SOME STUDIES ON SOLAR AIR AND WATER HEATERS

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SUMMARY

This thesis presents the theoretical and experimental investigations carried out on some solar air heaters and also on simple collector cum storage water heaters. The aim throughout the work has been to investigate and improve the collector performance. An improved empirical correlation for the computation of overall heat loss coefficient is proposed and the results obtained with this correlation found to be in good agreement with the actual solution, for a wide range of design and climatic conditions.

An attempt has been made to optimise the collector duct depth so as to collect maximum energy at minimum pumping cost. A detailed steady state analysis on the performance of a conventional black painted solar air heater has been carried out with different rates of air leakages at various positions along its length , both in the suction and pumping mode.

Systematic experiments are conducted on finned air heaters and the performance is found to be better as compared to that of a conventional air heater. A self consistent transient analysis of a finned air heater has been developed to predict its performance for different air flow rates, fin densities, position of fins, (i.e. fins attached to the top plate, fins attached to the bottom plate and fins on both plates) for both single and double glazing. Periodic analysis of a matrix type solar air heater has been developed,

for both air flow upwards, and air flow downwards, and the effect of parameters like extinction coefficient, depth of matrix, air flow rate, etc., has been studied.

Detailed experimental and theoretical analysis of collector cum storage solar water heaters under transient conditions using finite difference technique has been carried out, and the effect of baffle plate (insulated plate in the collector) has been studied for summer as well as winter seasons. The transient analysis is used to study the performance of such water heaters for different flow conditions like constant flow rate, intermittent flow rate, intermittent draw, and draw-offs at constant temperature. A novel system of a collector cum storage water heater with a PCM storage is proposed and modelled with simplified assumptions in this thesis. It is observed that this system works more efficiently under certain operating conditions as compared to conventional collector/storage water heaters.

C O N T E N T S