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Performance Characteristics of a Vapour Compression Refrigeration Cycle using an Ejector

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Extended Abstract

The performance improvement of a vapour compression cycle has been studied extensively. An ejector, which is a possible replacement of conventional expansion devices such as a capillary tube and thermostatic expansion valve, has been proposed to save energy during the expansion process in the refrigeration cycle. The conventional expansion process is considered as isenthalpic process because of the energy loss in the throttling process. The ejector is designed to recover the throttling energy loss (Mahesh and Valiya, 1999), which may lead to isentropic process.

The objective of this study is to investigate the performance characteristics of an ejector designed for a vapour compression cycle. The performance of a vapour compression cycle using an ejector was measured by varying operating conditions and ejector geometries. A reciprocating compressor with the cylinder volume of 15 cc was adopted and a double tube type condenser was used. A heater was used as an evaporator. The compressor frequency was varied from 25 Hz to 45 Hz using an inverter driver. This study mainly discussed the pressure lifting ratio in terms of the entrainment ratio. The pressure lifting ratio indicates the ratio of the exit pressure to the suction pressure, and the entrainment ratio represents the mass flow rate ratio of the secondary to the total flow. The pressure lifting ratio and total mass flow rate decreased with the increase in the entrainment ratio due to the decreased effect of the primary nozzle and the decreased compressor suction pressure. The pressure lifting ratio and total mass flow rate increased with the increase in the compressor speed due to the accelerated motive flow with the compressor speed. At the low entrainment ratio, the pressure lifting ratio of smaller mixing section diameter was higher than that of larger mixing section diameter. At the high entrainment ratio, the pressure lifting ratio of larger mixing section diameter was higher than that of smaller mixing section diameter.

Mahesh, N., Valiya, N., 1999, Investigation of Single and Two-phase Flow Ejectors, Ph.D. thesis, University of Maryland, Adelphi, Maryland.