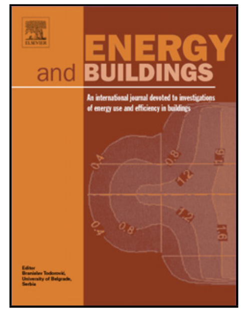
Accepted Manuscript



Title: Effect of Seawater Intake Methods on the Performance of Seawater Source Heat Pump Systems in Cold Climate Areas

Authors: Jia Xin, Duanmu Lin, Shu Haiwen

PII: S0378-7788(16)31279-8
DOI: http://dx.doi.org/doi:10.1016/j.enbuild.2017.08.016
Reference: ENB 7845

To appear in: *ENB*

Received date: 21-10-2016
Revised date: 30-5-2017

Please cite this article as: Jia Xin, Duanmu Lin, Shu Haiwen, Effect of Seawater Intake Methods on the Performance of Seawater Source Heat Pump Systems in Cold Climate Areas, Energy and Buildingshttp://dx.doi.org/10.1016/j.enbuild.2017.08.016

<AT>Effect of Seawater Intake Methods on the Performance of Seawater Source Heat Pump Systems in Cold Climate Areas

<AU>Jia Xin[a], Duanmu Lin[a,*], Shu Haiwen[a]
<AFF>[a]School of Civil Engineering, Dalian University of Technology, Dalian 116028, China

The Seawater Source Heat Pump (SWHP) system is an energy-saving and environmentally-friendly technology for the cooling and heating of buildings. The SWHP system is based on obtaining ``free'' heat from the sea by using heat pumps. In this study, field test and analysis were conducted to compare the performances of beach well infiltration intake system and direct intake system for SWHP systems at the Liaodong Peninsula, China. The average unit COP was 2.99 for the direct intake system and 4.66 for the beach well infiltration intake system, with the average seawater temperature being 5.83 °C and 12.85 °C, respectively. The test results indicate that the beach well infiltration intake method effectively improves the stability, reliability and energy efficiency of the SWHP systems in cold climate areas, and the intake seawater temperature is a critical factor influencing the performance of SWHP system. A simulation study was conducted for further illustration that how the intake seawater temperature of the beach well infiltration intake system was increased. The simulation result shows that the intake seawater temperature of beach well infiltration intake system is higher than the direct intake system, and the main reason is that the underground seawater with higher temperature is extracted. The intake seawater temperature is very sensitive to the seepage velocity in a range, and the flow quantity of pump seawater should not be too large under limited engineering conditions. The simulation results are foundations for further successful SWHP system engineering.
<KWD>Keywords: seawater source heat pump; beach well infiltration intake; seawater seepage; heat transfer;

Nomenclature	
α	permeability (m^2 or D)
C_2	inertial resistance factor
T	temperature of the porous media (℃)
c_p	specific heat capacity (J/kg·℃)
p	pressure (Pa)
V	velocity vector (m/s);
S	source term
Greece symbols	
μ	molecular viscosity (Pa·s or kg/(m·s))
ρ	density of seepage fluid (kg/m^3)
k	thermal conductivity (W/m·℃)
γ	void fraction
τ	time (s)
Subscripts	
eff	effective