Optimal Arrangement of Coil Heat Exchanger in Single Thermal Storage Tank with Molten Salt

Suli Shi, Yu Qiang and Yuanwei Lu*

[1]College of Environmental and Energy Engineering, Beijing University of Technology, Beijing, 100022, China.
*Corresponding author: Yuanwei Lu. Email: luyuanwei@bjut.edu.cn

Abstract: Low cost heat charge and discharge can be realized by the single storage thermal tank integrated with a coil heat exchanger and an annular baffle. Arrangements of the coil heat exchanger will directly affect the heat discharging performance of the system. Simulations were performed for six arrangements of the coil heat exchanger which are evaluated by outlet temperature, heat transfer rate and heat discharging efficiency. For different arrangements, the law of heat discharging performance of the single thermal storage tank is given, and the change of flow field around the coil heat exchanger is analyzed. The results show that the higher the coil heat exchanger is placed, the better the heat discharging performance is. Because a stagnation zone appears when the coil heat exchanger is arranged at a lower position, which prevents the high-temperature heat storage fluid from flowing through the outer surface of the heat exchanger. However, the best heat discharging performance occurs duo to the greater velocity across the heat exchanger when the heat exchanger is arranged in the whole annular channel. In addition, increasing temperature stratification and increasing the velocity across the heat exchanger are not compatible, and increasing the velocity across the heat exchanger has a more significant effect on improving the heat discharging performance. The scheme with variable inlet velocity of the heat exchanger becomes one of the effective ways to solve the imbalance between supply and demand. The research results provide a theoretical basis for the design of the single thermal storage tank system.

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