WATER ENERGY DISTRIBUTORS, INC.
2 Starwood Drive Hampstead, NH 03841
603-329-8122 fax: 603-329-0285
www.northeastgeo.com

Flat Plate Exchangers, Scaling & Water
Technical Bulletin 2007-16

GENERAL

Anyone reading the Chapter 31 of ASHRAE Applications and forming the opinion that a flat plate heat exchanger is need on all open geothermal applications is making a specific judgment on a universal observation. (Section written by K. Rafferty of Geo-Heat Center)

Of note, a recent excerpt in "Outside the Loop" Klamath Falls Oregon Geo-Heat Center web site, Kevin Rafferty – "Generally speaking water in New England states is on the acidic end of the spectrum and quote low in TDS – generally offering little problems in terms of use in heat pumps"

COMMENTS ON SCALING & WATER

We would respectfully suggest any one holding a position of using a flat plate exchanger and softening the geothermal water has gathered all of their geothermal knowledge from a universal text with little or no field experience. The flat pate exchanger in New England is neither desirable nor required. Consider:

1. We have been involved in over 10,000 geothermal installations since 1974 and none have required an intermediate flat plate heat exchanger (FPHX). Well over 95% of the installations are direct well water installations with no FPHX,

2. The use of a FPHX reduces the efficiency and the capacity of a heat pump since it interposes another heat exchanger in the source/sink (water) route. A typical cost effective FPHX would have a 10°F "approach" temperature with the following comparative results for a typical New England Well Water system and a ten ton water to water geothermal heat pump using R-22.:

	Straight Well	FPHX	Reduction by FPHX
Entering Water	50°F winter 50°F summer	40°F winter 60°F summer	
Capacity:			
Heating	106,300	93,6000	22%
Cooling	112,400	109,500	3%
Efficiency:			
COP Heating	3.89	3.48	11%
EER Cooling	24.1	21.2	12%

The use of the FPHX can substantially reduce both the heating and cooling capacity of a geothermal heat pump as well as over a 10% reduction in efficiency.

NOTES

WATER ENERGY DISTRIBUTORS, INC.
2 Starwood Drive Hampstead, NH 03841
603-329-8122 fax: 603-329-0285
www.northeastgeo.com

3. The GeoHeat Center at Klamath Falls (Kevin Rafferty) is an open well geothermal protagonist, much in the same way Oklahoma State University (International Ground Source Heat Pump Association – IGSHPA) is the closed loop (plastic pipes in ground) protagonist. Please consider that the writing of the Geo Heat Center must be universal and applied over the entire US and foreign geothermal heat pump applications. Many heat pumps termed “geothermal” do not have heat exchangers that automatically shed themselves of sale or are easily cleansed. The GeoHeat Center would be remiss in not recognizing the most sensitive heat pump heat exchangers.

Cu-Ni 706 Alloy Water Tube Fluted HX in Steel Refrigerant Outer Tube

CUT AWAY OF KOAX GEOTHERMAL HEAT EXCHANGER
Requirement for Open & Standing Column Well GeoExchange

Copper-Nickel Geo Heat Exchanger Tolerates Light Freezing & Sheds Scaling

The ClimateMaster heat exchanger is made by its sister company “KOAX Corp”. As al all true geothermal heat exchangers for open systems, the heat exchanger is fabricated from 709 copper-nickel alloy. This alloy is similar in corrosion resistant properties to stainless steel and monel alloy (shipboard use).

The ClimateMaster heat exchanger is unique in that it is compliant and as the temperature of the refrigerant gases changes as much as 140 °F over the annual winter-to-summer period, the movement of the flutes, see figure, break away any scaling and any iron bacteria occlusions. We have never had the need to descale or otherwise clean iron (or its accompanying manganese) from any heat exchangers in the past 29 years.

There has not been an anticipated nor proven need for an intruding FPHX in any installations since our involvement in geothermal heat pumps since 1974.

4. At present there IS a planned installation in New York City that has designed in the use of a FPHX. For this high rise building the FPHX provides pumping pressure isolation. On building over 12± stories the FPHX proves isolation from the open pumping requirements from the submersible well pumps to a closed water circulation loop in the building with its commensurate lower pumping costs.

WATER ENERGY DISTRIBUTORS, INC.
2 Starwood Drive Hampstead, NH 03841
603-329-8122 fax: 603-329-0285
www.northeastgeo.com

5. Of note, the use of the FPHX in any design adds approximately 10% to the cost of the heat pumps; as larger heat pumps are required to achieve the specified heating and cooling capacities large dollar amounts are required.

COMMENTS ON USE OF A SECONDARY (BACK UP) SYSTEM

6. Secondary systems are <u>not</u> recommended. They are:

    a. Not required if the design engineer provides a full design requirement for heating.
    b. Dual systems have demonstrably added cost by adding a fossil system with its cost added to the installation and well demonstrated twice the maintenance costs of the geothermal heat pump (see ASHRAE, EPRI and DOE documents, provide on request)
    c. Have added substantial cost be the need for a more complex control system.

    Do you normally add a secondary system to oil or gas based systems??

COMMENTS ON THE WATER QUALITY

7. The installation of a softening and filtering system for the large amounts of water used by a heat pump is unnecessarily costly and a proven maintenance head-ache. Water softening is NOT required nor recommended.

8. If the water contains particles greater than 0.015 inches (approximately 600 microns) we recommend a simple “spin down” type filter. Particles this large are most often attributed to a poor well installation that was improperly cased (low bidder).

9. With respect to pipe corrosion, we would submit that the issue may be electrolysis – not chemical, nor mechanical.

WATER ENERGY DISTRIBUTORS, INC.
2 Starwood Drive Hampstead, NH 03841
603-329-8122 fax: 603-329-0285
www.northeastgeo.com

COMMENTS ON IRON BACTERIA

10. Iron Bacteria (TB#5) is found in Northeast waters. One of the four varieties, ganiella, is most commonly found. The iron bacteria is not harmful to man but can create am unwanted restriction in heat exchangers and piping.

11. Heat exchangers can reduce their surface and consequent performance area by more than 50% with layers of the iron bacteria deposit. This deposit can take months to develop. But will develop and as its get thicker, it becomes exponentially difficult to remove because of a bio-film formation on its surface and its thickness

12. A Water-to refrigerant heat exchanger, unlike a flat plate exchanger is able to kill the iron bacteria film and self-clean it's self during the period (air conditioning or chiller) when that heat exchanger flow hot gas and is acting as the condenser.

13. Typical condenser hot gas temperatures are in the 160-180°F range, Iron bacteria is killed with temperatures above 130°F.