

Hydrocarbon Refrigeration System

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ABSTRACT: This paper shows the substitution of R134a with R436A in domestic refrigerator without any modification in refrigeration cycle. Results show that in comparison to the base refrigerator working with R134a, the ON time ratio and energy consumption per day were reduced by 12% and 5% respectively. The charge amount of refrigerant used in this system is reduced as compared to R134a hence increase in COP and energy efficiency index of refrigerator. Main purpose of this refrigeration system is to reduce the Global Warming Potential (GWP) and maintaining Ozone Depletion Potential (ODP) as zero.

Keywords: Global Warming, Hydrocarbon refrigerant, R436A, R134a, COP.

INTRODUCTION

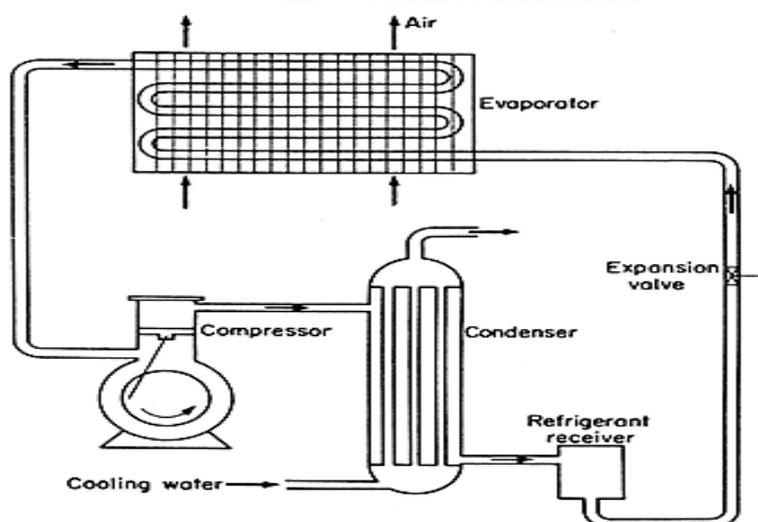
Domestic refrigerators use R-12 and R-134a as refrigerants still now due to excellent thermodynamic properties. According to Montreal and Kyoto protocols, R12 should have been phased out by 2010 and the consumption of R134a must be reduced. The reason for R12 phase out is its ODP effect, and for R134a reduction is its high GWP effect. From the environmental, ecological and health point of view, it is urgent to find some better substitute for HFC refrigerants. Domestic refrigerators and freezers are identified as major energy consuming domestic appliances in every household. Many researchers have reported that hydrocarbon mixtures were found to be environment friendly alternative refrigerants.

Our motive is for lowering of GWP and making zero ODP as compared to R-134a. We are using the mixture of isobutane (R600a) and propane (R290) as the refrigerant in place of traditional refrigerant HFC (R-134a). Domestic refrigerator is used for this purpose. We are replacing compressor of refrigerator and remaining parts are same.

II. EXPERIMENTAL PROCEDURE

Inserting mixture of isobutane and propane into the compressor (Semi hermetic). The work of compressor is to increase the pressure of refrigerant. Phase change of the refrigerant is occurred in the condenser. Then Reduction in refrigerant pressure is done with the help of expansion valve. The temperature of the refrigerant is increased in the evaporator. Evaporator provides the essential cooling effect. Refrigerant flows continuously in the system.

III. WORKING DIAGRAM



Major Benefits

The two main advantages of hydrocarbon refrigerants are lower environmental impact and economic gains:-
First, hydrocarbons do not damage the ozone layer.

Moreover, hydrocarbons can significantly reduce emission from greenhouse gases of refrigeration and air conditioning equipment.

Because of their very low global warming potential, their impact on global warming from direct emissions is much lower.

Hydrocarbons lead typically to much higher efficiency than traditional chemical refrigerants, thereby reducing energy consumption and greenhouse gas emissions related to them.

In terms of economic benefits, besides energy-related savings, hydrocarbons can be easily implemented in conventional cooling systems, requiring minimal investment in components and design.

Advantages (in brief)

Hydrocarbons are one of the most climate-friendly and cost-efficient refrigerants to heat, cool and freeze.

Non-ozone depleting.

Not climate damaging.

Non-toxic.

Safe with proper handling.

Energy-efficient.

Easy replacement.

Cost-efficient.

Applications

This system can also be applied in :

Commercial Refrigeration.

Air Conditioning.

Mobile Air Conditioning.

Heat Pumps.

IV. CONCLUSION

The results show that in comparison with R134a it is better in following described ways:

Global Warming Potential (GWP) becomes 3 and Ozone Depletion Potential (ODP) is negligible. Refrigeration Effect will be more than that of R-134a. Charge amount, ON time ratio, Energy consumption, Evaporator inlet temp are reduced by 48%, 13%, 5.3% and 3.5 degree Celsius respectively. Energy efficiency index is raised. TEWI of R436A is 11.8% less.

According to our results and known environmental effects, R436A appears to be a suitable replacement for R134a as far as this study is concerned.

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