Experimental Investigations On Passive Devices In A Vcr System With R600a Refrigerant

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Abstract- *Vapour compression system the process of throttling is isenthalpic, which means that the kinetic energy produced during the pressure reduction is dissipated and eventually wasted. Through the action of passive devices (diffuser and nozzle), the compression section pressure higher than it would be in standard cycle and increases flow of the refrigerant. In domestic refrigerator the power consumption increases with increase in compression load. The diffuser provides additional compression to the refrigerant which reduces the mechanical work required for the compressor and reduces vibrations in system, nozzle provides increase in flow which provides more refrigeration effect.*

Keywords: passive devices (diffuser & nozzle), R600a refrigerant.

I. INTRODUCTION

In today's world refrigeration systems are important for both domestic and industrial applications. Most of household refrigerators are work on vapour compression system. The leaked refrigerants from refrigerators may cause several problems to environment like ozone depletion, global warming etc. this is one of the big issues in refrigeration field.in order to reduce this problem we have to use environmental safety refrigerants like hydrocarbons, their blends etc. R600a is one of the environmental safety refrigerants with zero ODP and GWP is less than 3. In VCR system the kinetic energy produced during the pressure reduction is dissipated and eventually wasted. Through the action of passive devices (diffuser & nozzle), the compression section pressure higher than it would be in standard cycle and increases flow of the refrigerant. In domestic refrigerator the power consumption increases with increase in compression load. The diffuser provides additional compression to the refrigerant which reduces the mechanical work required for the compressor and nozzle provides increase in flow.

II. EXPERIMENTALSETUP & METHODOLOGY

The figure 1 shows layout of the tested refrigerator. In this the main components are R600a compressor, diffuser, condenser, capillary tube (expansion valve), nozzle and evaporator. The details of diffuser and nozzle as shown in fig 3 and fig 4 respectively. By incorporate this diffuser kinetic energy is converted into pressure energy before entering the condenser and nozzle is for converting pressure energy to kinetic energy by this velocity of refrigerant increases before entering the evaporator which increases cooling rate of refrigerator.

Fig 1: experimental refrigerator

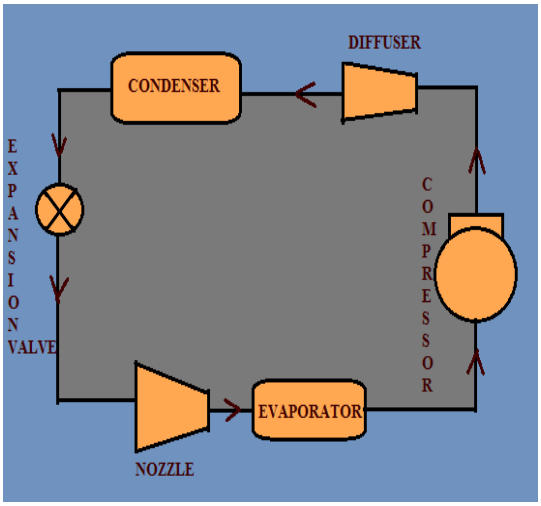

Fig 2: Line Diagram for experimental refrigerator

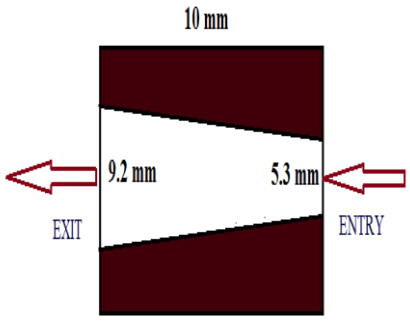

Fig 3: Line Diagram of Diffuser

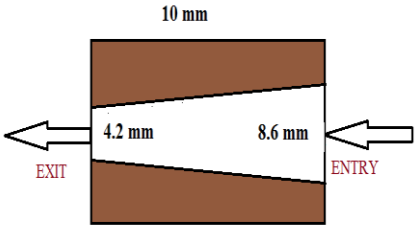

Fig 4: Line Diagram of nozzle

III. CONCLUSION

- The compressor work saved due to nozzle inlet at evaporator inlet to the normal cycle is 4.23%. The compressor work saved due to diffuser cycle when compared with normal cycle is 8.6%. The compressor work saved due to diffuser at condenser inlet and nozzle at inlet of evaporator when compared to the normal cycle is 12.5%

- The refrigeration effect for R-600a using diffuser at condenser inlet and nozzle at evaporator inlet is more than that of all the remaining three cases. The refrigeration effect is 9.08% increased when compare with normal cycle.

- The percentage increase of COP with nozzle to the normal cycle is 5.1%. The percentage increase of COP for diffuser cycle when compared with normal cycle is 9.26%. The percentage increase of COP for diffuser and nozzle when compared to the normal cycle is 21.35

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