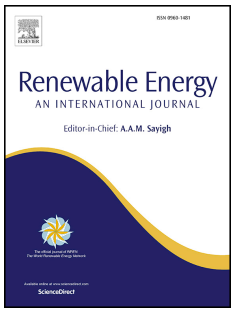
Accepted Manuscript



Experimental and numerical research of thermal stratification with a novel inlet in a dynamic hot water storage tank

Zilong Wang, Hua Zhang, Binlin Dou, Huajie Huang, Weidong Wu, Zhiyun Wang

PII: S0960-1481(17)30300-2

DOI: 10.1016/j.renene.2017.04.007

Reference: RENE 8701

To appear in: *Renewable Energy*

Received Date: 8 December 2016

Revised Date: 1 April 2017

Accepted Date: 4 April 2017

Please cite this article as: Wang Z, Zhang H, Dou B, Huang H, Wu W, Wang Z, Experimental and numerical research of thermal stratification with a novel inlet in a dynamic hot water storage tank, *Renewable Energy* (2017), doi: 10.1016/j.renene.2017.04.007.

Experimental and numerical research of thermal stratification with a novel inlet in a dynamic hot water storage tank

Zilong Wang* Hua Zhang Binlin Dou Huajie Huang Weidong Wu Zhiyun Wang
School of Energy and Power Engineering, University of Shanghai for Science and Technology, Shanghai, China
Emails: wzl@usst.edu.cn zhanghua3000@163.com bldou@dlut.edu.cn

Abstract: Heat storage is an important task in the use of solar energy; in particular, the use of water as the thermal storage medium is one of key technologies in solar thermal energy utilization. With the purpose of improving the thermal stratification of a heat storage tank, a novel equalizer was designed in this paper. To investigate the influence factor of thermal stratification in hot water storage tank, numerical analyses based on the three-dimensional (3D) unsteady Computational Fluid Dynamics (CFD) model were performed using the commercial software ANSYS. The initial and inlet temperatures were considered along with various flow rates. The performance parameters, such as the Richardson number、the MIX number and exergy, were involved in the evaluation. This study was further extended to explore the fill efficiency as the performance parameters of thermal stratification within a storage tank. The numerical model was validated with the experimental data; the results were determined to be in good agreement. The results demonstrate that with the growth of flow rate, the Richardson number decreases, fill efficiency and exergy increased first and later decreased, but the MIX number decreased first and later increased. When the flow rate was 3 L/min, the equalizer performs best, and the storage tank had a better thermal stratification. The RMS error increased first and subsequently decreases before increasing again with the growth of the flow rate. Furthermore, the MIX number reaches a minimum at the dimensionless time of 0.5 in the numerical results, whereas it is 0.4 in the experimental results. It was also observed that the contribution of the equalizer on the flow-suppressing of influent results in a decrease of mixing process between the hot