



12th International Conference on Optimization of Electrical and Electronic Equipment OPTIM 2010

May 20-22, 2010, Brasov, Romania

Monitoring of a Ground Source Heat Pump with Horizontal Collectors

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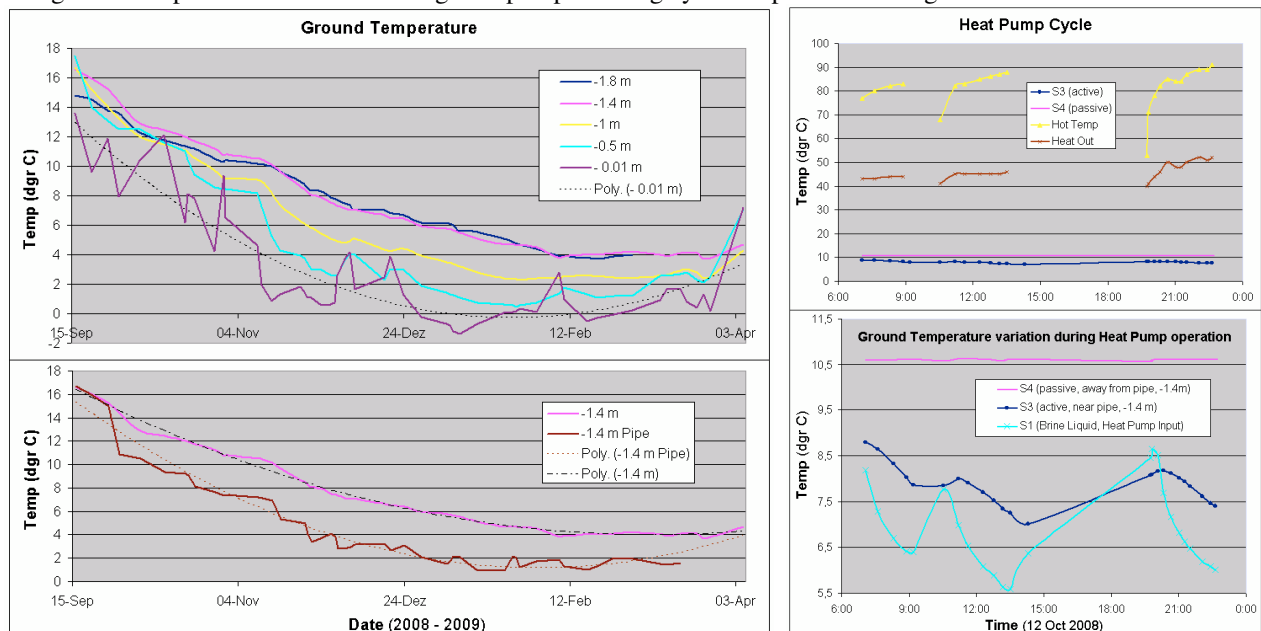
Abstract

The present paper presents the results of the ground temperature monitoring for a residential heat pump system. It is presented a procedure to estimate the ground loop of the heat pump, based on ground temperature measurements. Data are acquired in Halchiu, Brasov, from September 2008 to April 2009 at a depth of -1.8 to zero meters, in two locations through the pipe length: first location at the pipe input (heat pump output) and the second one near the pipe output. The measurement results in the second location are presented in figure 1.

The length of ground loop was initially estimated based on [1], [2], [3], [4] after an initial test of the ground-water thermal transfer. The experimental determination of thermal transfer from ground to the pipes liquid permits a more accurate design. The thermal transfer was split in two parts and the respective temperature drops were estimated from the measured data. Some practical conclusions of this study can be used for a new ground-loop design:

- at a depth of -1.5 m the minimum temperature is 3 to 4°C lower than the annual mean value of the region;
- the temperatures at -1.4 and -1.8 m depth are almost identical (during the heating season);
- the temperature drops are:
 - from ground to pipe area: $3 \dots 4^{\circ}\text{C}$ and
 - from pipe area to liquid in pipes: $1 \dots 3^{\circ}\text{C}$;
- the spiral pipe ground loop with a length of $50 \text{ m} / \text{kW}$ was sufficient for the analyzed example.

The ground temperature variations during heat pump working cycle are presented in figure 2.



The temperature variation: Fig 1. - in the ground

Fig.2. - during 3 heat-pump cycles.

References

- [1] Worcester-Bosh Group, *Greenstore Ground Source Heat Pumps - Technical and Specification Information*, June 2006.
- [2] *** *CTC EcoPart Product Specification*, CTC Sweden, 2007.
- [3] *** *Manual de instalare si intretinere - CTC EcoPart (Installing and Service Manual - CTC EcoPart)*, 2007.
- [4] Serban Cristian, *Curs Pompe de caldura CTC EcoHeat/EcoAir (CTC Heat Pumps Course)*, TermoMax Romania, 2007.