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Experimental Analysis on R12A, R600A and R404A in Vapour Compression Refrigeration

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ABSTRACT

This project includes the testing of different refrigerants in order to calculate coefficient of performance of different refrigerants. This project involves the detailed study of actual and theoretical coefficient of performance of three different refrigerants which are R12a, R404a and R600a.

KEYWORDS: Coefficient of performance (COP), R12A, R404A and R600A, refrigerants.

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1 INTRODUCTION

The job of a refrigerator is to cool articles or substances down to, and maintain them at a temperature lower than the ambient temperature. Refrigeration can be defined as a process that removes heat. When refrigerant absorbs the unwanted heat, this raises the refrigerant's temperature ("Saturation Temperature") so that it changes from a liquid to a gas — it evaporates. The system then uses condensation to release the heat and change the refrigerant back into a liquid. This is called "Latent Heat". This cycle is based on the physical principle, that a liquid extracts heat from the surrounding area as it expands (boils) into a gas. To accomplish this, the refrigerant is pumped through a closed looped pipe system. The closed looped pipe system stops the refrigerant from becoming contaminated and controls its stream. The refrigerant will be both a vapor and a liquid in the loop. Refrigeration has had a large impact on industry, lifestyle, agriculture, and settlement patterns. The idea of preserving food dates back to at least the ancient Roman and Chinese empires. However, mechanical refrigeration technology has rapidly evolved in the last century, from ice harvesting to temperature-controlled rail cars. The introduction of refrigerated rail cars contributed to the westward expansion of the United States, allowing settlement in areas that were not on main transport channels such as rivers, harbors, or valley trails. Settlements were also developing in infertile parts of the country, filled with newly discovered natural resources.

2 EXPERIMENTAL SECTION

For carrying out this investigation and experimental work, refrigeration test rig was works on Vapour compression cycle. This experimental set up was designed to find out the COP of the domestic vapour compression system. The Refrigeration test rig consists of a compressor, Forced convection air cooled condenser, Expansion valve (Capillary tube) and an evaporator (Shell and coil type). The compressor used here is a hermetically sealed reciprocating compressor. A serpentine coil finned tub e air cooled heat exchanger is used as condenser and is made up of copper. Condenser is cooled using fan. The evaporator is in the type of cylindrical spiral coil shape and made up of the copper. Separate pressure gauges are provided to measure the suction and discharge pressures. The Digital temperature indicators are used to measure the various temperatures at various locations such as condenser inlet (T1), condenser outlet (T2), evaporator inlet (T3) and evaporator outlet (T4). Energy meter is used to measure the power consumption of the compressor. For carrying out the testing of the Refrigeration test rig. Each refrigerant (i.e. R12A, R404A and R600A) are charged separately one by one after proper evacuation using vacuum pump. The values are tabulated separately for each gas and then different cop are calculated (i.e. Actual cop, experimental cop and relative cop).

Fig 1: Experimental Setup

3 RESULTS AND DISCUSSION

3.1 Actual Cop Comparison

In this section the actual cop of the taken three refrigerants after the calculation are taken and plotted on the graph. The best cop is considered here and according to this the best cop is given by R600A.

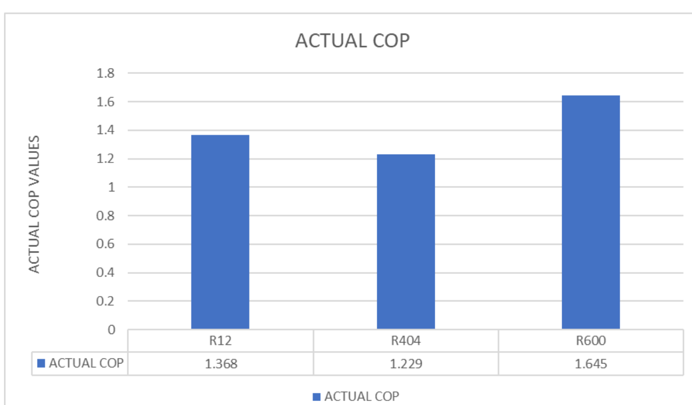

Fig.2: Comparison between Actual cop of the Refrigerants

3.2 Experimental Cop Comparison

In this section the experimental cop of the taken three refrigerants after the calculation are taken and plotted on the graph. The best cop is considered here and according to this the best cop is given by R600A.

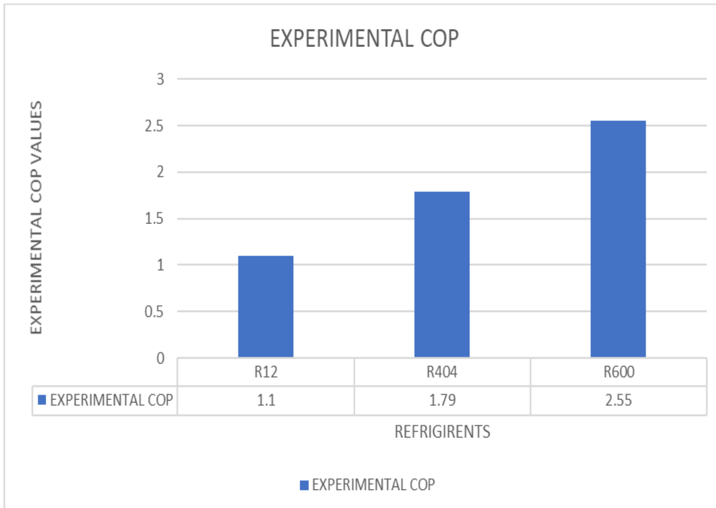

Fig.3: Comparison between the Experimental cop of the Refrigerants

3.3 Relative Cop Comparison

In this section the relative cop of the taken three refrigerants after the calculation are taken and plotted on the graph. The best cop is considered here and according to this the best cop is given by R600A.

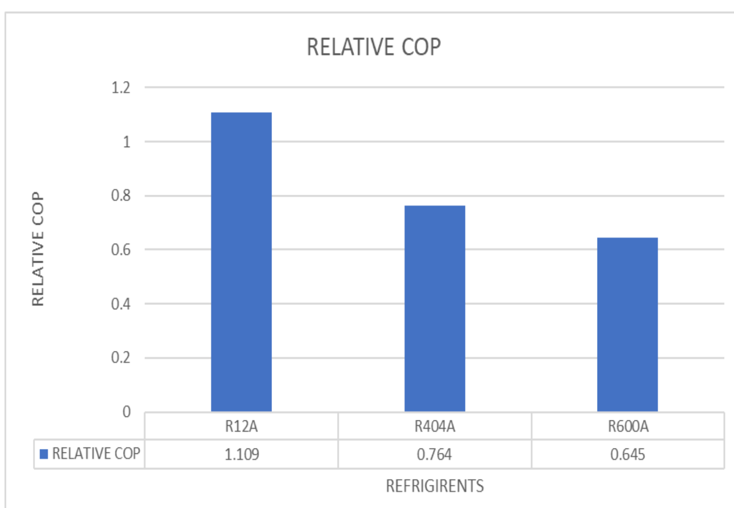

Fig 4: Comparison between Relative cop of the Refrigerants

4 CONCLUSIONS

The following points were drawn from this experimental analysis.

- The actual cop value of the R600A is higher than R12A and R404A
- The experimental cop value of R600A is higher than R12 and R404A
- The relative cop value of the R12A is higher than R12 and R404A

Based on the obtained value by comparing the three refrigerants R600A is better than other two refrigerants taken.

5 RFERENCE

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