INSTALLATION CONSIDERATIONS
enviroPlate Surface Water Heat Exchangers

Summary Design Considerations

EnviroPlates are intended for closed loop, surface water applications for GSHP systems. These stainless steel or titanium heat exchangers are sized using the peak flow rate required by the heat pump(s), water temperature at design temperature conditions, peak heat of absorption, and peak heat rejection from the heat pump system.

The designer will need to select the minimum EWT required for the heat pump(s) in the heating mode if the peak and duration of the application is heating dominated. If the heating load is anticipated to have a long duration (high heating degree days climate, etc.) and host water conditions are expected to be at or below 40°F (4.4°C) the return water temperature design is recommended to not exceed 1°F Δ. The reason for this is to reduce the potential for ice buildup on the enviroPlates which can have a cascading effect of lowering the RWT back to the heat pump(s) over time causing the heat pump(s) to lock out.

For a cooling dominated load, the maximum EWT to the heat pump(s) is required along with the anticipated summer or host water temperature. In most cooling dominant situations more latitude may be possible in the reduction of the number of plates but this will be dependent upon individual applications.

The final number of units selected may also be adjusted to minimize pumping power.

As with any closed loop GSHP mechanical system, "rule of thumb" assumptions have absolutely NO place in the design or configuration of a heat exchanger.

We recommend a minimum depth of installation of at least 6' between the water surface, or bottom of the ice sheet if surface ice development is anticipated, and top of the plate (see below).

Water Depth

For most situations we recommend a minimum water depth of at least six feet (6') from the top of the enviroPlate to the water surface, or if in an extremely cold climate, 6' below the anticipated bottom of the ice cap. This minimizes impact from solar heat gain for cooling dominant applications and heat loss to surface climate conditions for heating dominant loads, and may be critical in small surface water bodies that have no natural water movement.

Water environments where natural flow from currents or tidal action are present may mitigate this minimum depth recommendation, but is always a judgment call for each individual application.

Maintenance - External

In most cases no maintenance will be required of the enviroPlates. However, for some environments such as marine applications a stainless steel or titanium heat exchanger may turn out to be the perfect structure for organisms to attach and grow on the plates. If this is a concern site the heat exchanger array for diver access to permit cleaning, or removal of the plates for surface removal of organisms. Our palletized systems are provided with lifting hooks.

Maintenance - Internal

Again, in most cases this is not a concern. However, if a heat exchanger water solution is high in total dissolved solids (TDS) or otherwise has constituents that may react to form solids, allowances may be necessary in the mechanical system to permit periodic flushing of the system. See the **Water Quality – Ground Heat Exchanger Fluid** section below.

Another concern is maintaining cleanliness of the other components such as HDPE header lines during installation to make absolutely certain no solid contaminants can migrate back to the plates and plug flow paths of the enviroPlate unit(s).

The best safeguard for internal maintenance is to verify water purity to avoid this situation entirely, and the installation contractor is required to guarantee that all related components are installed without any potential of contamination from dirt or other debris.

Other Considerations

Consider the installation site with regards to other uses and potential conflicts with the location of the enviroPlate installation. For example if a pond or lake installation will be in conflict where people swim or dive into the water other location or configuration strategies should be considered for safety considerations. Where installations may be in conflict with boat or personal water craft traffic, deeper installation depths may be necessary or another location may be required. Where other recreational efforts are expected such as fishing, another location may be preferred. If the plates are in the vicinity of a storm drain, river mouth, or other feature that could have periodic strong water surges, the plate installation may be in jeopardy of being impacted from debris such as boulders, trees or other large water-borne materials from flooding. Use common sense to anticipate these and other potential issues.

Installation Configurations

EnviroPlates may be installed individually, in palletized assemblies, or even take advantage of existing structures such as boat docks for placement.

Palletized assemblies may be installed using a crane or other suitable lifting device. In some situations the plates amy be installed in ponds or small lakes that will be excavated; in these situations it makes sense to install the enviroPlates before the basin is filled.

Header Lines

Ideally the header lines between the mechanical room or heat pumps and enviroPlates should be installed to a minimum of 5' to 6' depth in a header trench from the building structure to the edge of the water body.

If the situation requires that the header lines be exposed above the water or at a shallow water depth from where the lines egress from the dry-land header trench, use appropriate insulation and pipe protection to minimize adverse impacts from climate or physical damage from other activities.

Should installation variables require the use of antifreeze components greater than that described under **Antifreeze & Fluid Capacity** section (see below) another header placement configuration should be considered to avoid excessive antifreeze that will harm the performance of the system.

Flow Direction

Supply water from the heat pump(s) to the enviroPlates should be to the lowest water port of the plate(s), for both purging and operational flow. This facilitates purging of air (see below) and ensures best possible performance of the enviroPlate.

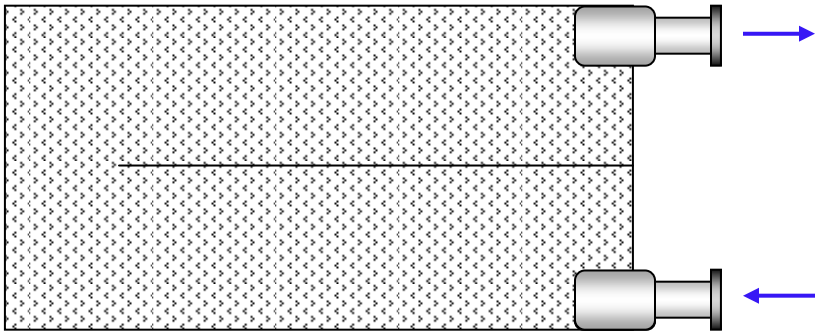
Purging

As with any closed loop heat exchanger, air removal is imperative for efficient operation of the heat pump system. Air purging should always be done prior to adding antifreeze, which entrains air.

The minimum recommended purge rate and pressure drop for a single enviroPlate is as follows:

Purge performance requirement, 2' velocity per second, pure water: 25 gpm @ 5 psi

As noted above, purging should be completed prior to adding any antifreeze or other constituent that may entrain air. Plates should always be purged at the minimum required flow rate, with the water being induced from the bottom to minimize the chance of trapping or retaining air in the plate.



When calculating purging pressure drop include the header line size and length to point of purging (mechanical room manifold, packaged pump pack, etc.). Once the total pressure drop is calculated verify your purge pump is capable of meeting the minimum flow rate and pressure drop resistance.

Please note that the flow paths for enviroPlates are relatively small and will not tolerate contamination. Make certain all of your piping is clean and free of any contaminants that could block flow and harm heat transfer prior to tie-in and charging with water.

Water Quality – Ground Heat Exchanger Fluid

Verify that the water to be used in your heat pump, piping and enviroPlate system is not susceptible to mineralization that can block fluid flow in the plate(s). Reference your heat pump manufacturer's IOM manual for water quality standards.

Some constituents in some domestic water sources may react to form solids with certain antifreeze blends. As the water temperature will vary in some systems due to seasonal variations, load durations, etc., this may have a catalyst effect not apparent under static conditions.

If in doubt utilize a local water laboratory testing service to verify that the water intended to charge the system and your preferred antifreeze are compatible.

Antifreeze & Fluid Capacity

The total fluid capacity for a standard 4' x 15' enviroPlate is approximately 10.5 gallons. For antifreeze capacity calculate as percentage by volume. For example if 25% by volume propylene glycol is required, multiply .25 x 10.5 to determine 2.6 gallons of propylene glycol per plate. Add to the rest of your system capacity (piping, heat pump water-refrigerant coil, etc.) for the required total.

Note: We recommend not using any more antifreeze than is necessary as excessive freeze protection can inhibit heat transfer. Recommended maximums:

Antifreeze Type	Concentration by Volume	Freeze Protection
Propylene glycol	25%	13.8°F
Ethanol	15%	12.6°F
Methanol	25%	12.9°F

These are approximate percentages and freeze protection values (IGSHPA GSHP Residential and Light Commercial Design and Installation Guide, 2010, C. Remund, Table 4.21, Page 4-26). Confirm with your antifreeze vendor for any differences.

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