Thesis Title	Case Study of Thermosyphon in a Condition-Controlled Room System
Author	Mr. Sarode Waikluan
M. Eng.	Mechanical Engineering

Examining Committee :	Assistant Prof. Dr. Pradit	Terdtoon	Chairman
	Assistant Prof. Dr. Wiwat	Klongpanich	Member
	Assistant Prof. Somkid	Saladyanunt	Member

Abstract

This research presents a case study of applying thermosyphon in a condition-controlled room system. The objectives of this research were to study, design, construct, and analyse the thermosyphon in a heat exchanger between entering air and leaving air from the cooling coils of the air-conditioner in a system for saving energy. Coil-loop thermosyphon used in this research consisted of evaporator coils and condenser coils whose characteristics were the same as cooling coils. The coils were circular tube-continuous wavy fins with a frontal area of 580 mm. x 203 mm., smooth inner copper tubes with outside diameter of 10 mm and aluminium fins with fin pitch of 12 fin/inch and a thickness of 0.15 mm. The two types of coil-loop thermosyphon were 4-loop thermosyphon (made from 1 row-coils) and 8-loop thermosyphon (made from 2 row-coils). R-134a was used as the working fluid.

This research used a condition-controlled room system consisting of an air-conditioner with 1 ton of cooling capacity and a 0.4 kW electric heater. The experiments were conducted at a constant control dry-bulb temperature of 25$^{\circ}C_{db}$, a constant relative humidity

of 50%RH, a constant total room heat load of 1.21 kW with a constant sensible heat ratio of 0.70. Blower speed was selected at high level which corresponds to the air flow rate of 260 m^3/hr. In this experiment, three experimental cases were conducted without using thermosyphon, then using 4-loop thermosyphon, and then using 8-loop thermosyphon. The experiments were conducted in the Faculty of Engineering, Chiangmai University, at 8.00 AM-17.00 PM of 27 October-17 November, 1996. After that the air properties at each point and the electric power consumption of all equipments in the system were measured. These were consequently analysed and the performance of the system, the thermal characteristics of thermosyphon, the energy savings, and the economic aspects were compared.

The results were that the 4 coil-loop thermosyphon saved electric power consumption at the rate of 0.76 kW-hr per day or 6.6% when compared with the system which did not use thermosyphon. The effectiveness was 0.54 and the internal rate of return was 30.4%. The 8 coil-loop thermosyphon saved electric power consumption at the rate of 0.62 kW-hr per day or 5.4%. The effectiveness was 0.48 and the internal rate of return was 24.3%. This demonstrates that 4 coil-loop thermosyphon was better than 8 coil-loop thermosyphon for this condition-controlled room system.