

# Performance Analysis of R-508a An Eco Friendly Refrigerant Comparing With R-134a In VCR System To Reduce Depletion of Ozone Layer

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**Abstract-** The purpose of this mission is to relatively examine of COP the usage of R-134A & R-508A Refrigerant in Domestic fridge at regular country circumstance. Two special refrigerants are R-134A and R-508A. The refrigerant 134A is 0 ozone depletion layer and excessive worldwide caution and R-508A is 0 ozone depletion layer and occasional worldwide caution. The residences of R-134A and R-508A have been taken from REFPROP information base. The condensing pressures various among 1190kPa and 1950kPa, the evaporating pressures various among 110kPa and 550kPa, and the sub-cooling temperatures various among -55°C and -75°C. In the existing studies have a look at a refrigerant belongings based thermodynamic version of a easy reciprocating device, that can simulate the overall performance of real device as carefully as possible, has been used to examine the traits of diverse refrigerants [R22, R134a, R508A, R407C ] utilized by international producers to satisfy the demanding situations of better performance and environmental duty at the same time as maintaining their device affordable. The results of the investigated refrigerant at the depletion of the ozone layer boom in worldwide warming, and flammable and poisonous traits have been considered. The utilization of the refrigerant R-508A turned into discovered to be the high-quality in phrases of the coefficients of overall performance (COP), refrigerant rate quotes and 0 Ozone Depleting Potential (ODP).

**Keywords-** Refrigerant, R508A, Ozone Depletion Layer, COP, R134A

## I. INTRODUCTION

In the beyond decades, the Ozone layer Depletion Potential (ODP) and Global Warming Effects have will become the dominant environmental issues, because of the leakages of the CFC and HCFC refrigerants. The Montreal protocol (UNEP, 1997) declared the phasing out of CFC's and HCFC's as refrigerants that Ozone layer Depletion (UNEP, 1997). The Kyoto protocol (UNFCCC, 2011) advocated

advertising of guidelines for sustainable improvement and discount of Global Warming Potential (GWP) consisting of the rules of HCFC's (United Nations, 2011). Both of CFC and HCFC have excessive ODP and GWP. Because in their excessive GWP, options to refrigerants CFC and HCFC which includes azeotropic combos refrigerants with their 0 ODP had been favored to be used in lots of commercial and home packages intensively for a decade.

The procedure of maintaining an object underneath room temperature with the aid of using storing the object in a device or substance designed to chill or freeze. The maximum not unusual place shape of refrigeration is furnished with the aid of using systems (i.e. fridges) that use a refrigerant chemical to do away with warmness from gadgets saved in the device. The task of a refrigeration plant is to chill articles or materials down to, and preserve them at a temperature decrease than the ambient temperature. Refrigeration may be described as a procedure that gets rid of warmness. The oldest and maximum famous amongst refrigerants are ice, water, and air. In the start, the only motive turned into to preserve meals. The Chinese have been the primary to discover that ice multiplied the lifestyles and stepped forward the flavor of beverages and for hundreds of years Eskimos have conserved meals with the aid of using freezing it.

## II. LITERATURE REVIEW

Let's take a journey returned in time approximately three,000 years ago. Of route we will should eliminate our mobileular phones, I-Pods and computers; those cool toys may not do us any exact here. The pinnacle responses could be "electricity", "walking water" and "transportation". With exact cause, those solutions pinnacle the listing in maximum instances however there's one which appears to elude the pinnacle of the listing and receives little appreciate for its' effect on the arena we stay in...refrigeration. There isn't anyt any doubt that many innovations have had an effect on our lives however refrigeration and the capacity to manipulate our

surroundings has had a miles deeper effect than we deliver it credit score for. From historic meals garage strategies to the cutting-edge day principal air con machine, the subsequent will offer you an entire new appreciation for the technological know-how and significance of refrigeration.

### III. REFRIGERENTS TO REDUCE OZONE DEPLETION

Ozone gift within side the stratosphere paper work a protecting layer and referred to as ozone layer, ozonosphere or ozone umbrella. Its attention in environment is ready 10 ppm. In the top environment, atmospheric gases take in the solar's radiation, get ionized, and launch molecules. In decrease environment, atmospheric oxygen get dissociated and finally combines with molecular oxygen of the top stratosphere, there through generating ozone.

$O_2 \xrightarrow{\text{UV radiation}} O + O$

O<sub>3</sub> The presence of ozone layer within side the stratosphere is of crucial importance for all biota, because it take in the damaging ultraviolet radiation which might be deadly to existence.....

$O_3 + \text{UV radiation} \rightarrow O_2 + O$

The ozone absorbs ultraviolet radiation and save you them to attain earth's floor . If those radiations are allowed to attain the earth's environment they may boom the temperature of decrease environment to such an quantity, that it'll be not possible for any existence to live on on the earth. These UV radiations can purpose extreme radiation harm in human and animals along with DNA mutation and pores and skin cancer.

#### Ozone Depletion:

Ozone depletion describes wonderful however associated phenomena located for the reason that overdue 1970s: a regular decline of approximately four% consistent with decade within side the overall extent of ozone in Earth's stratosphere (the ozone layer), and a miles large springtime lower in stratospheric ozone over Earth's polar regions. The latter phenomenon is known as the ozone hollow. In addition to those famous stratospheric phenomena, there also are springtime polartropospheric ozone depletion events.

#### Effects of Ozone Layer Depletion:

Effects of Ozone Layer Depletion: If you're questioning why is the ozone layer crucial, then the solution lies in the damaging results of ultraviolet rays. The ozone

layer is chargeable for soaking up the ultraviolet rays and thereby stopping them from passing thru the environment of Earth. Ultraviolet rays of the Sun are related to some of fitness associated and environmental issues. The maximum crucial of those is the affiliation among ultraviolet rays and an multiplied chance of growing numerous forms of pores and skin cancers together with malignant melanoma, basal and squamous mobileular carcinoma. Even the incidents of cortical cataracts also can boom considerably with the multiplied publicity to ultraviolet rays. Another statement on this regard is that a lower within side the ozone within side the stratosphere can cause an boom within side the ozone gift within side the decrease environment. Ozone gift within side the decrease environment is specifically appeared as a pollutant and a inexperienced residence fueloline which could make a contribution to international warming and weather alternate.

However, researches have talked about that the lifespan of atmospheric ozone is pretty much less in comparison to stratospheric ozone. At the identical time, boom within side the floor degree of ozone can decorate the cappotential of daylight to synthesize diet D, which may be appeared as an crucial useful impact of ozone layer depletion. The results of ozone depletion aren't constrained to people handiest, as it may have an effect on animals and vegetation as properly. It can have an effect on crucial meals plants like rice through adversely affecting cyanobacteria, which facilitates them take in and make use of nitrogen nicely. Phytoplankton, an crucial factor of the marine meals chain, also can be stricken by ozone depletion. Studies on this regard have proven that ultraviolet rays can impact the survival fees of those microscopic organisms through affecting their orientation and mobility. The growing subject for the reasons and results of ozone depletion caused the adoption of the Montreal Protocol, withinside the yr 1987, if you want to lessen and manipulate the commercial emission of chlorofluorocarbons. International agreements have succeeded to a outstanding quantity in lowering the emission of those compounds, but, extra cooperation and expertise amongst all of the international locations of the sector is needed to mitigate the problem.

### IV. REFFPROP SOFTWARE

REFFPROP is an acronym for REference fluid PROPERTIES. This software, advanced via way of means of the National Institute of Standards and Technology (NIST), calculates the thermodynamic and delivery residences of industrially critical fluids and their combos. These residences may be displayed in tables and plots thru the graphical person interface; they're additionally on hand thru spreadsheets or person-written packages gaining access to the REFFPROP DLL or the FORTRAN assets subroutines. REFFPROP is primarily based totally at the maximum correct natural fluid

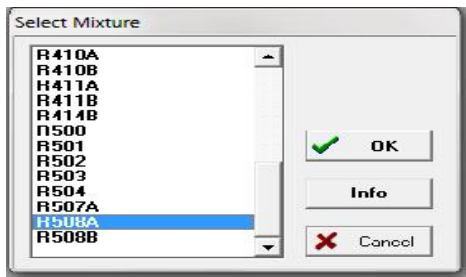
and combination fashions presently to be had. It implements 3 fashions for the thermodynamic residences of natural fluids: equations of kingdom specific in Helmholtz electricity, the changed Benedict-Webb-Rubin equation of kingdom, and an prolonged corresponding states (ECS) version.

**V. DISCUSSION OF THE REF-PROP DATABASE**

In this project it is worked on to reduce the ozone depletion, for which pre-defined mixture (R-508A) is selected. Further, the analysis is done for varying properties using the software Refprop which described in detail in chapter no:4.

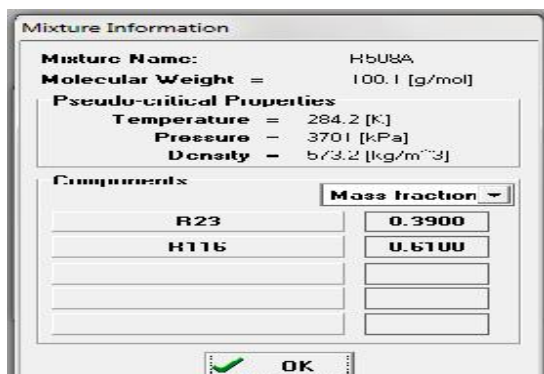
**Selection of Substance:**

Hereby Select R-508A from predefined mixture for the analysis purpose as shown in figure



**Mixture Information:**

These is the mixture information as shown in figure



**Iso-property Table of R-508A at Constant Pressure:**

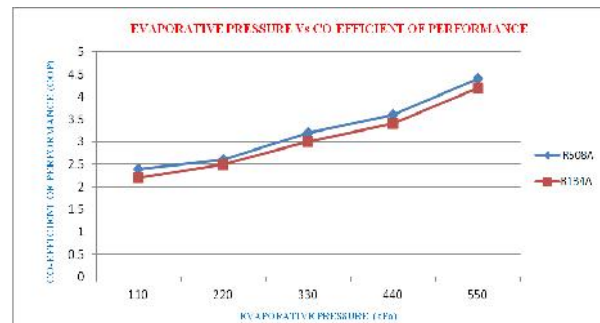
These are the iso-properties of R-508A at constant P=100kPa

	Temp [K]	Pressure [kPa]	Density [kg/m <sup>3</sup> ]	Enthalpy [kJ/kg]	Entropy [kJ/K-kg]
1	180.0	100.0	1568	82.90	0.4938
2	200.0	100.0	6.233	254.9	1.420
3	220.0	100.0	5.604	267.7	1.481
4	240.0	100.0	5.103	281.0	1.538
5	260.0	100.0	4.690	294.8	1.584

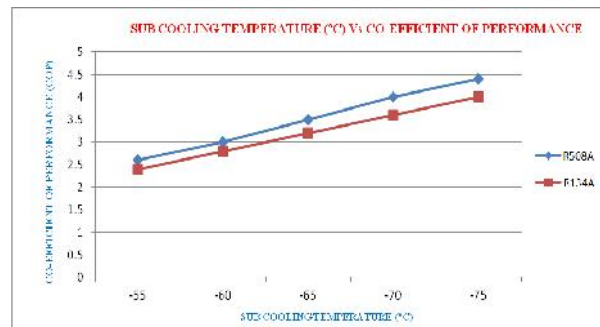
**VI. RESULTS AND DISCUSSION**

**Comparison between R-134A and R-508A:**

**Variation of COP with Evaporator Pressure :-**



**Variation of COP with Condenser Pressure :**



**VII. CONCLUSION**

R-508A is refrigerant blend, with zero ozone layer depletion potential. It has higher volumetric cooling capacity compared to R-134A and has better thermal exchange properties. The overall COP of the system is 5% to 6% is more than R-134A. R-508A operates at approximately 50 to 70 percent higher pressure at the same saturated temperatures than R-134A.

The comparison between R-134A and R-508A has been done in three ways. COP is placed against evaporator pressure, condenser pressure and sub cooling temperature. In

all the situations, the COP values are high for the same evaporator pressure, condenser pressure and sub cooling temperature used in R-134A. This shows that behaviour of R-508A is better when comparing to R-134A.

Chlorine, which is main cause for Ozone layer depletion is being released by R-134A refrigerant series air conditioners as a part of HCFC. R-508A series is remedy to avoid chlorine and found R-508A is best when compared to R-134A.

As per the proposed work the refrigerant R-508A is considered and analyzed in detail. This is done by the help on NIST software named REFPROP; the various ranges of analysis are Temperature From 200K To 320K, Pressure From 110kPa to 550kPa.

The complete analysis is carried out in S.I. units and the resultant graphs shows that the refrigerant is suitable for using in Refrigeration and Air Conditioning systems.

It may be noted that one chlorine atom can destroy 100000 ozone molecules. The relative ability of a substance to deplete the ozone layer is called ozone depletion potential (ODP). i.e. R-134A has ODP=0.05. The HFC refrigerants do not cause any ozone depletion, i.e., R-508A has ODP=0. Therefore in this paper an analysis has been done on R-508A and it is concluded that R-508A is an Eco friendly refrigerant to avoid depletion of ozone layer for different applications.

## REFERENCES

- [1] The Ozone Cell of the Ministry of Environment & Forests (MoEF), Government of India, in co-operation with the Government of Germany represented by Deutsche Gesellschaft fur International Zusammenarbeit (GIZ) GmbH and United Nations Environment Programme (UNEP).
- [2] Rani Tusha and P. Balachander, 2008. Numerical Simulation Of fin and tube condenser in a R134a system charged With R4010a, J. Scientific and Industrial Res., 67: 209-218.
- [3] McLinden MO, Klein SA, Lemmon EW, Peskin AP. NIST thermodynamic and transport properties of refrigerants and refrigerant mixtures (REFPROP), Version 6.0..Gaithersburg, MD: National Institute of Standards and Technology, 1998.
- [4] Chang SD, Ro ST. Pressure drop of pure HFC refrigerants and their mixtures flowing in capillary tubes. Int J Multiphase Flow 1996;22(3):551-6
- [5] Manual as energy Efficiency at design stage, CII Godrej Energy Management Cell-1998 edition
- [6] CII-Godrej Green Business Centre – HVAC 0 &M Manual
- [7] Adnan Sozen, ErolArcaklioglu, TayfunMenli\_k and Mehmet Ozalp, 2008. Determination of thermodynamic properties of an alternative refrigerant (R407c) using artificial neural network, Expert Systems with Applications.
- [8] Kim YC, Cho IY, Choi JM. Experimentation and modeling on the flow of R407C and R290 through capillary tubes. Korean Journal of Air-Conditioning and Refrigeration Engineering 1999;11(4):492-8.