

**Aluminium Heat Exchangers with Small Inside Volume****W. Primal D. Fernando, Bjön Palm**

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**ABSTRACT**

This paper describes the performance of a small inside volume aluminium heat exchangers (micro-channelled aluminium heat exchangers). The heat exchangers were designed and fabricated in order to have same heat transfer areas as plate type heat exchangers at same duty requirements. The evaporator and condenser capacities are approximately 3.75 kW and 5 kW at evaporation and condensing temperatures  $-8^{\circ}\text{C}$  and  $41^{\circ}\text{C}$  using propane as a refrigerant.

In this paper, the design and fabricated procedure of two aluminium heat exchangers (evaporator and condenser), experimental results of pressure drops in evaporator and condenser and the numerical calculations of pressure drops in evaporator and condenser, based on correlations from the literature are presented

Also, the comparison of experimental results of brazed plate heat exchangers and micro-channelled heat exchangers are presented.

**INTRODUCTION**

Many types of heat exchangers are widely employed in applications of power plants, building heating, refrigeration and air conditioning, marine, automobiles and aerospace vehicles etc. The commonly use heat exchangers are shell-and-tube type, plate type, radiators, cooling towers, tube in tube type and roll-bond heat type etc.

Selection or a design, a heat exchanger for a specific job depends on many parameters. Some of them are, heat transfer area, total size of the heat exchanger, weight, flow arrangements, operating pressures, operating temperatures and temperature differences, materials, cost, easiness to fabricate, technology available, fluids in use and flow rates, space available to fix and some more.

The heat transfer area in a heat exchanger is one of a very important parameter. The heat transfer coefficient of a heat exchanger is increased with the increase of heat transfer area for a given heat flux. But the increase in area causes the increase in size of heat exchanger. There are some practical methods to increase the heat transfer area without much increasing size and weight, such as making finned surfaces and rough surfaces.

The plate type heat exchangers are widely used in refrigeration and air conditioning applications due to its high heat transfer area, low-pressure drop and compactness.

Although, the plate type heat exchangers are compact, it contains considerable amount of refrigerant. This has been experimentally shown in; on going project "Minimisation of Refrigerant charge in small capacity (5kW) heat pump running with Propane as a Refrigerant" in Royal institute Technology, Sweden.

It is worthy to see that, the micro channelled (tubes with small diameters) heat exchangers could be more compact than the plate type heat exchangers. The micro- channelled tubes are widely produced in industry for many applications.

The most common materials for producing micro-channelled tubes are copper and aluminium. Aluminium is one of a very good material to extrude long small channels with low inside volumes and fins and also with small wall thickness. It is very cheaply available various geometry types of aluminium tubes in different lengths. Two heat exchangers were fabricated by using small diameter aluminium tubes. The idea behind this fabrication is, while keeping the same heat transfer area as plate type heat exchanger lower inside volume than plate type heat exchanger.