Magnetic Devices for Improving (R134a) Refrigerant Properties

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July 5, 2021

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ABSTRACT

The mechanical vapour compression cycle is employed in the process of cooling food products in refrigerators, which are used in both commercial and home appliances. Optimization for better system performance has become a major concern, and numerous studies are still underway to increase the system's efficiency. The major goal of this project is to increase the performance of residential refrigerators in the evaporator is flooded with liquid refrigerant The magnetic field is put on the refrigerator line to achieve this goal (exit of condenser). The refrigerator's performance is compared with and without a magnetic field. In addition, there is a refrigerant analysis (R134a). The addition of a magnetic field improves the system's COP and refrigeration impact, according to the findings. With the installation of a magnetic field, the system also benefits from a reduction in compressor effort. According to the literature, the introduction of a magnetic field improves performance by lowering the viscosity of the fluid, increasing flow rate, and thus cooling capacity while lowering compressor power.

Keywords: COP, Compressor power consumption, Permanent magnets, Magnetic caloric effect

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I. INTRODUCTION.

The most common refrigeration cycle is the vapour compression cycle. The use of magnetic components to improve the vapour compression cycle has been documented in several research. With the find of the magneto-caloric effect, the investigation of magnetic refrigeration began. In 1881, War burg discovered the thermal-effect of metal iron by putting it in a changing magnetic field.The magneto caloric effect is used in magnetic refrigeration, which is a cooling process (MCE). This magnetic field is invisible, and it will be responsible for a magnets most worthy property. a force that pull or repels another magnets and attracts other ferromagnetic elements, such as iron. At all points in space around a magnet, a variable field, the magnetic field, is produced.

II. LITERATURE REVIEW.

This study compares the effect of a magnetic field on Replacing of chlorofluoro carbon and hydrofluoro carbon. With the new propane/ISO-butane refrigerant mixture as drop replacement refrigerant. Refrigerant propane / ISO-butane has refrigerating capacity of 19.5-50.1 % higher than Dichlorodifluoromethane and 28.6-87.2% higher than Tetrafluoroethane in tests conducted without magnets.[1]

Samuel and Shawn investigated the influence of a magnetic field of up to 12000 Gauss at the condenser outlet (full liquid line) on the show of a refrigeration cycle employing refrigerant combinations such as mixture of difloromethane and pentafloroethane, trifluoroethane, pentfluoroethane.[2]

The researchers have a look at the strength intake of the gadget for the hydrocarbon refrigerant they may be development with inside the Coefficient of Performances of Vapour compression cycle and discount with inside the compressor strength intake use of everlasting magnets with exceptional depth hooked upat the gasoline line of the two-stroke engine, and have a look at its wallop on gasoline intake, in addition to emissions of exhaust fuel line and as compared with overall performance with out utility of magnetic discipline to estimation of overall performance betterment.[3]

In this experimental examine of VCR machine with usage of magnetic energy directly applied to liquid refrigerant line (Outlet of Condenser) and way of means usages of nano lubricant can beautify overall performance of VCR System.[4]

III. OBJECTIVES

Performance of VCRS System (like COP of system).

IV, WORKING PRINCIPAL

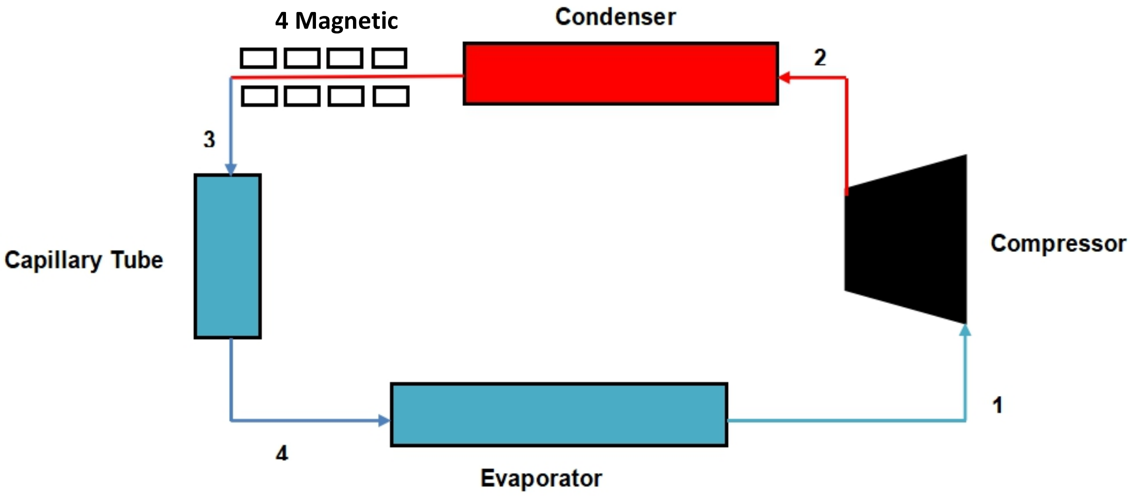


Fig.01 :- Conceptual Diagram (VCR System)

Fig 01 shows an experimental Setup of vapor Compression refrigeration system which will help to investigate the performance of refrigerant R134a. The experimental setup which is shown consist of compressor, condenser.evaporator, capillary tube and magnetic pair. Circulating vapour refrigerant coming out from the evaporator enters to the compressor and the compressor compressed it from lower presser to higher pressure. The high pressure R134a refrigerant then enters to the condenser where its phase get change from vapour to liquid. The refrigerant then flows in to the evaporator to capillary tube. The 4 magnetic pair with a Gauss value of 3000 is place in the system on liquid line (Condenser outlet) and the reading will be taken with the the number of magnet pair. Two pressure gauges are placed in the system to note down the compressor inlet (suction) and compressor outlet (discharge) pressure. During the study, the initial temperature of water on the evaporator side will be maintained at 30C and the reading of T1,T2,T3,T4 will be taken at an interval of 10 min. The number of magnetic pair applied on the liquid line is varied from one pair to four pair to find out is effect on compressor power and cop of the system.

V. EXPERIMENTAL SETUP

Fig. 02 :- VCR System.

1. Hermetically sealed Compressor
2. Air cooled Condenser
3. Capillary tube
4. Bare tube Evaporator
5. Magnets (N-35 -Neodymium)
6. Presser gauge
7. Temperature indicator

1 Refrigerant use in system :-

R134a (Tetrfluroethane)

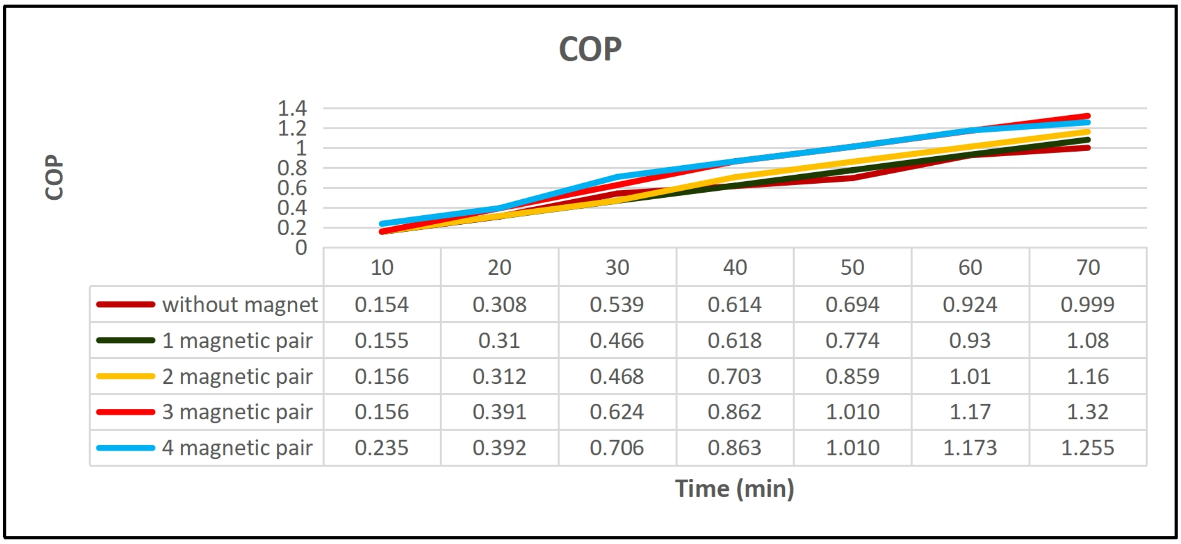
2 R134a properties:-

Chemical Name:- CH2FCF3

Molar mass:- 102.03gm/mole

Density:- 0.00425 gm/c.m3.gas.

VI. RESULTS



	10	20	30	40	50	60	70
without magnet	0.154	0.308	0.539	0.614	0.694	0.924	0.999
1 magnetic pair	0.155	0.31	0.466	0.618	0.774	0.93	1.08
2 magnetic pair	0.156	0.312	0.468	0.703	0.859	1.01	1.16
3 magnetic pair	0.156	0.391	0.624	0.862	1.010	1.17	1.32
4 magnetic pair	0.235	0.392	0.706	0.863	1.010	1.173	1.255

Chart 1: COP vs. Time (min)

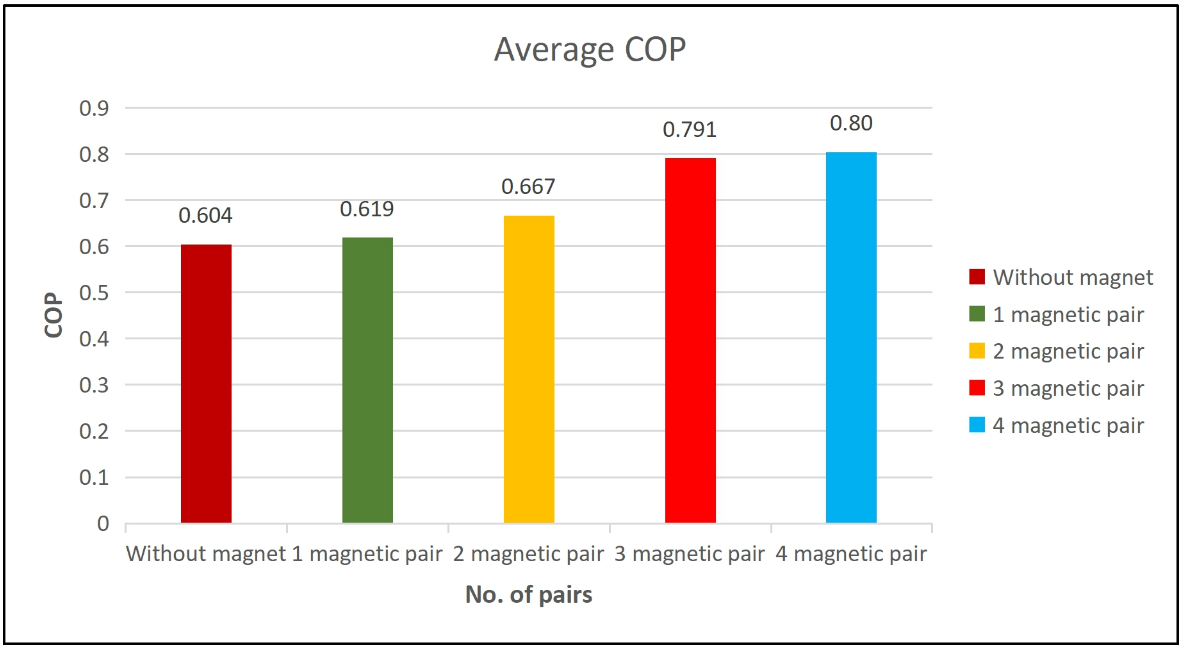
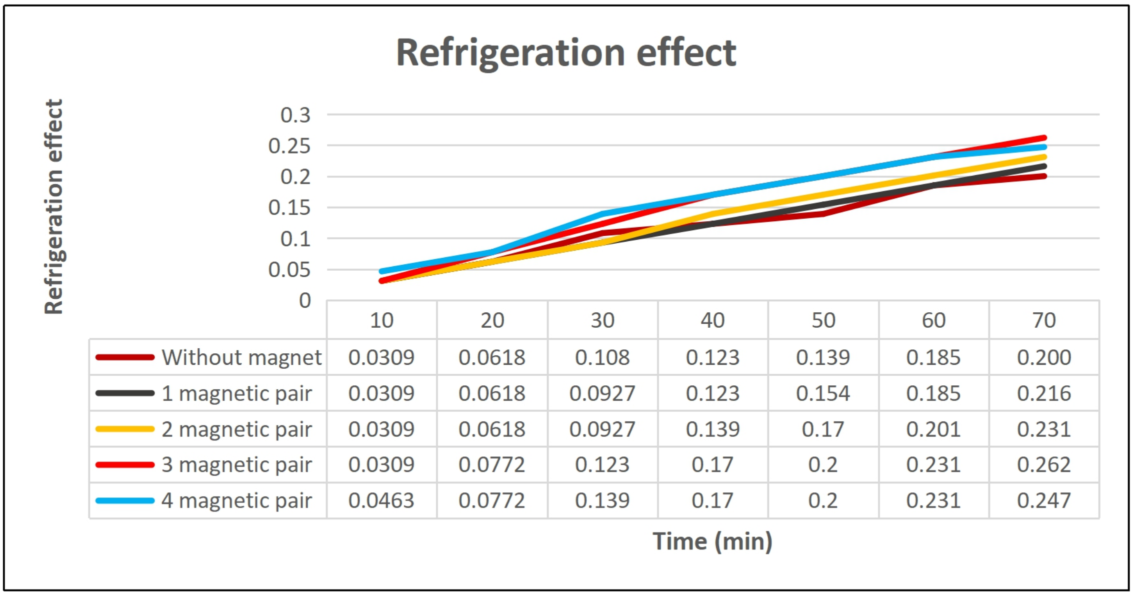


Chart 2:- Coefficient of performances vs. No. of pairs

The graph shown Coefficient of Performance vs. number of magnetic pairs is shown in diagram above. The Coefficient of Performances of the system is observed to be affected by the magnetic field. According to the graph above, COP increased by 2.48 percent for a 1 magnetic pair, 10.43 percent for 2 magnetic pairs, 30.96 percent for 3 magnetic pairs, and 33.11 percent for 4 magnetic pairs.The COP increases for pairs of magnets due to an gain in refrigerant effect and a drop-off in compressor power.



	10	20	30	40	50	60	70
Without magnet	0.0309	0.0618	0.108	0.123	0.139	0.185	0.200
1 magnetic pair	0.0309	0.0618	0.0927	0.123	0.154	0.185	0.216
2 magnetic pair	0.0309	0.0618	0.0927	0.139	0.17	0.201	0.231
3 magnetic pair	0.0309	0.0772	0.123	0.17	0.2	0.231	0.262
4 magnetic pair	0.0463	0.0772	0.139	0.17	0.2	0.231	0.247

Chart 3: Refrigeration effect vs. Time (min)

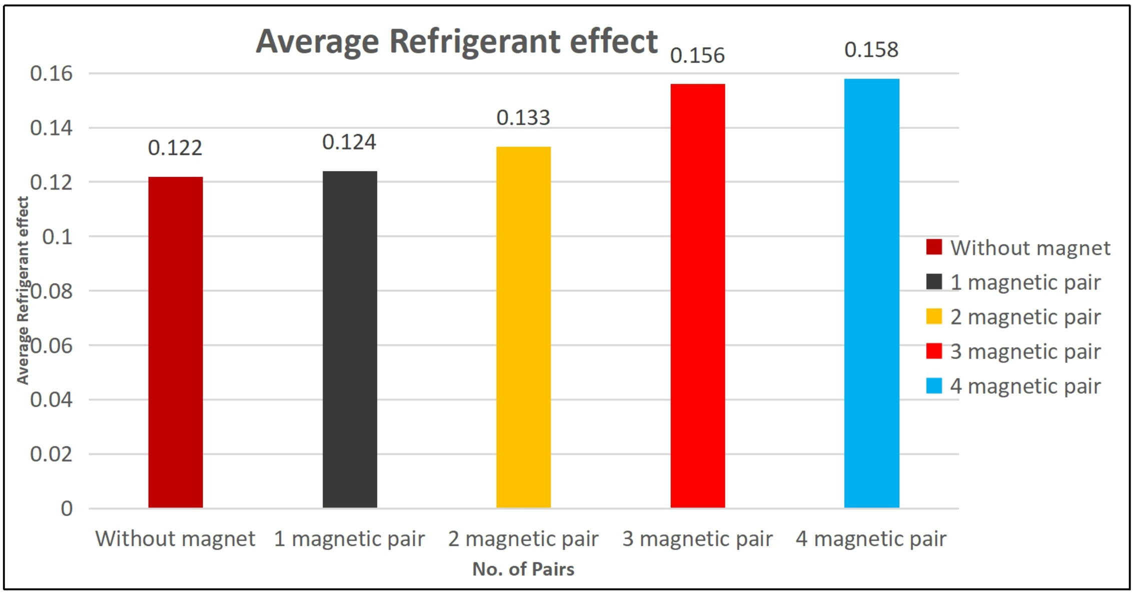


Chart 4: Refrigeration effect vs. No. of pairs

The refrigerating effect is depicted in the graph above as a function of number of magnetic pairs. Refrigerant effect rises with the number of magnetic pairs, up to 4 magnetic pairs. Heat transmission rate rises as the refrigerant's specific heat increases.

The refrigerant absorbs substantially more heat from the water as a result of the enhanced heat transfer rate, and thus the refrigerating effect increases. When a 1 magnetic pair is utilize, the refrigerating impact increases by 1.82 percent compared to when no magnetic pair is used. When 2 magnetic pairs is utilize, the refrigerating impact increases by 9.08 percent, while when 3 pairs are used, the refrigerating effect increases by 28.82 percent. The refrigerating impact increased by 30.47 percent for 4 magnetic pairs.

Condition	Average time for 10 blinks (sec)	Average refrigerat ion effect (kw)	Average Compressor Work (kw)	Average COP
without mag netic pair	56.2	0.122	0.2001	0.604
With 1 magn etic pair	56.56	0.124	0.1989	0.619
With 2 magn etic pair	56.90	0.133	0.1977	0.667
With 3 magn etic pair	57.10	0.156	0.1970	0.791
With 4 magn etic pair	57.18	0.158	0.1968	0.804

Table.1 Experimental VCRS using R134a

VII. CONCLUSION

The results of the tests reveal that using a magnetic pair has a favourable impact on the Coefficient of Performances of VCRS cycle. As a result of this research, the reported phenomenon of improved COP refrigerant systems when a magnetic pair is apply at the liquid refrigerant line has been confirmed.

Improvement in COP = (magnetic field (COP) vs. without magnetic field(COP)) * 100. When the magnetic pair is apply to R134a, it results in a 33.11 percent increase in COP.

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