

Maytham A. Jasim, Utilization of air-water solar collector system for space heating, university of technology, department of machines and tools, MSc, supervisor: Dr. Ahmed A. Mohammed saleh. 2014. 91p.

Abstract

Utilizing solar energy has received a great interest by energy programs in different states in the world. The sun is considered good source supplying free pure energy. In this research, experimental and theoretical study has been done to estimate the performance of solar heating system by air-water solar collector. Flat plate air-water solar collector with dimensions (120 cm length, 80 cm width and 15 cm thickness) has been used for heating the test space with dimensions (2×2×2.5) m. The solar energy that falls on absorber plate of the solar collector transfers to the water that flow in 8 copper riser pipes of solar collector. A small circulation pump has been used to circulate the water in the system with constant volumetric flow rate 100 L/hr. The energy has been stored in water storage tank which is insulated by a glass wool layer. A small blower has been used to circulate the air through the system with air velocity of 2 m/s. During the night, air-water solar collector operates as a heat exchanger. The heat will transfer from the hot water of storage tank to the cold air when solar radiation is unavailable. In this study, the system has been operated in Al-Najaf city with 45° tilt angle due south during February and March months. Three cases of operating mode have been done. The first case: Air solar collector was operated from 8 AM to 5 PM of 24 February, Second case: Water solar collector was operated from 8 AM to 5 PM of 1 March, and third case: Air-water solar collector was operated at 11 and 12 March. Data has been recorded by data acquisition system to estimate the performance of each case of operation.

Theoretically, number of transfer unit method (NTU) has been used to drive the necessary equations for flat plate air-water solar collector performance. MATLAB computer program has been used to calculate the theoretical results in this study.

The experimental results obtained that the dual-function solar collector is more efficient than the other types of solar flat plate collectors (air collector or water collector). They also showed the ability to use dual solar collector as heat exchanger at night to maintain room temperature in the comfort condition for space heating in the winter season (space temperature >19 °C). The theoretical results showed that the efficiency and useful energy of air side and water side of dual solar collector higher than experimental.

Keywords: solar radiation, Dual solar collector, space heating.