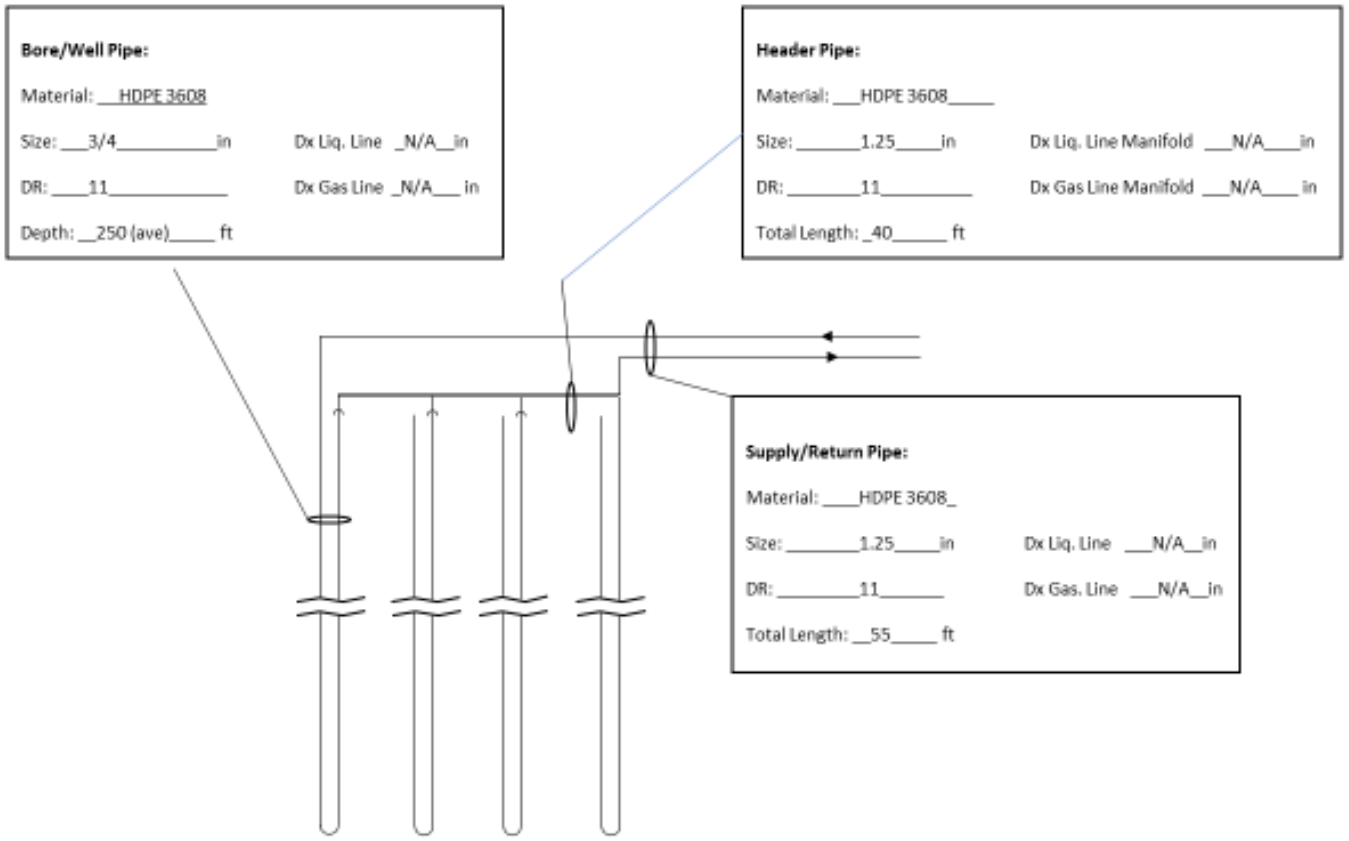
Dx Systems – Anode Distance from House:_____ft

Ground Heat Exchanger Piping Schematic

Outline the loop field piping layout and specifications.

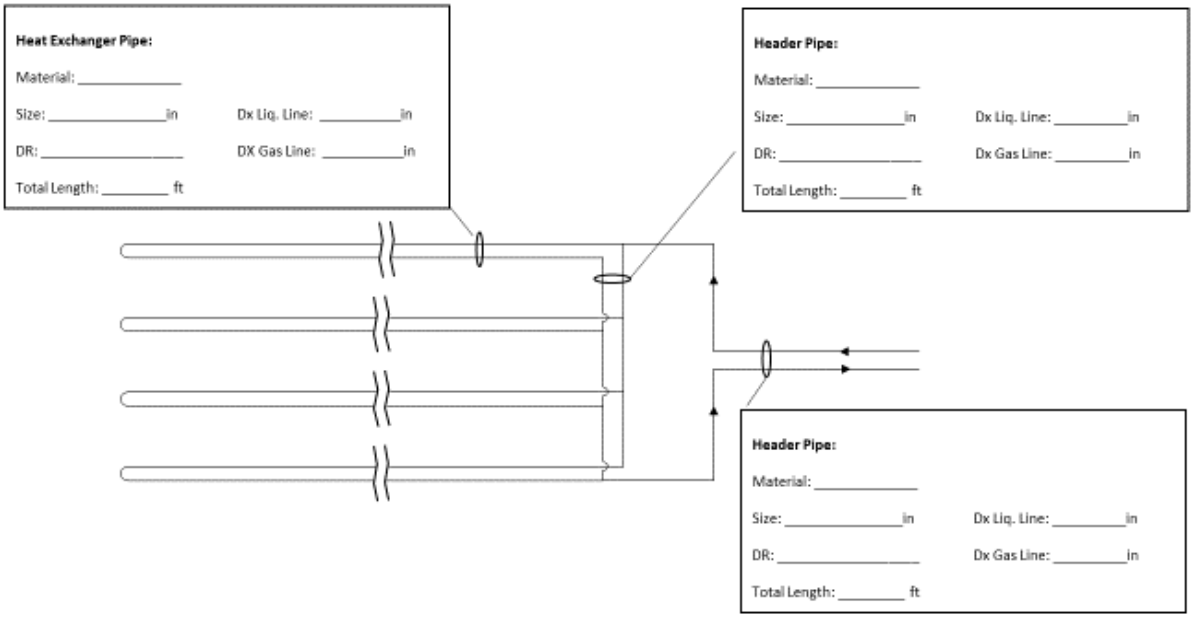
☑ Vertical Loop

Ground Heat Exchanger Piping Schematic: Vertical – EXAMPLE 1



☐ Horizontal or Surface Water Loop

Ground Heat Exchanger Piping Schematic: Horizontal/Pond



Ground Heat Exchanger System Specifications

Grout type: Geogrout Co. A-2

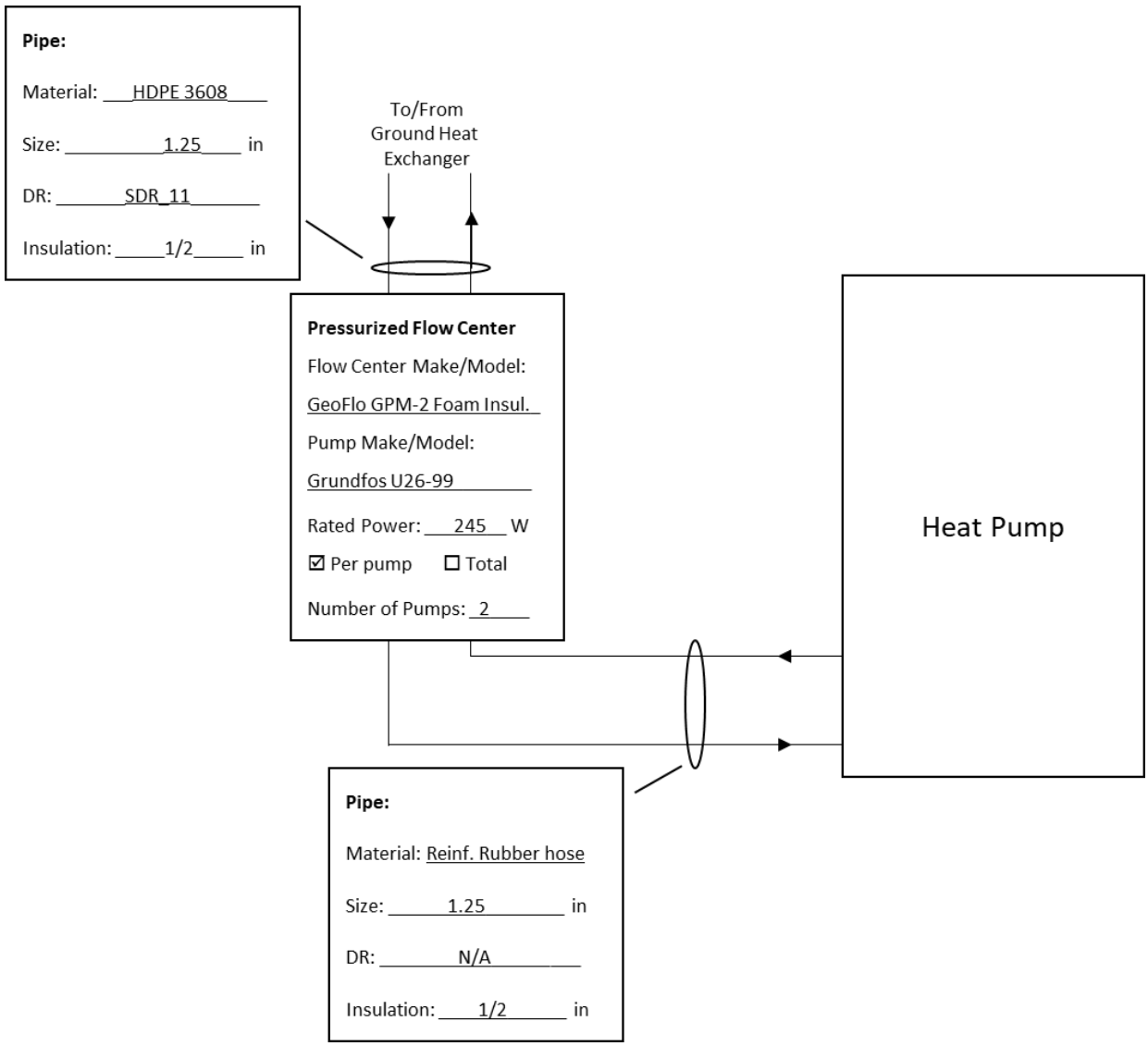
Grout thermal conductivity (mixed): 1.14 Btu/hr-ft-°F

Antifreeze type:	Ethanol denaturant:
☑ Propylene glycol (CAS No. 57-55-6) ☐ Methanol (CAS No. 67-56-1) ☐ Ethanol (CAS No. 64-17-5) ☐ Other (Specify: _____)	☑ 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 %	= _____ containers × _____ gallons per container ÷ _____ gallons in loop field × 100%

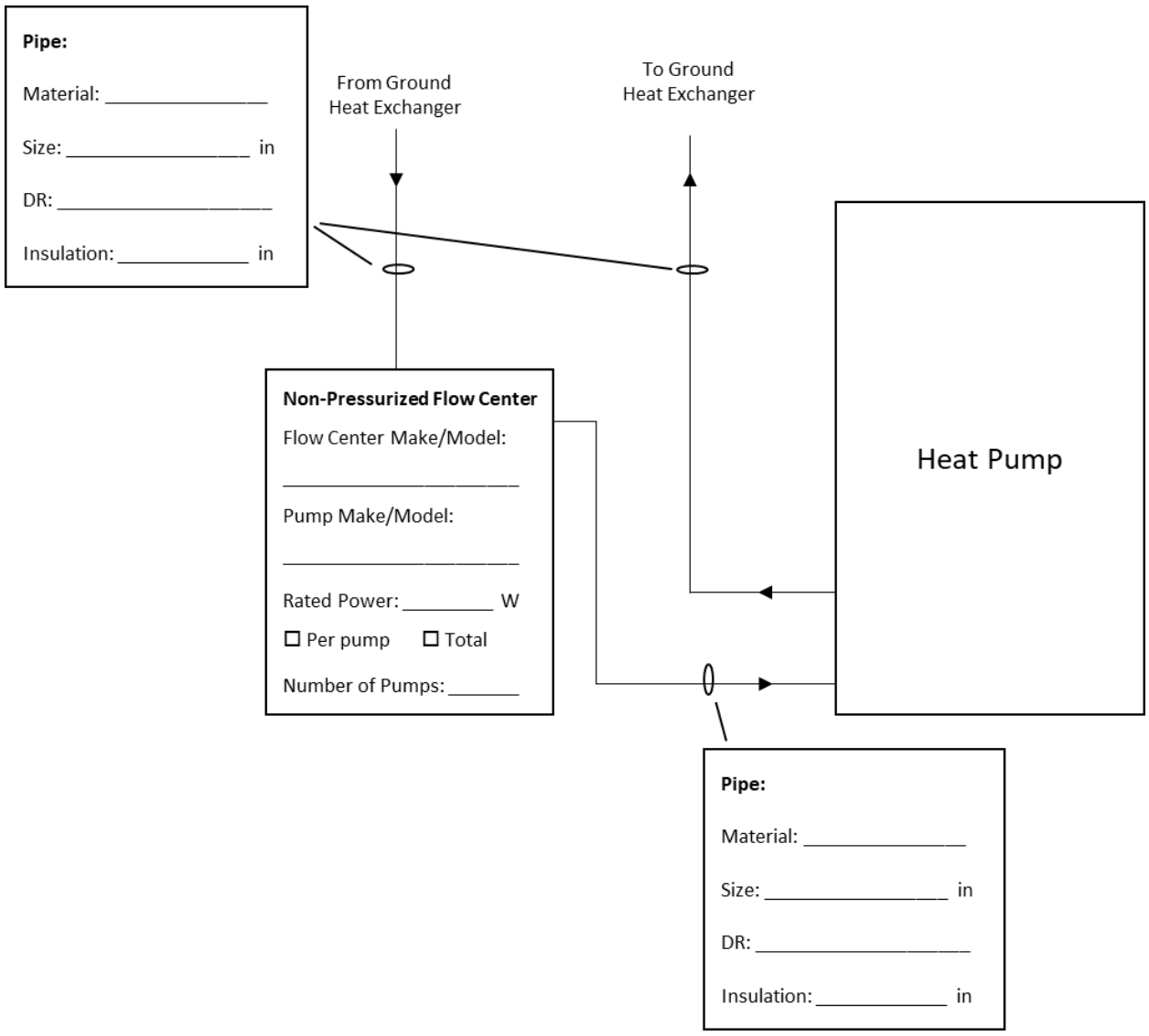
Ground Loop Interior Piping Schematic

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



☐ Non-pressurized (standing column) flow center



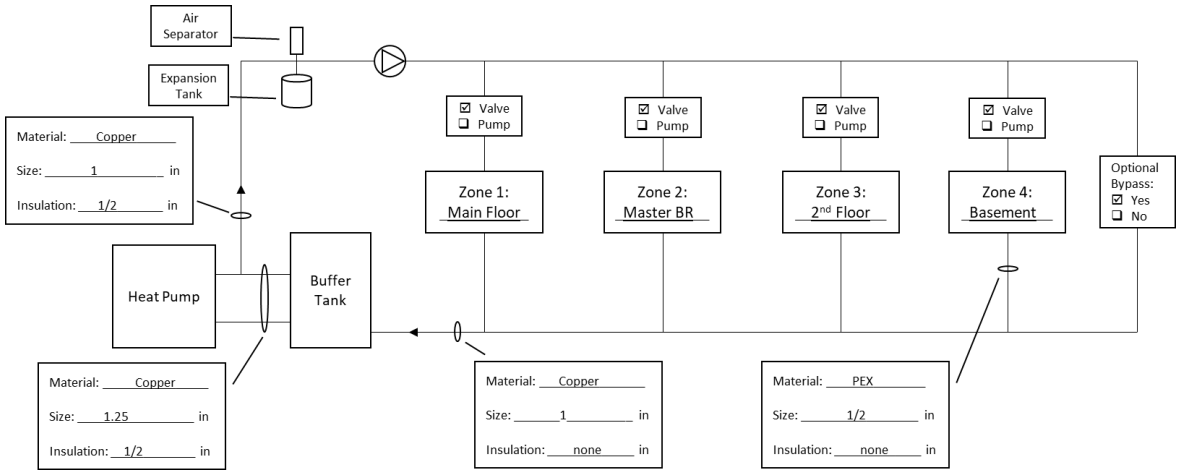
Hydronic Piping Schematic

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

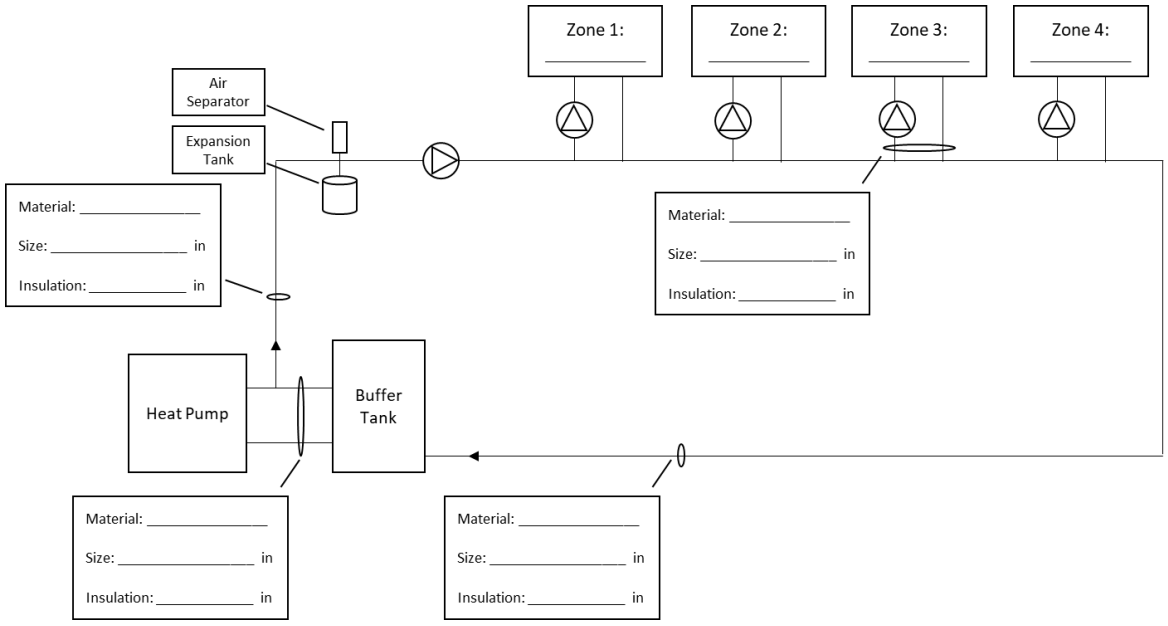
Antifreeze Type: propylene glycol

Antifreeze Concentration: 20%

☑ 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: _____

Equipment Schedule

Heat Pump Compressor Unit(s)

Manufacturer	Model Number	Number of Units	Load / Zone
GeoStar	111H072TL151C00S0	1	Whole House

Hydronic Buffer Tank

Manufacturer	Model Number	Capacity (gallons)
Caleffi	Thermocon NAS20050	50

Hydronic Expansion Tank(s)

Manufacturer	Model Number	Max. Pressure (psi)	Location
Flexcon	FLEX2PRO HTX30	100	Hydronic Loop
Amtrol	Extrol EX-30	100	Buffer Tank

Hydronic Pumps or Valves

Manufacturer	Model Number	Number of Units	Load / Zone
Grundfos	UP 26-116 F	4	Each Zone

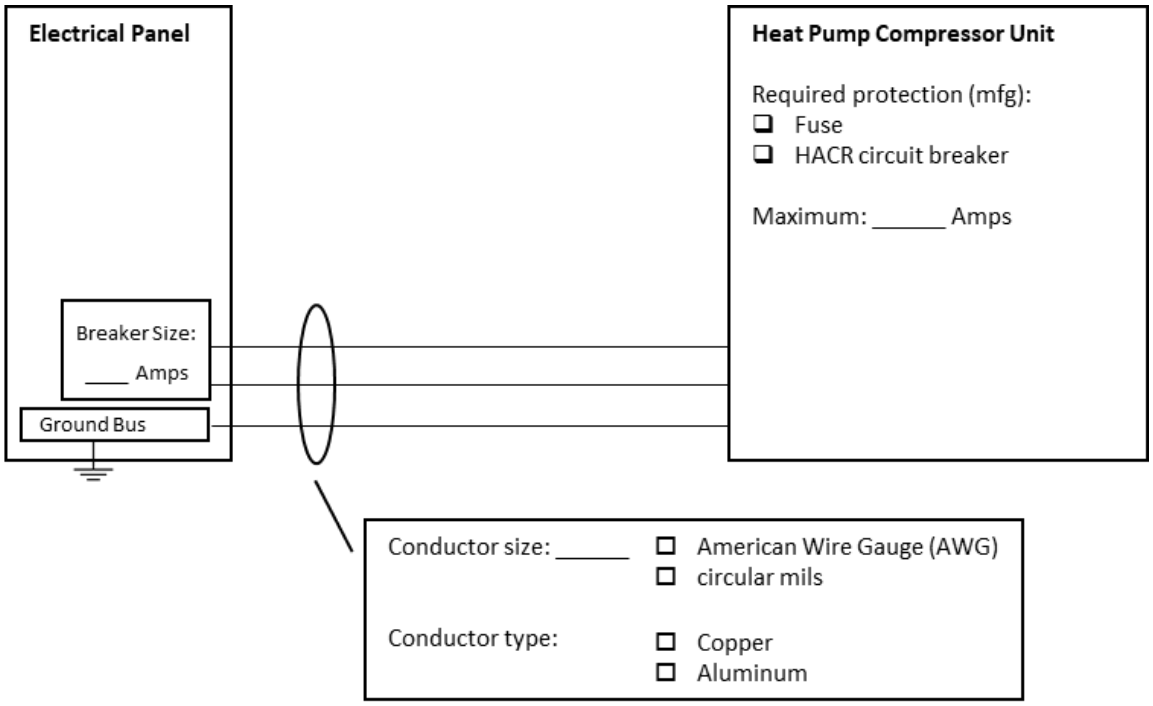
Hydronic Air Handler(s)

Manufacturer	Model Number	Number of Units	Load / Zone
N/A			

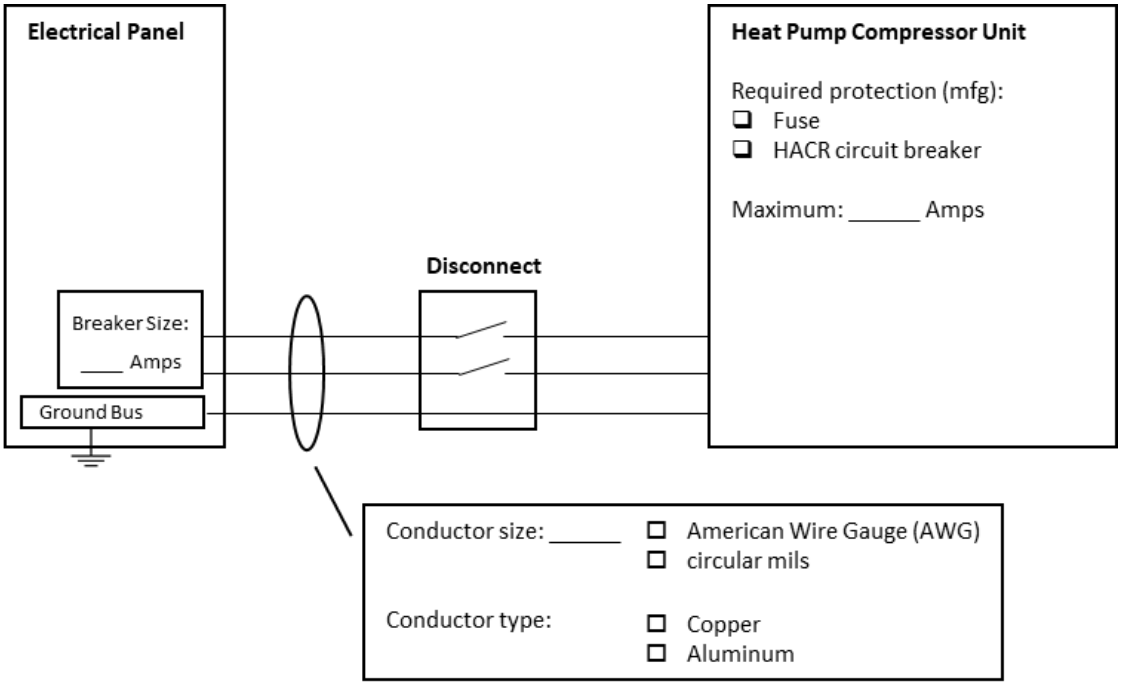
Electrical Drawing

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

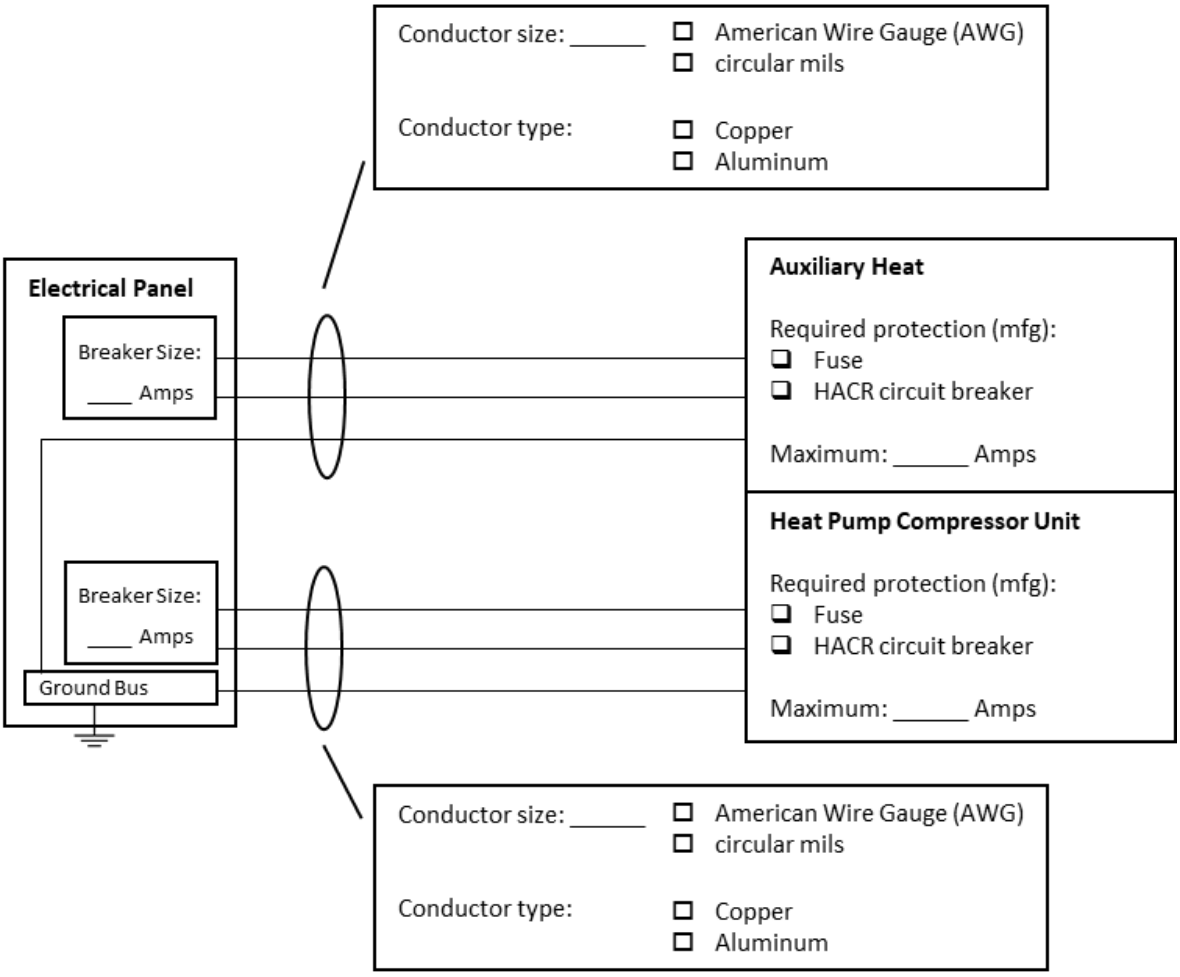
☐ Electrical panel within sight of heat pump compressor unit



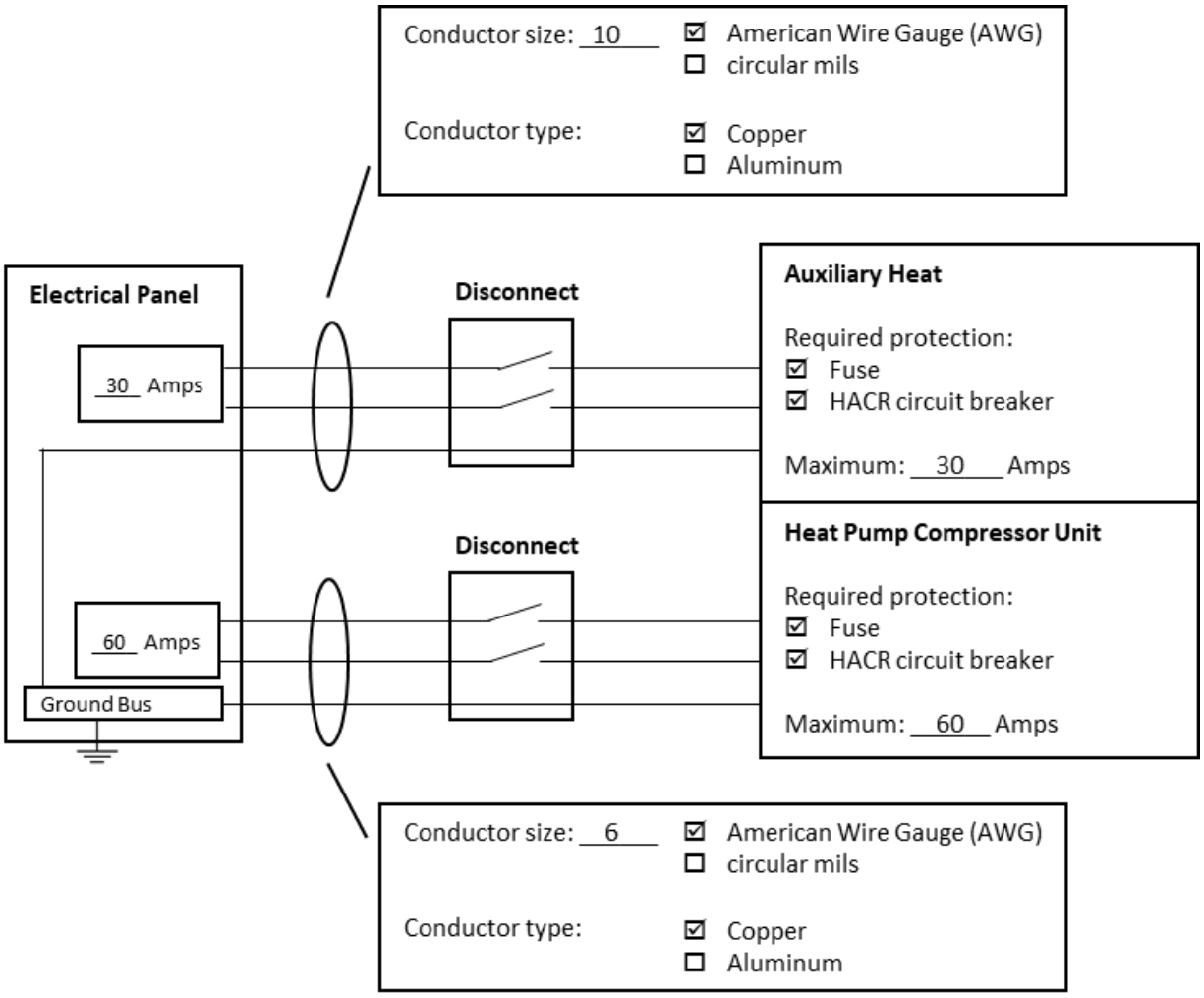
❑ Supplementary disconnect within sight of heat pump compressor unit



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

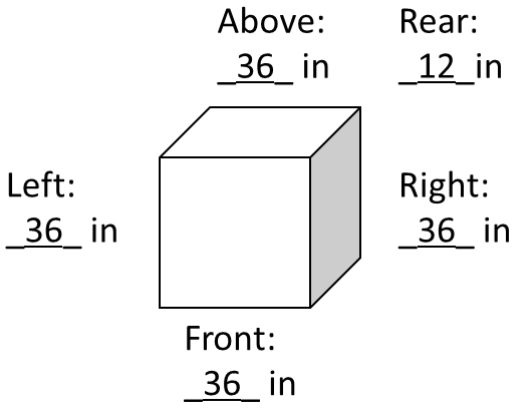


☑ Supplementary disconnect within sight of heat pump compressor unit, with auxiliary heat



Service Clearance

Indicate minimum service clearance required around the heat pump equipment.



GSHP Design Templates – EXAMPLE 2

Documentation Stage

- ❒ Design
- ☑ As-built

Design Conditions

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

Heating design temperatures Outdoor 99% dry bulb: 3 °F Indoor set point: 70 °F	Cooling design temperatures Outdoor 1% dry bulb: 86 °F Indoor set point: 75 °F
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: ☑ Soil/geological survey – Source: Soil Conservation Service Survey & IGHSPA Manual ☐ Drill log (please attach) ☐ FTC test (please attach) ☐ Other:	

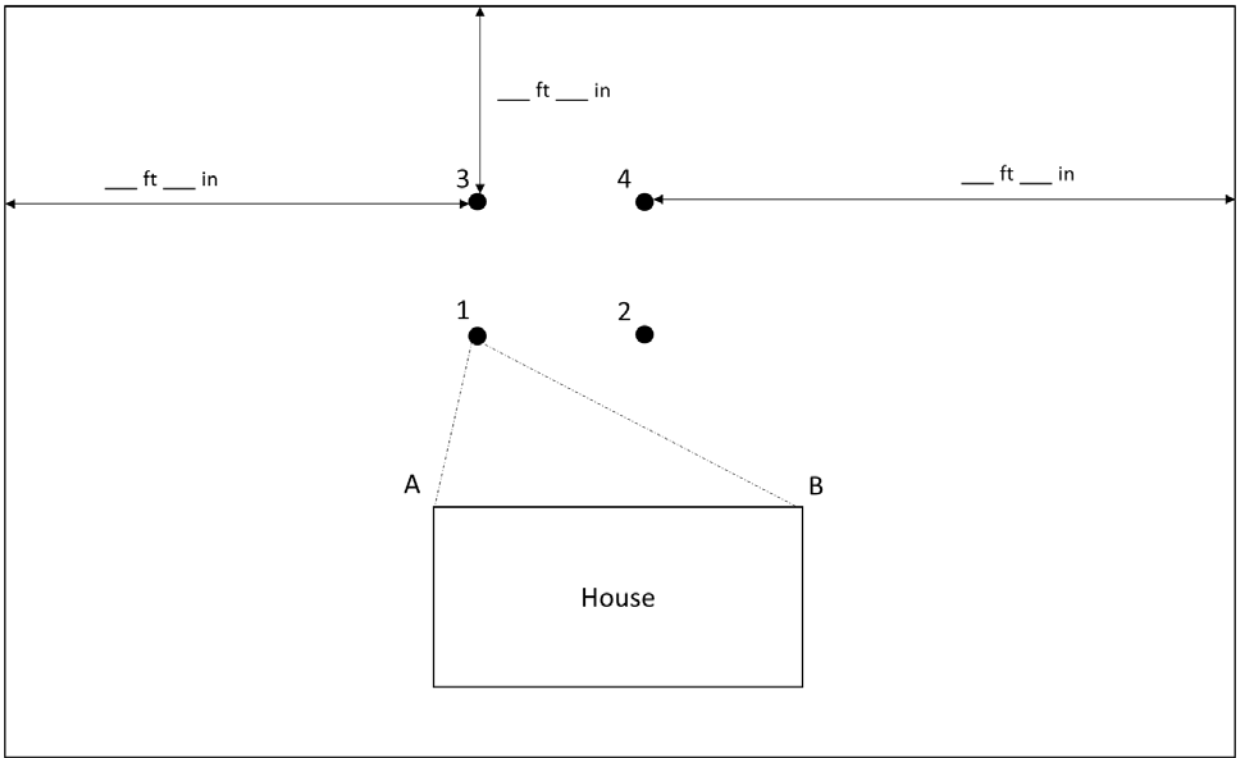
Ground Heat Exchanger Site Plan

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

Utility	Minimum Distance to Bore/Well/Loop Field
❑ Electric	_>85_ ft_____in
❑ Gas	_____ft_____in
❑ Communications	>100_ ft_____in
❑ Water	>100_ ft_____in
❑ Sewer	_>25_ ft_____in
❑ Other:	_____ft_____in

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.

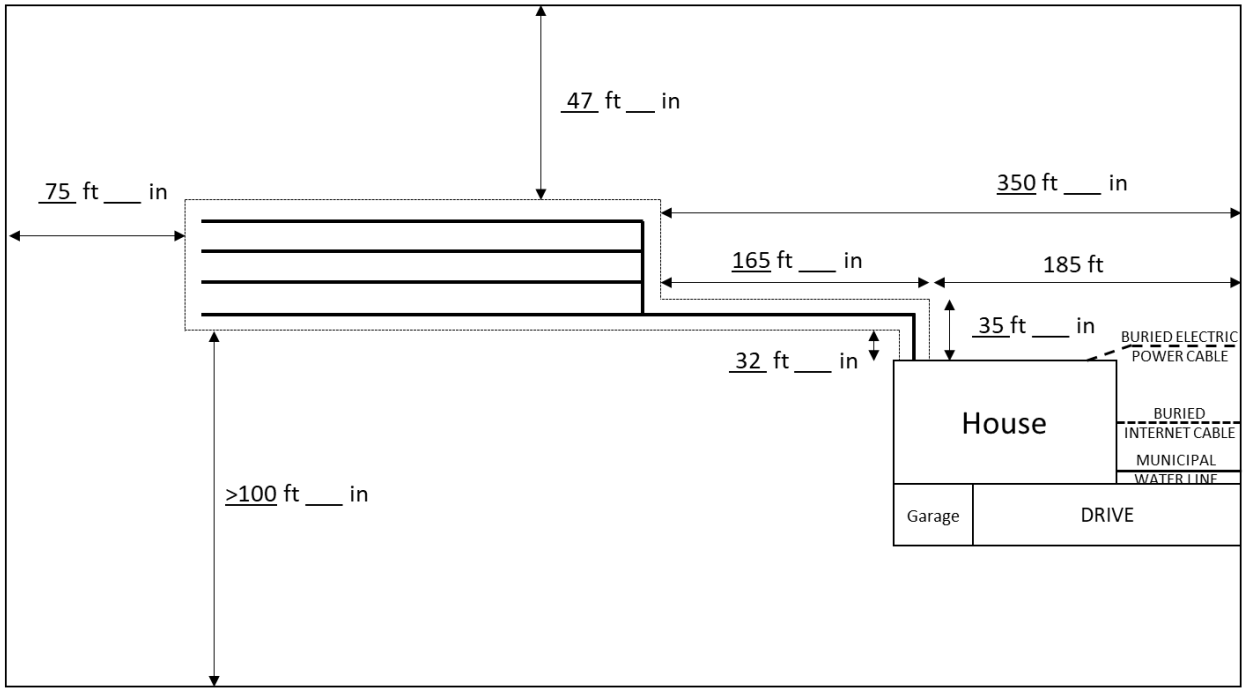
☐ Vertical Loop



For as-built drawings, list the precise location and actual depth of each bore/well in the following table.

Bore/Well	Depth (ft)	Method 1		Method 2
		Distance to A (ft-in)	Distance to B (ft-in)	GPS Coordinates
1				
2				
3				
4				
Dx Anode				

☑ 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

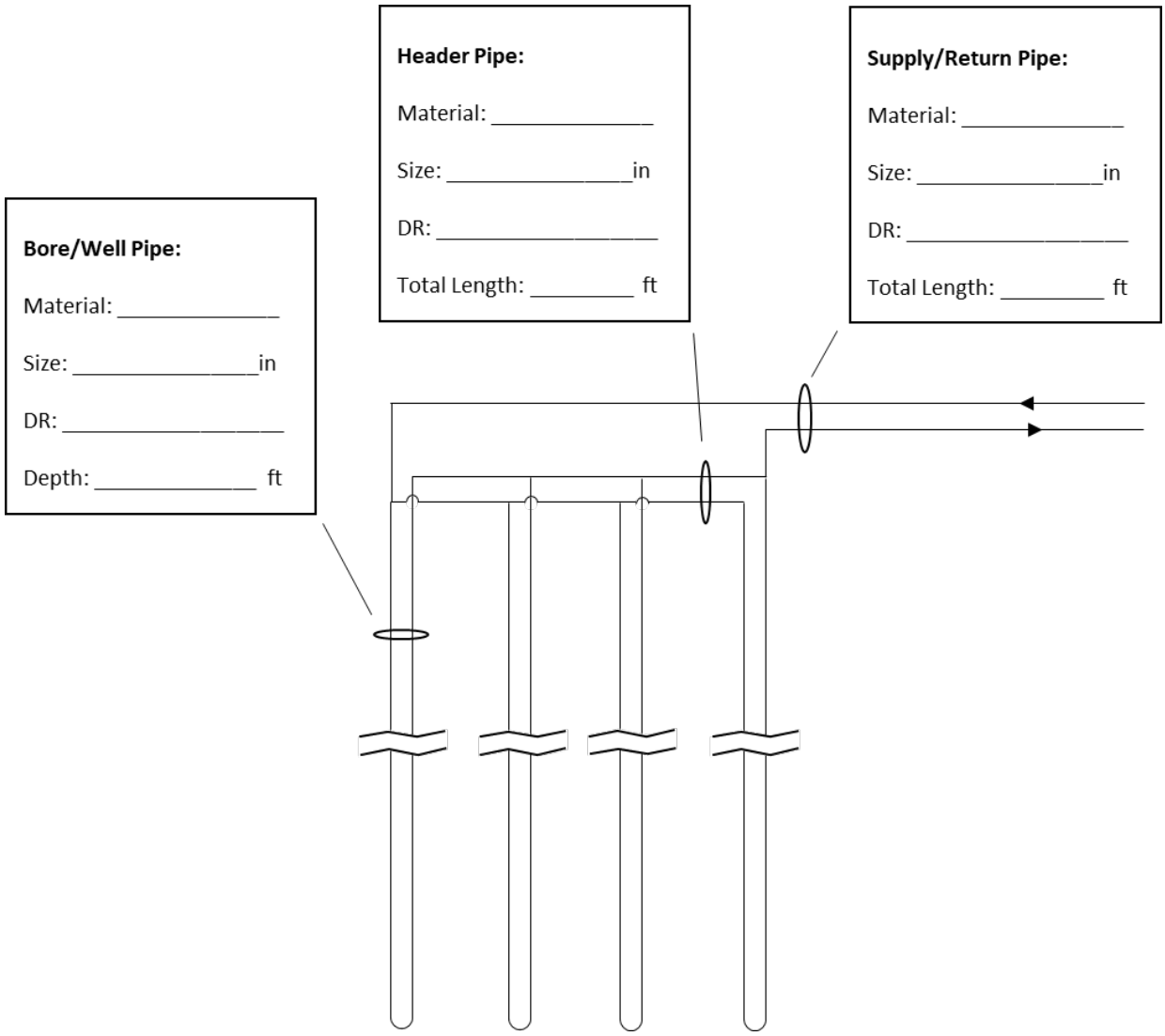
Dx Systems – Anode Distance from House: _____

N/A ft

Ground Heat Exchanger Piping Schematic

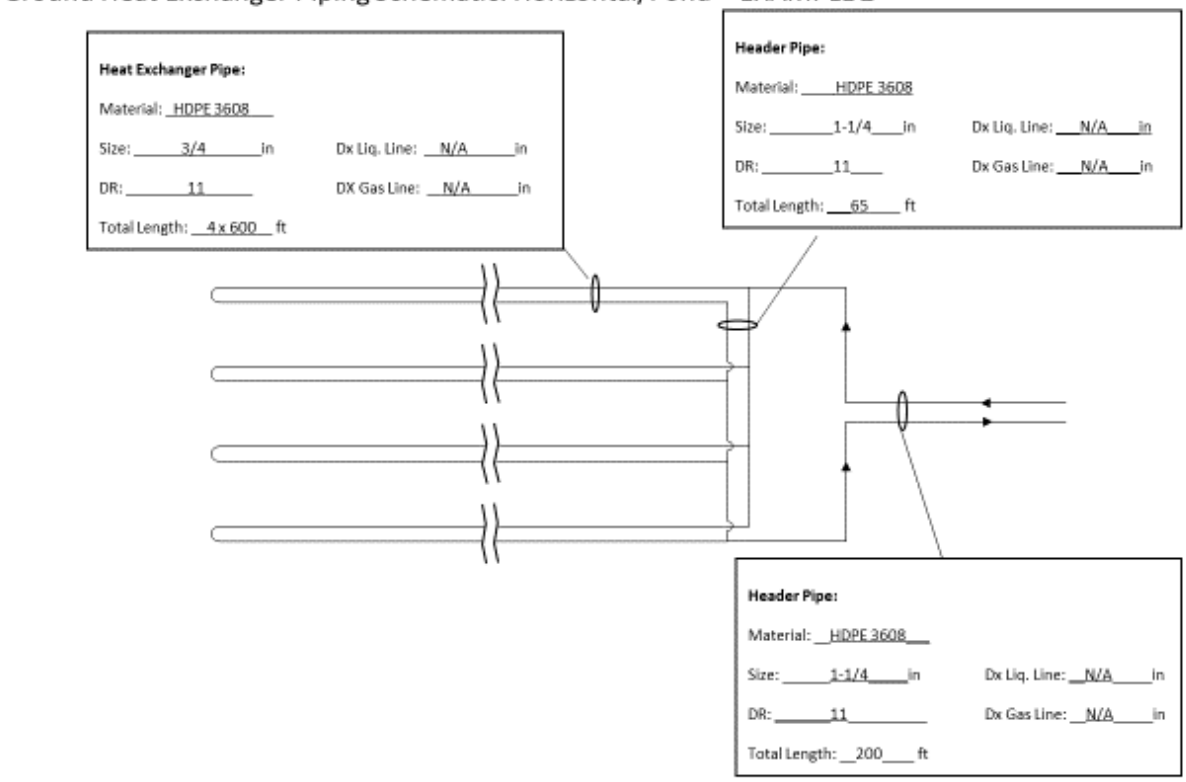
Outline the loop field piping layout and specifications.

☐ Vertical Loop



☑ Horizontal or Surface Water Loop

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



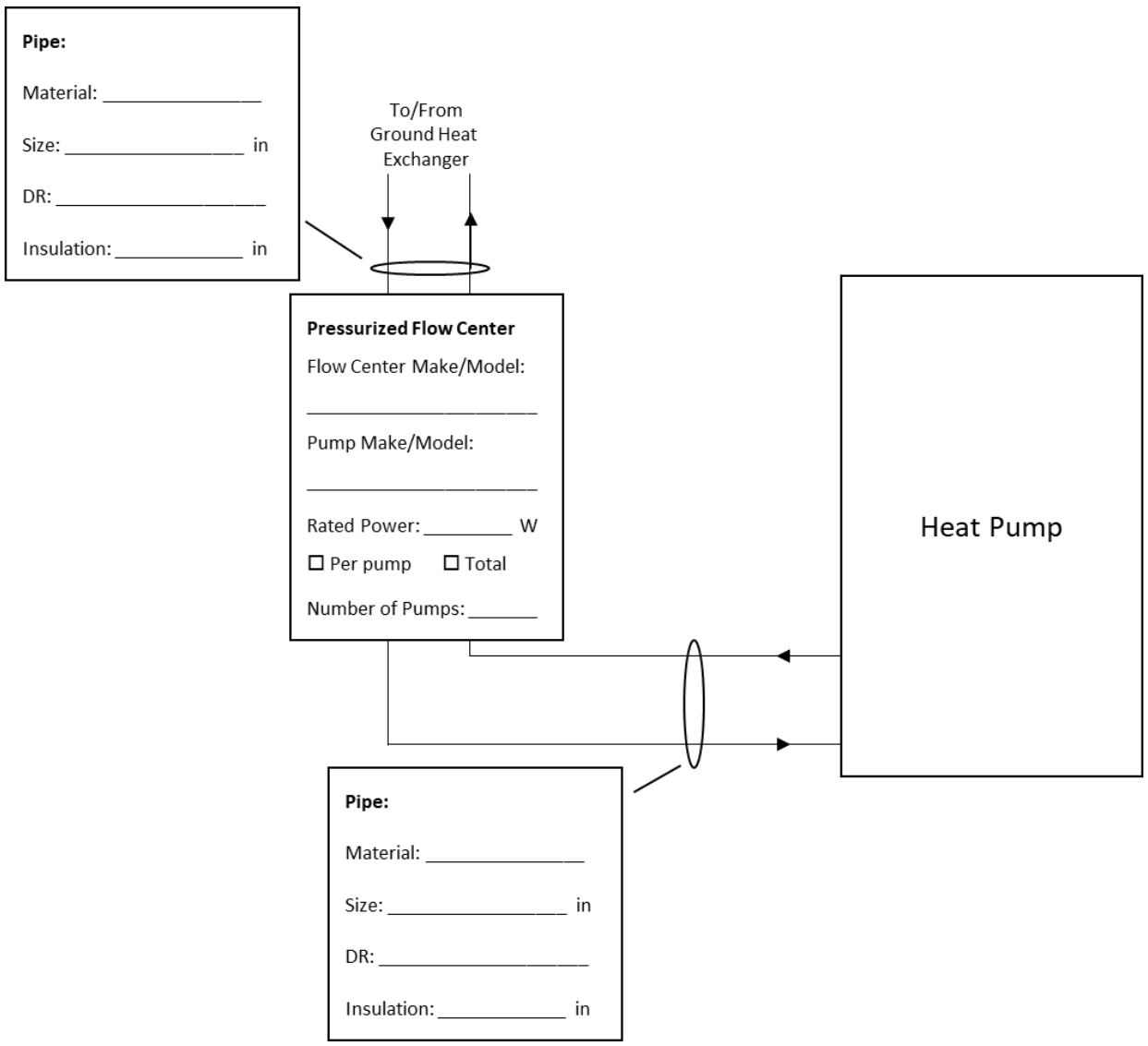
Ground Heat Exchanger System Specifications

Grout type: Groutco M1 Grout thermal conductivity (mixed): 1.25 Btu/hr-ft-°F	
Antifreeze type: ☐ Propylene glycol (CAS No. 57-55-6) ☑ Methanol (CAS No. 67-56-1) ☐ Ethanol (CAS No. 64-17-5) ☐ Other (Specify: _____)	Ethanol denaturant: ☐ 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: 12 %	=_____containers ×_____gallons per container ÷_____gallons in loop field × 100%

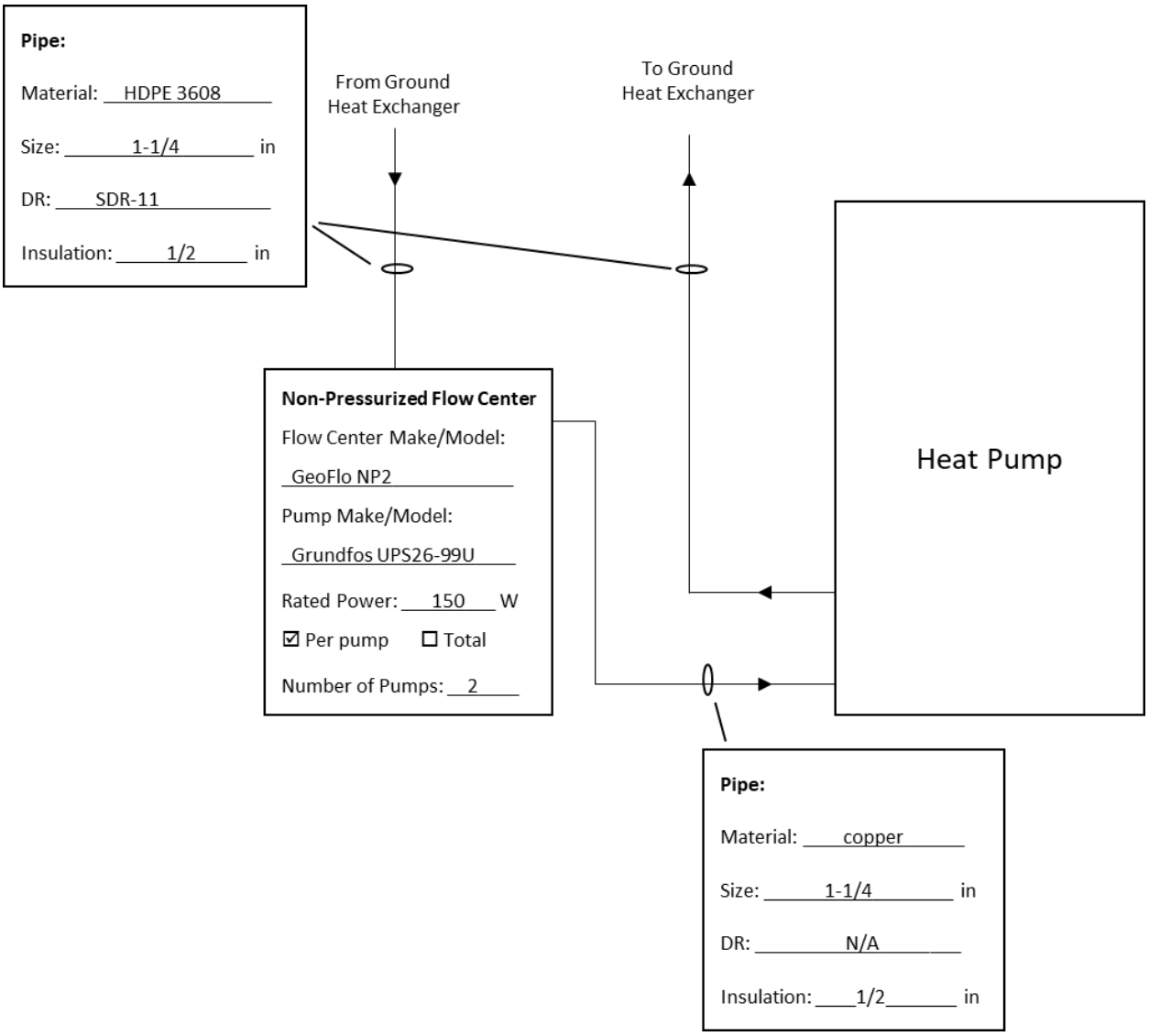
Ground Loop Interior Piping Schematic

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



☑ Non-pressurized (standing column) flow center

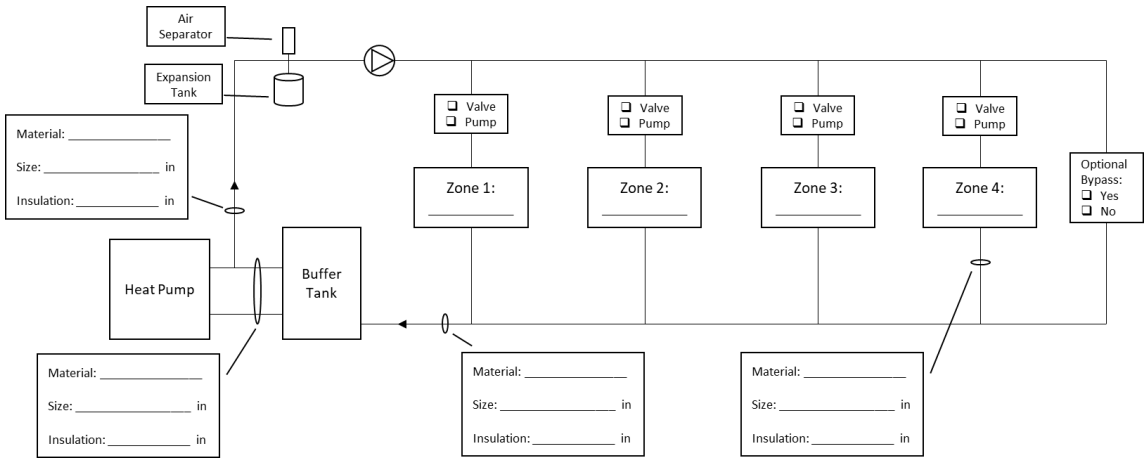


Hydronic (Water-to-Water) Piping Schematic

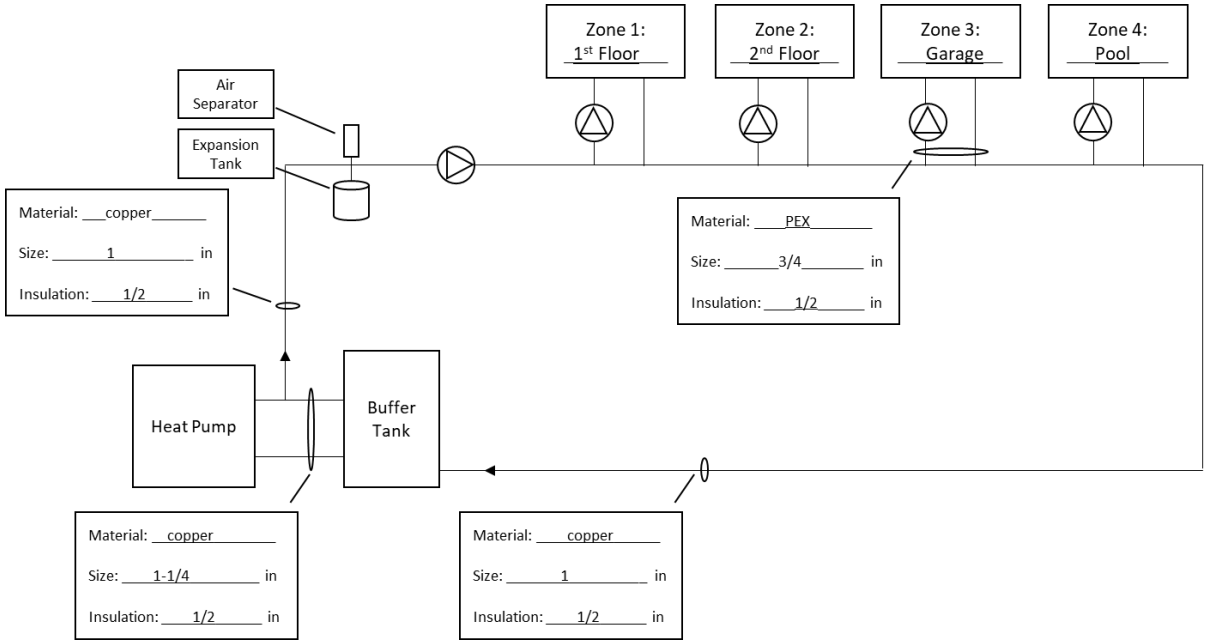
For water-to-water systems, provide a schematic indicating all system elements.

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)

Manufacturer	Model Number	Number of Units	Load / Zone
Geohydro	AWW-048-2XL3	1	Whole house

Hydronic Buffer Tank

Manufacturer	Model Number	Capacity (gallons)
Hydrobuffer	SGW-50	50

Hydronic Expansion Tank(s)

Manufacturer	Model Number	Max. Pressure (psi)	Location
ExpTank Inc	ET-30	100	Main hydronic loop

Hydronic Pumps or Valves

Manufacturer	Model Number	Number of Units	Load / Zone
Pumpco	59388	1	Main hydronic loop
Pumpco	23849	4	Individual zones

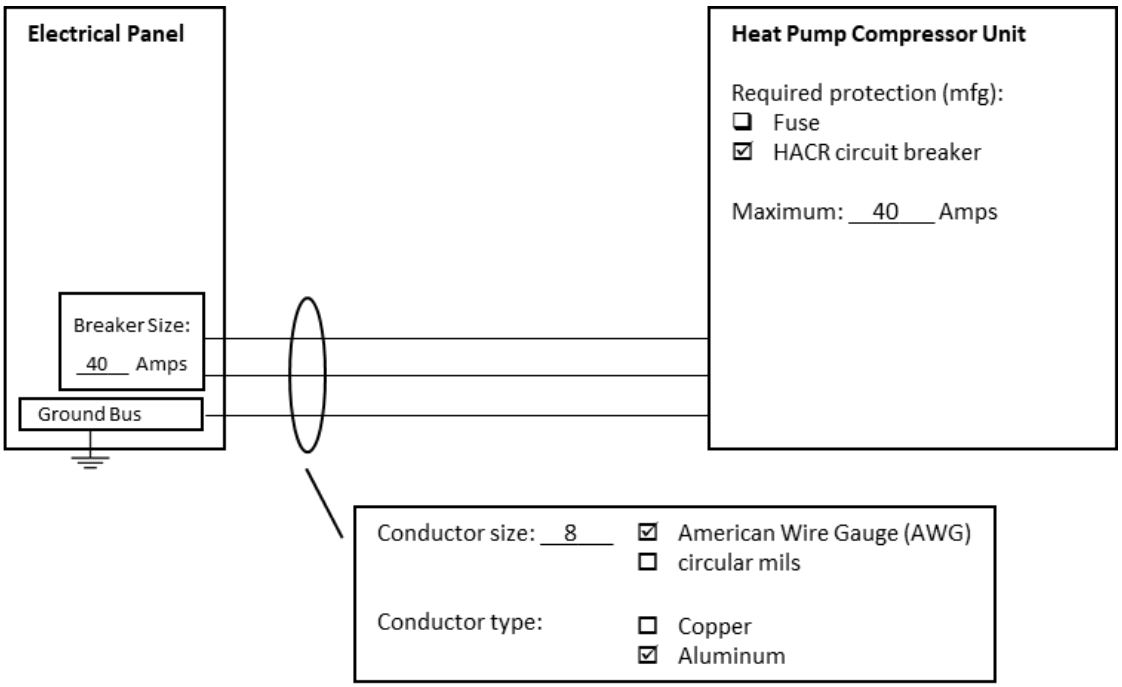
Hydronic Air Handler(s)

Manufacturer	Model Number	Number of Units	Load / Zone
HydroAHU Company	AHU-29-45-29	4	Individual zones

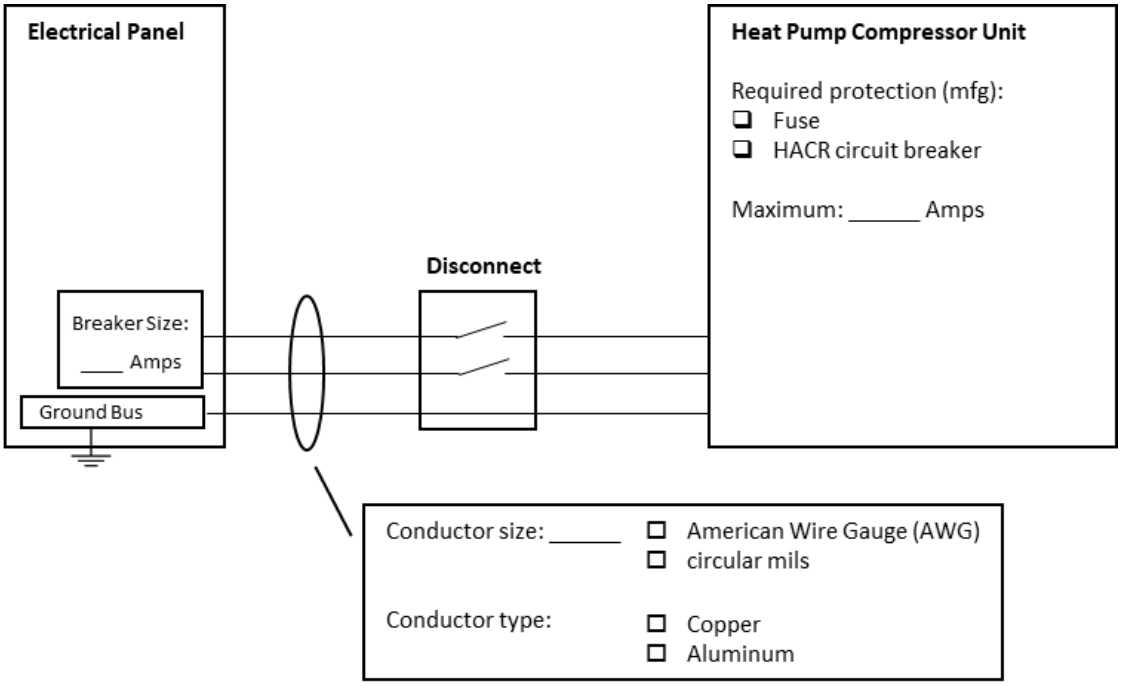
Electrical Drawing

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

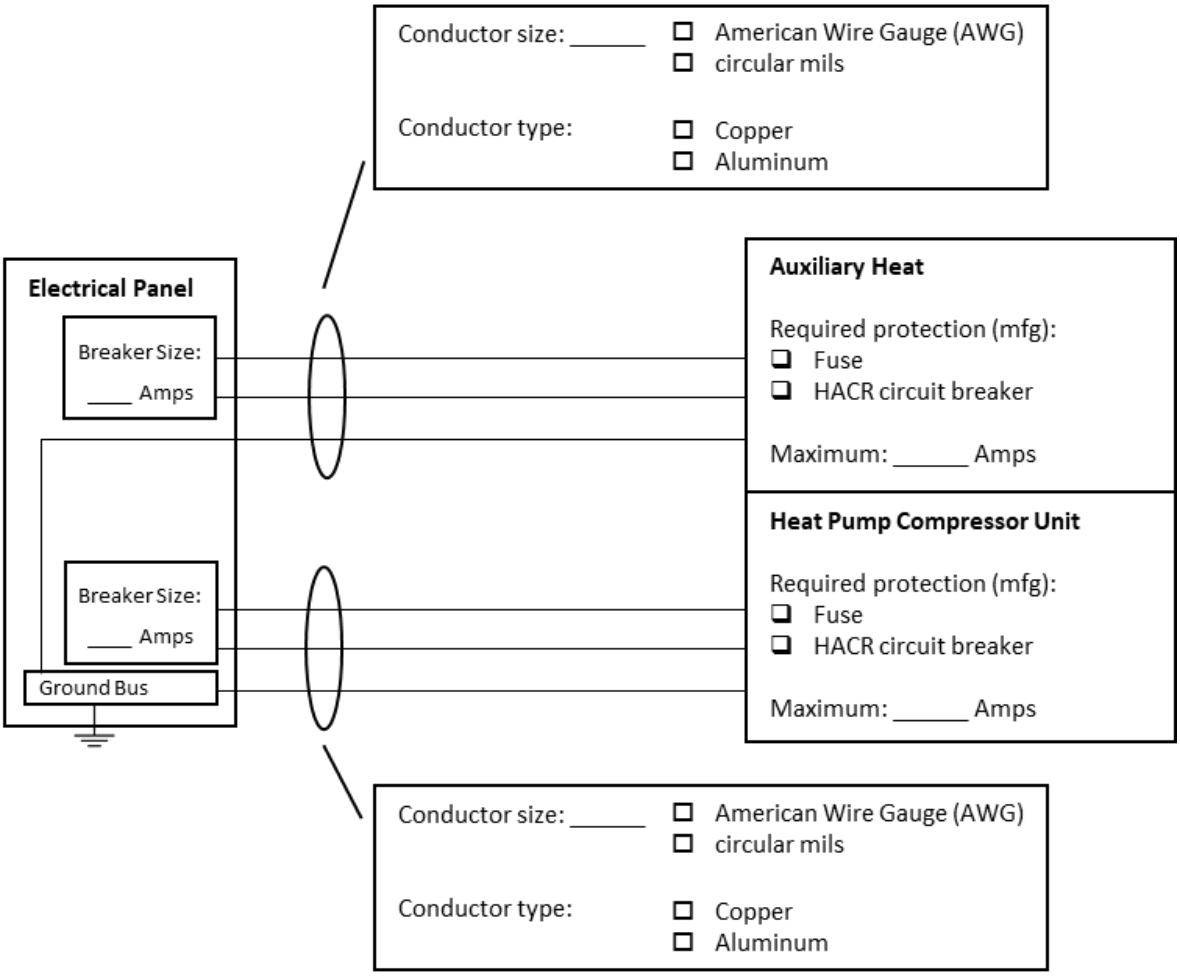
☑ Electrical panel within sight of heat pump compressor unit



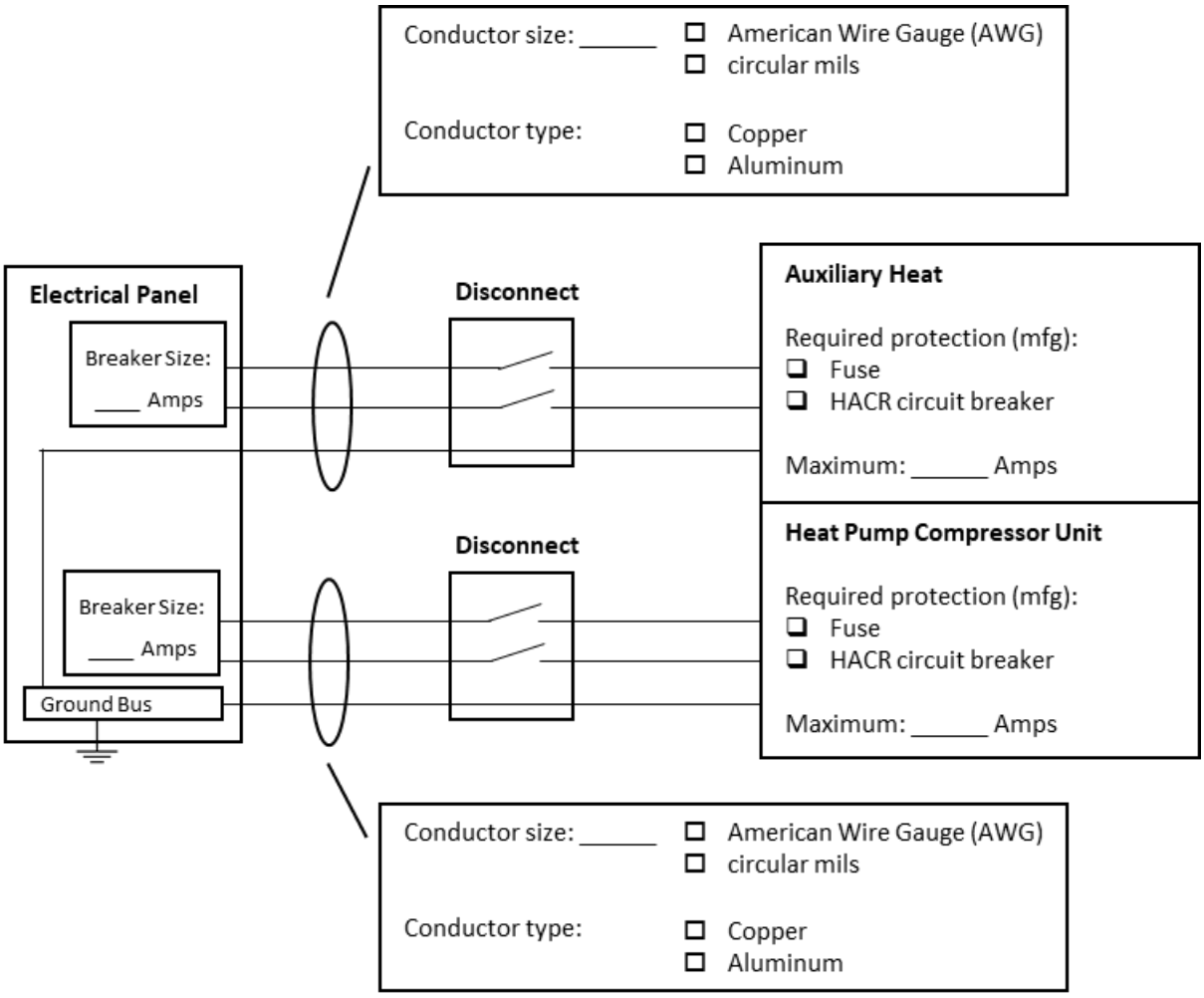
❑ Supplementary disconnect within sight of heat pump compressor unit



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

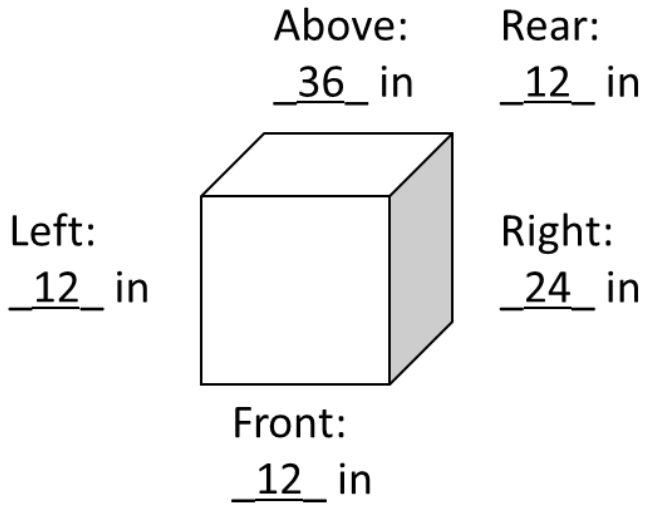


❑ Supplementary disconnect within sight of heat pump compressor nit, with auxiliary heat



Service Clearance

Indicate minimum service clearance required around the heat pump equipment.



State of New York
Andrew M. Cuomo, Governor

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